CRITICAL
APPLICATION
CONNECTIVITY

GW1000M Series User Manual

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1 Introduction

This user manual describes the features and how to configure Virtual Access GW1000M Series routers.

Virtual Access GW1000M Series routers enable 3G or LTE connectivity in vehicles such as buses, taxis and fleet vehicles for applications such as passenger WiFi internet access, telemetry and employee WiFi access to corporate network services.

Designed for managed network providers, GW1000M Series routers provide secure WAN connectivity for internet and private networking environments over 3G or 4G broadband paths and incorporate optional 802.11n WiFi connectivity.

1.1 Document scope

This document covers models in the GW1000M Series.

The Virtual Access GW1000M Series router is a compact 3G, 4G/LTE router with WiFi, designed with a rugged metal housing for use in vehicles and a wide range of site-based applications.

GW1032M:	Dual Ethernet, 3G, Dual SIM, Dual WiFi SMA female connectors
GW1042M:	Dual Ethernet, 4G/LTE, Dual SIM, Dual WiFi SMA female connectors

1.2 Using this documentation

You can configure your router using either the router's web interface or via the command line using UCI commands. Each chapter explains first the web interface settings, followed by how to configure the router using UCI. The web interface screens are shown along with a path to the screen for example, 'In the top menu, select **Service -> SNMP**.' followed by a screen grab.

After the screen grab there is an information table that describes each of the screen's fields.

1.2.1 Information tables

We use information tables to show the different ways to configure the router using the router's web and command line. The left-hand column shows three options:

- **Web:** refers the command on the router's web page,
- **UCI:** shows the specific UCI command, and
- **Opt:** shows the package option.

The right-hand column shows a description field that describes the feature's field or command and shows any options for that feature.

Some features have a drop-down menu and the options are described in a table within the description column. The default value is shown in a grey cell.

Values for enabling and disabling a feature are varied throughout the web interface, for example, 1/0; Yes/No; True/False; check/uncheck a radio button. In the table descriptions, we use **0** to denote Disable and **1** to denote Enable.

Some configuration sections can be defined more than once. An example of this is the routing table where multiple routes can exist and all are named 'route'. For these sections, the UCI command will have a code value [**0**] or [**x**] (where x is the section number) to identify the section.

Web Field/UCI/Package Option	**Description**
Web: Metric UCI: network.@route[0].metric Opt: metric	Specifies the route metric to use.

Note: these sections can be given a label for identification when using UCI or package options.

```
network.@route[0]=route

network.@route[0].metric=0
```

can be witten as:

```
network.routename=route

network.routename.metric=0
```

However, the documentation usually assumes that a section label is not configured.

The table below shows fields from a variety of chapters to illustrate the explanations above.

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enable
UCI: cesop.main.enable
Opt: enable</td><td>Enables CESoPSN services.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Syslog Severity
UCI: cesop.main.severity
Opt: log_severity</td><td>Selects the severity used for logging events CESoPSN in syslog. The following levels are available.<table><tr><td>0</td><td>Emergency</td></tr><tr><td>1</td><td>Alert</td></tr><tr><td>2</td><td>Critical</td></tr><tr><td>3</td><td>Error</td></tr><tr><td>4</td><td>Warning</td></tr><tr><td>5</td><td>Notice</td></tr><tr><td>6</td><td>Informational</td></tr><tr><td>7</td><td>Debug</td></tr></table></td></tr>
<tr><td>Web: Agent Address
UCI: snmpd.agent[0].agentaddress
Opt: agentaddress</td><td>Specifies the address(es) and port(s) on which the agent should listen.
[(udp|tcp):]port[@address][,…]</td></tr>
</table>

Table 1: Example of an information table

1.2.2 Definitions

Throughout the document, we use the host name 'VA_router' to cover all router models.

UCI commands and package option examples are shown in the following format:

```
root@VA_router:~# vacmd show current config
```

1.2.3 Diagnostics

Diagnostics are explained at the end of each feature's chapter.

1.2.4 UCI commands

For detailed information on using UCI commands, read chapters 'Router File Structure' and 'Using Command Line Interface'.

1.3 Safety

Virtual Access routers must be installed by authorised personnel only.

The router is complicated electronic equipment that may be repaired only by authorised and qualified personnel.

- Do not try to open or repair the router yourself
- Do not place the router in a damp or humid place
- Do not stack the router

The router should be used in a sheltered area, within a temperature range of -20^{o}C to 70^{o}C.

Do not expose the router to direct sunlight.

HIGH VOLTAGES

Under no circumstances is the router to be operated with the cover removed.

DANGEROUS SUBSTANCES

Semiconductor devices contain dangerous substances, such as beryllium and arsenic. Electronic devices must not be opened. If they become damaged, they must only be handled using protective gloves. If the substances inside the electronic devices come into contact with broken skin or wounds, hospital care must be sought immediately. Electronic components must be disposed of as hazardous toxic waste and must not be incinerated.

1.4 Product disposal

Virtual Access is committed to meeting the requirements of the European Union (Waste Electrical and Electronic Equipment) Regulations 2014. These Regulations require producers of electrical and electronic equipment to finance the takeback of WEEE resulting from products that we place on the Irish and other EU markets. This helps us to ensure that WEEE is reused or recycled safely. In line with that commitment, Virtual Access operates an RMA scheme and will take back WEEE from you. Please contact us for further details.

You also have a role to play in ensuring that WEEE is reused and recycled safely. So, if you choose not to return WEEE to us then you should not dispose of it in your bin. The crossed out wheeled-bin symbol on the product reminds users not to dispose WEEE in the bin. You should ensure that the WEEE is collected separately and sent for proper treatment. WEEE contains hazardous substances and if not managed and treated safely it can cause pollution and damage human health.

In line with our commitment, our product packaging is marked with the crossed out wheeled bin symbol to indicate that the product must not be disposed of in domestic waste but disposed of through an approved WEEE take back scheme.

1.5 Approvals and statements

As part of the GW1000M Series, the GW1042M-X-OFR and GW1042M-QFR are approved for use in the EU block, the U.K, Brazil, Morroco and the USA.

The sections below describe each country's regulations and their application to the GW1042M-X-QFR and GW1042M-QFR.

1.5.1 Brazil: Anatel Regulation on Restricted Radiation Radiocommunication Equipment (Resolution No. 680)

Este produto não é apropriado para uso em ambientes domésticos, pois poderá causar interferências eletromagnéticas que obrigam o usuário a tomar medidas necessárias para minimizar estas interferências.

This is a class A Product. This product is not suitable for use in a domestic environment, as it may cause radio interference, causing the end user to take appropriate measures to minimize such interference. For more information, visit Anatel website: https://www.gov.br/anatel/pt-br

1.5.2 Morocco: ANRT regulations for low power, short range (A2FP) devices (Law No 24-96/Decision ANRT/DG/ N°07/20)

AGREE PAR L'ANRT MAROC

Numéro d'agrément : MR00036706ANRT2023

Date d'agrément : 10/02/2023

Approved by ANRT Morocco

Approval Number: MR00036706ANRT2023

Approval Date: 10/10/2023

For more information, visit ANRT website: https://www.anrt.ma/en/

1.5.3 USA: FCC Part 15 Regulations

Operating requirements and conditions

The design of the GW1042M-QFR complies with U.S Federal Communications Commision (FCC) guidelines respecting safety levels of radio frequency (RF) exposure for mobile or fixed devices.

1.5.3.1 Caution statement for modifications

CAUTION

Any changes or modifications not expressly approved by Virtual Access (Ireland) Lts., could void the user's authority to operate the equipment.

1.5.3.2 FCC ID

The GW1042M-QFR has been approved for the following regulation:

FCCIP: 2ACWY1042QFR

1.5.3.3 Labelling

A label showing the following FCCID number is affixed on the outside of the equipment

FCCID: 2ACWY1042QFR

1.5.3.4 FCC Part 15 statement

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

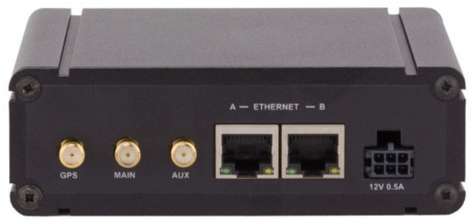
- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

For more information, visit the FCC website: https://www.fcc.gov/

2 GW1000M Series router hardware

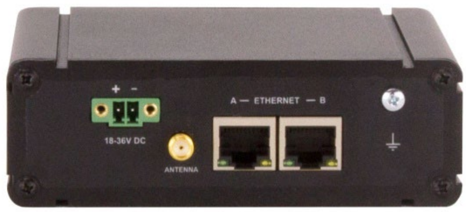
2.1 GW1000M Series router hardware model features

2.1.1 GW1000M with standard locking DC power connector

	
Figure 1: GW1000M Series router front	**Figure 2: GW1000M Series router back**

GW1032M	Dual SIM sockets
	Dual antenna SMA connectors for 3G main and aux
	GPS antenna with 3.3V active power feed
	Two 10/100 Mbps Ethernet ports
	Dual WiFi internal antennas
	Dual WiFi SMA female connectors
	Concurrent Access Point and Station mode
	Metal casing
	Carrier bracket
GW1042M	Dual SIM sockets
	Dual antenna SMA connectors for LTE main and aux
	GPS antenna with 3.3V active power feed
	Two 10/100 Mbps Ethernet ports
	Dual WiFi internal antennas
	Dual WiFi SMA female connectors
	Concurrent Access Point and Station mode
	Metal casing
	Carrier bracket

GW1000M with isolated DC power connector

	
Figure 3: GW1000M Series router front	**Figure 4: GW1000M Series router back**

GW1032M	Dual antenna SMA connectors for 3G main and aux
	GPS antenna with 3.3V active power feed
	Two 10/100 Mbps Ethernet ports
	Concurrent Access Point and Station mode
	No WiFi
	Metal casing
	Carrier bracket
GW1042M	Dual SIM sockets
	Dual antenna SMA connectors for LTE main and aux
	GPS antenna with 3.3V active power feed
	Two 10/100 Mbps Ethernet ports
	Concurrent Access Point and Station mode
	No WiFi
	Metal casing
	Carrier bracket

2.2 GW1000M Series router dimensions

Unit size:	114W 114D 38Hmm
Unit size with carrier:	120W 120D 42Hmm
Unit weight:	450g

2.3 GSM technology

- LTE
- HSPA+
- EDGE/GPRS
- GPS

2.4 WiFi technology

- 802.11 b/g/n
- Single band 2.4GHz
- Up to 20dBm output power
- Internal antenna

2.5 Power supply

The GW1000M Series router has four power supply options:

- External standard 12V DC 0.5 A
- External standard 12V DC 0.5 A with extended temp (-20°C to -70°C)
- Internal isolated 18-36V DC input
- Power lead with 3 connectors for 12V permanent, 12V switched (ignition sense) and ground

2.6 Compliance

The GW1000M Series router is compliant and tested to the following standards:

Safety	EN60950-1: 2006
EMC	EN55022:1998 Class B and EN55024:1998 ETSI 301489-17
Environmental	ETSI 300 019-1-3 Sinusoidal Vibration and Shock ETSI 300 019-2-3 Random Vibration.
WiFi 2.4GHz	ETSI EN 300 328 V1.9 (2015-02)

2.7 Operating temperature range

The operating temperature range depends on the RF band of the module. Refer to the Radio Bands datasheet.

2.8 Antenna

The GW1000M Series router standard locking DC power connector model has two additional SMA female WiFi antenna sockets.

2.8.1 Antennas on the GW1000M Series router

- 2 x LTE SMA female antenna connectors
- MIMO support in LTE versions
- 1 x GPS SMA female antenna connector with 3v3 active power feed
- 2 x SMA female WiFi antenna sockets*

*No WiFi on GW1000M isolated DC power connector models.

2.9 GW1000M Series components

To enable and configure connections on your router, it must be correctly installed.

The routers contain an internal web server that you use for configurations. Before you can access the internal web server and start the configuration, ensure the components are correctly connected and that your PC has the correct networking setup.

2.9.1 Standard components

1 x GW1000M Series router	
1 x plastic carrier	
1 x lockable SIM cover	

Table 2: GW1000M Series router standard components

2.9.2 Optional components

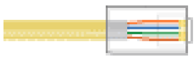
Ethernet cable. RJ45 connector at both ends.		
Power supply unit.		
Right angle antenna for 3G or 4G network.		Virtual Access supplies a wide range of antennas for 3G or 4G networks. Please visit our website: www.virtualaccess.com or contact Virtual Access for more information.
Right angle or straight stubby antenna for WiFi connection		Virtual Access supplies a wide range of antennas for WiFi. Please visit our website: www.virtualaccess.com or contact Virtual Access for more information.
1 x fused automotive cable		
1 x non-fused automotive cable		

Table 3: GW1000M Series router optional components

2.10 Inserting a SIM card

1. Ensure the unit is powered off.
2. Hold the SIM 1 card with the chip side facing down and the cut corner front left.
3. Gently push the SIM card into SIM slot 1 until it clicks in.
4. If using SIM 2 then hold the SIM with the cut corner front right
5. Gently push the SIM card into SIM slot 2 until it clicks in.

2.11 Connecting the SIM lock

Connect the SIM lock using the Allen key provided.

2.12 Connecting cables

Connect one end of the Ethernet cable into port A and the other end to your PC or switch. For information on connecting cables for a vehicle installation, read chapter 4, 'Installing a router into a vehicle'.

2.13 Connecting the antenna

If you are connecting only one antenna, screw the antenna into the MAIN SMA connector.

If you are using two antennas, screw the main antenna into the MAIN SMA connector and the secondary antenna into the AUX SMA connector.

2.14 Installing the GW1000M

You can install the GW1000M in a vehicle or on a wall. To read how to install the GW1000M in a vehicle read the Chapter 'Installing the router in a vehicle'.

2.15 Installing the GW1000M on a wall

You can mount the router on a wall using the supplied carrier and suitable mounting fixtures for the wall type (not supplied). You must not mount it more than 2 metres above floor level.

2.16 Powering up

The router takes approximately 2 minutes to boot up. During this time, the PWR/CONFIG LED flashes in a double flash pattern – 2 quick fashes followed by a pause.

Other LEDs display different diagnostic patterns during boot up.

Booting is complete when the PWR/CONFIG LED stops double flashing and stays solid or flashing steady, indicating the particular running configuration is loaded. Read the chapter 'GW1000 LED behaviour', for PWR/CONFIG LED states.

2.17 Reset button

The reset button is used to request a system reset.

When you press the reset button the PWR/CONFIG LED will display different patterns depending on how long you press the button. The flashing patterns will be different for the 2 flashing phases indicated below. The length of time you hold the reset button will determine the router behaviour.

Press duration	PWR/CONFIG LED behaviour	Router behaviour on depress
0-3 seconds	Solid on	Normal reset to running config. No special LED activity.
Between 3 and 15 seconds	Flashing fast	Releasing between 3-15 seconds switches the router back to factory configuration.
Between 15 and 20 seconds	Solid on	Releasing between 15-20 seconds performs a normal reset to running config.
Between 20 seconds and 30 seconds	Flashing slowly	Releasing between 20-30 seconds reboots the router in recovery mode.
Over 30 seconds	Solid on	Releasing after 30 seconds performs a normal reset.

Table 4: GW1000M Series router reset behaviour

2.17.1 Recovery mode

Recovery mode is a fail-safe mode where the router can load a default configuration from the router’s firmware. If your router goes into recovery mode, all config files are kept intact. After the next reboot, the router will revert to the previous config file.

You can use recovery mode to manipulate the config files but should only be used if all other configs files are corrupt. If your router has entered recovery mode, contact your local reseller for access information.

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3 GW1000M Series LED behaviour

3.1 Main LED behaviour

There are five LEDs on the GW1000M Series router

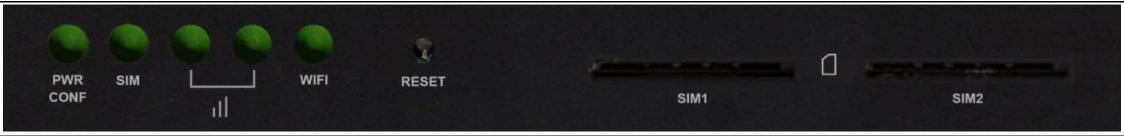

Figure 5: LEDs on the GW1000M Series router

The possible LED states are:

- Off
- Flashing slowing (2 flashes per second)
- Flashing quickly (5 flashes per second)
- Double flash (2 quick flashes then a pause)
- On

The following table describes the possible LED behaviours and meanings on the GW1000M Series router.

Booting		The router takes approximately 2 minutes to boot up. During this time, the power LED flashes. Other LEDs display different diagnostic patterns during boot up. Booting is complete when the power LED stops flashing and stays on steady.
PWR/CONFIG LED	Off	No power/boot loader does not exist.
	Double flash	Unit is booting from power on.
	Flashing slowly	Unit is in recovery mode.
	Flashing quickly	Unit is in factory configuration.
	Solid on	Unit has completed booting up process and is in either config 1 or config2.
SIM LEDs	Off	Not selected or SIM not inserted.
	Flashing	SIM selected and data connection is being established.
	Solid on	SIM selected and registered on the network.
Signal LEDs	Both LEDs off	Not connected or signal strength <= -113dBm.
	Left LED on Right LED off	Connected and signal strength <= -89dBm.
	Left LED off Right LED on	Connected and signal strength between -89dBm and -69dBm.
	Both LEDs on	Connected and signal strength >-69dBm.
WiFi LEDs	Off	WiFi not enabled.
	Flashing	Data activity on WiFi interface.
	Solid on	WiFi is enabled.

Table 5: LED behaviour and descriptions

Note: when a data connection does not exist, none of the signal LEDs will light regardless of signal strength.

3.2 GW1000M Series Ethernet port LED behaviour

The Ethernet port has two physical LEDs, one is green and one is amber. When looking at the port the green LED is on the left and is the only active LED.

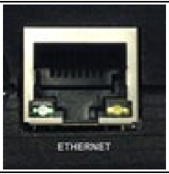

Figure 6: Ethernet LED on the rear of the GW1000M Series router

Link LED (green)	Off	No physical Ethernet link detected
	On	Physical Ethernet link detected
	Flashing	Data is being transmitted/ received over the link

Table 6: The Ethernet LEDs activity descriptions

4 Installing a router into a vehicle

The type of cable you need depends on your application and vehicle. You will have received either a fused or non-fused power cable for the installation.

4.1 Installing a router into a vehicle using a non-fused power cable

Install the router using the vehicle installation power cable 840-00076 provided.

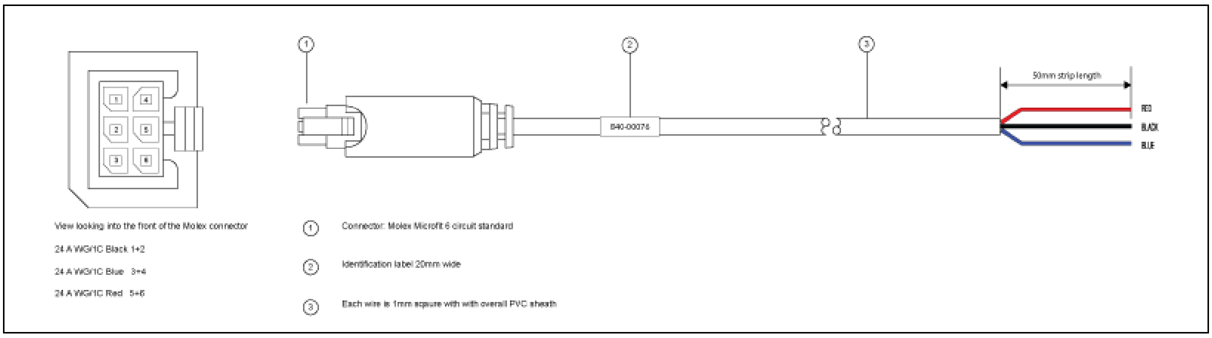

Figure 7: 840-00076 3 core power cable

(1)	Connector: Molex Microfit 6 circuit standard
(2)	Label 20mm wide
(3)	Each wire is 1.0mm square, with overall PVC sheath
Note:	Requires 5 amp fuse in series with red and blue wires

Table 7: Power cable descriptions

- Connect the **BLACK** wire to a ground wire.
- Connect the **BLUE** wire to a 12V switched vehicle ignition wire.
- Connect the **RED** wire to a 12V permanent wire.
- Plug the 6 pin connector into the router.

4.2 Installing a router into a vehicle using a fused power cable

Install the router using the vehicle installation power cable 840-00105 provided.

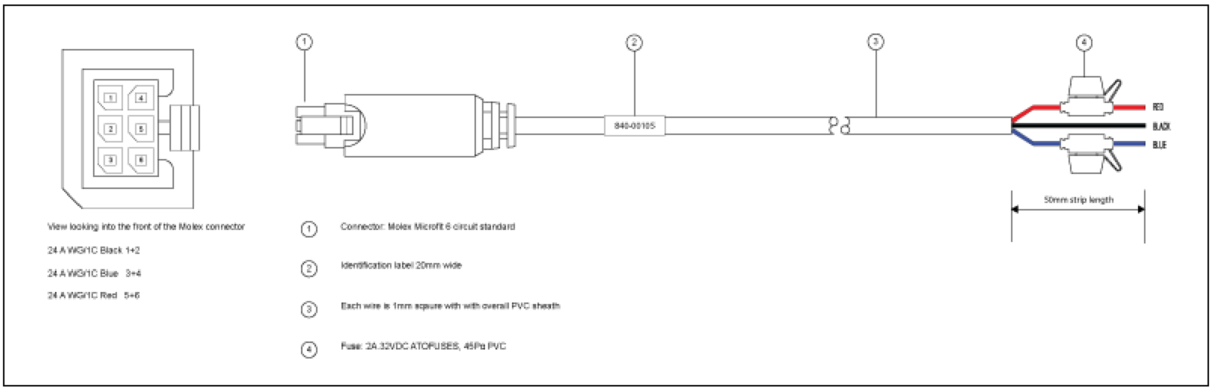

Figure 8: 840-00105 3 core power cable

(1)	Connector: Molex Microfit 6 circuit standard
(2)	Label 20mm wide
(3)	Each wire is 1.0mm square, with overall PVC sheath
(4)	Fuse
Note:	Requires 5 amp fuse in series with red and blue wires

Table 8: Power cable descriptions

- Connect the **BLACK** wire to a ground wire.
- Connect the **BLUE** wire to a 12V switched vehicle ignition wire.
- Connect the **RED** wire to a 12V permanent wire.
- Plug the 6 pin connector into the router.

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5 Factory configuration extraction from SIM card

Virtual Access routers have a feature to update the factory configuration from a SIM card. This allows you to change the factory configuration of a router when installing the SIM.

1. Make sure the SIM card you are inserting has the required configuration written on it.
2. Ensure the router is powered off.
3. Hold the SIM 1 card with the chip side facing down and the cut corner front left.
4. Gently push the SIM card into SIM slot 1 until it clicks in.
5. Power up the router.

Depending on the model, the power LED and/or the configuration LED flash as usual.

The SIM LED starts flashing. This indicates the application responsible for 3G and configuration extraction management is running. It also means the update of the configuration is happening.

When the update is finished, depending on the model, the power LED and/or the configuration LED blink alternatively and very fast for 20 seconds.

Note: factory configuration extraction is only supported on mobile modules that support phone book operations.

6 Accessing the router

Access the router through the web interface or by using SSH. By default, Telnet is disabled.

6.1 Configuration packages used

Package	Sections
dropbear	dropbear
system	main
uhttpd	main cert

6.2 Accessing the router over Ethernet using the web interface

DHCP is disabled by default, so if you do not receive an IP address via DHCP, assign a static IP to the PC that will be connected to the router.

PC IP address	192.168.100.100
Network mask	255.255.255.0
Default gateway	192.168.100.1

Assuming that the PC is connected to Port A on the router, in your internet browser, type in the default local IP address 192.168.100.1, and press **Enter**. The Authorization page appears.

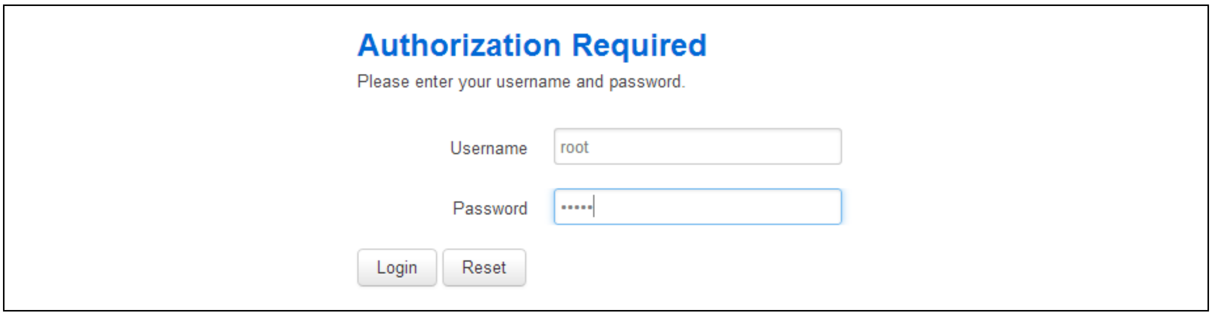

Figure 9: The login page

The password may vary depending on the factory configuration the router has been shipped with. The default settings are shown below. The username and password are case sensitive.

In the username field, type **root**.

In the Password field, type **admin**.

Click **Login**. The Status page appears.

6.3 Accessing the router over Ethernet using an SSH client

You can also access the router over Ethernet, using Secure Shell (SSH) and optionally over Telnet.

To access CLI over Ethernet start an SSH client and connect to the router's management IP address, on port **22: 192.168.100.1/24**.

On the first connection, you may be asked to confirm that you trust the host.

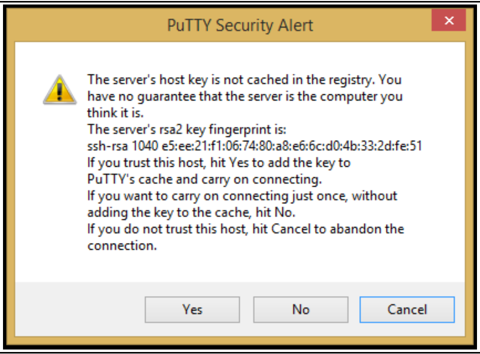

Figure 10: Confirming trust of the routers public key over SSH

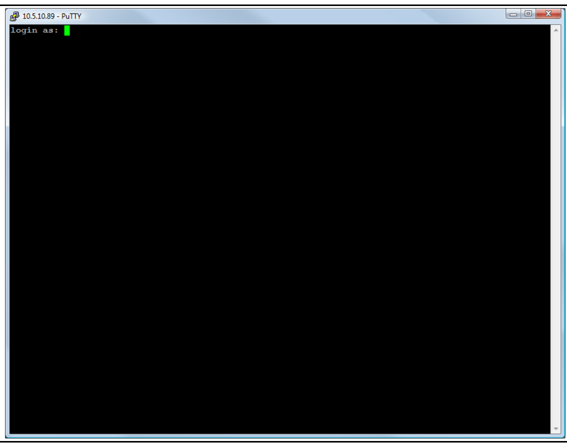

Figure 11: SSH CLI logon screen

In the SSH CLI logon screen, enter the default username and password.

Username: **root**

Password: **admin**

6.3.1 SCP (Secure Copy Protocol)

As part of accessing the router over SSH, you can also use SCP protocol. Use the same user authentication credentials as for SSH access. You can use SCP protocol to securely, manually transfer files from and to the router's SCP server.

No dedicated SPC client is supported; select the SCP client software of your own choice.

6.4 Accessing the router over Ethernet using a Telnet client

Telnet is disabled by default, when you enable Telnet, SSH is disabled.

To enable Telnet, enter:

```
root@VA_router: ~# /etc/init.d/dropbear disable
root@VA_router: ~# reboot
```

To re-enable SSH, enter:

```
root@VA_router: ~# /etc/init.d/dropbear enable
root@VA_router: ~# reboot
```

Note: as SSH is enabled by default, initial connection to the router to enable Telnet must be established over SSH.

6.5 Configuring the password

6.5.1 Configuration packages used

Package	Sections
system	main

6.6 Configuring the password using the web interface

To change your password, in the top menu click **System -> Administration**. The Administration page appears.

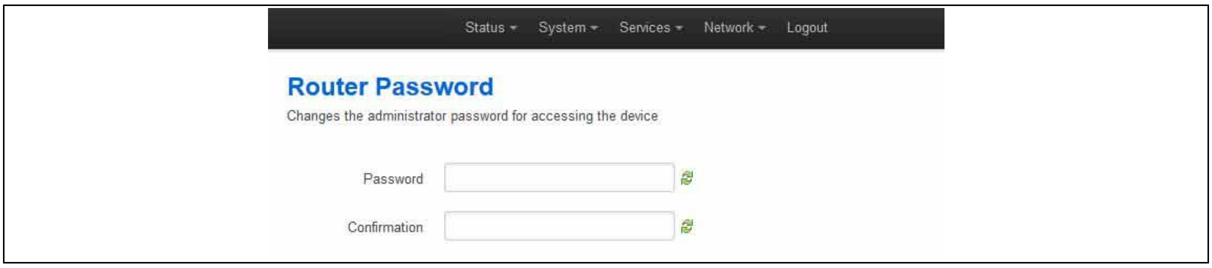

Figure 12: The router password section

In the Router Password section, type your new password in the password field and then retype the password in the confirmation field.

Scroll down the page and click **Save & Apply**.

Note: the username 'root' cannot be changed.

Web Field/UCI/Package Option	Description
Web: Password UCI: system.main.password Opt: password	Defines the root password. The password is displayed encrypted via the CLI using the 'hashpassword' option. UCI: system.main.hashpassword Opt: hashpassword

6.7 Configuring the password using UCI

The root password is displayed encrypted via the CLI using the hashpassword option.

```
root@VA_router:~# uci show system
system.main=system
system.main.hostname=VA_router
system.main.hashpassword=$1$jRX/x8A/$U5kLCMpi9dcahRhOl7eZV1
```

If you are changing the password using UCI, enter the new password in plain text using the password option.

```
root@VA_router:~# uci system.main.password=newpassword
root@VA_router:~# uci commit
```

The new password will take effect after a reboot and will now be displayed in encrypted format via the hashpassword option.

6.8 Configuring the password using package options

The root password is displayed encrypted via the CLI using the hashpassword option.

```
root@VA_router:~# uci export system
package system

config system 'main'
      option hostname 'VA_router'
      option hashpassword '$1$wRYYiJOz$EeHN.GQcxXhRgNPVbqxVw
```

If you are changing the password using UCI, enter the new password in plain text using the password option.

```
package system

config system 'main'
      option hostname 'VA_router'
      option hashpassword '$1$wRYYiJOz$EeHN.GQcxXhRgNPVbqxVw
      option password 'newpassword'
```

The new password will take effect after reboot and will now be displayed in encrypted format via the hashpassword option.

6.9 Accessing the device using RADIUS authentication

You can configure RADIUS authentication to access the router over SSH, web or local console interface.

```
package system


config system 'main'
        option hostname 'VirtualAccess'
        option timezone 'UTC'


config pam_auth
        option enabled 'yes'
        option pamservice 'login'
        option pammodule 'auth'
        option pamcontrol 'sufficient'
        option type 'radius'
        option servers '192.168.0.1:3333|test|20 192.168.2.5|secret|10'


config pam_auth
        option enabled 'yes'
        option pamservice 'sshd'
        option pammodule 'auth'
        option pamcontrol 'sufficient'          it checks package
management_users
        option type 'radius'
        option servers '192.168.0.1:3333|test|20 192.168.2.5|secret|10'


config 'pam_auth'
        option enabled 'yes'
        option pamservice 'luci"
        option pammodule 'auth'
        option pamcontrol 'sufficient'
        option type 'radius'
        servers '192.168.0.1:3333|test|20 192.168.2.5|secret|10'
```

<table>
<tr><th>UCI/Package Option</th><th>Description</th></tr>
<tr><td>UCI: system.@pam_auth[0].enabled=yes
Opt: enabled</td><td>Enables and disables RADIUS configuration sections.<table><tr><td>yes</td><td>Enables the following RADIUS configuration section.</td></tr><tr><td>no</td><td>Disables the following RADIUS configuration section.</td></tr></table></td></tr>
<tr><td>UCI: system.@pam_auth[0].pamservice
Opt: pamservice</td><td>Selects the method which users should be authenticated by.<table><tr><td>login</td><td>User connecting over console cable.</td></tr><tr><td>sshd</td><td>User connecting over SSH.</td></tr><tr><td>luci</td><td>User connecting over web.</td></tr></table></td></tr>
<tr><td>UCI: system.@pam_auth[0].pamcontrol
Opt: pamcontrol</td><td>Specifies authentication behaviour after authentication fails or connection to RADIUS server is broken.<table><tr><td>Sufficient</td><td>First authenticates against remote RADIUS if password authentication fails then it tries the local database (user defined in package management_users).</td></tr><tr><td>Required</td><td>If either authentication fails or the RADIUS server is not reachable then the user is not allowed to access the router.</td></tr><tr><td>[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die]</td><td>Local database is only checked if the RADIUS server is not reachable.</td></tr></table></td></tr>
<tr><td>UCI: system.@pam_auth[0].pammodule.auth
Opt: pammodule</td><td>Enables user authentication.</td></tr>
<tr><td>UCI: system.@pam_auth[0].type.radius
Opt: type</td><td>Specifies the authentication method.</td></tr>
<tr><td>UCI: system.@pam_auth[0].servers
Opt: servers</td><td>Specifies the RADIUS server along with port number, password and timeout in seconds.
Port and timeout are optional. The default port for RADIUS is 1812; default timeout is 10 seconds.
Multiple servers are entered using a space separator.
Syntax:
<server ip address>[:<port>]|<secret>[|timeout]
Examples:
option servers `192.168.0.1test’<br>option servers `192.168.0.1|test 192.168.2.5:1234|secret|10’</td></tr>
</table>

Table 9: Information table for RADIUS authentication

6.10 Accessing the device using TACACS+ authentication

You can configure TACACS+ authentication for accessing the router over SSH, web or local console interface.

```
package system


config system 'main'
```

```
        option hostname 'VirtualAccess'
        option timezone 'UTC'

config pam_auth
        option enabled 'yes'
        option pamservice 'sshd'
        option pammodule 'auth'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'

config pam_auth
        option enabled 'yes'
        option pamservice 'sshd'
        option pammodule 'account'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'
        option args 'service=ppp'

config pam_auth
        option enabled 'yes'
        option pamservice 'sshd'
        option pammodule 'session'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'
        option args 'service=ppp'

config pam_auth
        option enabled 'yes'
        option pamservice 'luci'
        option pammodule 'auth'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'
```

```
config pam_auth
        option enabled 'yes'
        option pamservice 'luci'
        option pammodule 'account'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'
        option args 'service=ppp'

config pam_auth
        option enabled 'yes'
        option pamservice 'luci'
        option pammodule 'session'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'
        option args 'service=ppp'
config pam_auth
        option enabled 'yes'
        option pamservice 'login'
        option pammodule 'auth'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'

config pam_auth
        option enabled 'yes'
        option pamservice 'login'
        option pammodule 'account'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'
        option args 'service=ppp'

config pam_auth
        option enabled 'yes'
        option pamservice 'login'
```

```
        option pammodule 'session'
        option pamcontrol 'sufficient'
        option type 'tacplus'
        option servers '192.168.0.1:49|secret'
        option args 'service=ppp'
```

<table>
<tr><th>UCI/Package Option</th><th>Description</th></tr>
<tr><td>UCI: system.@pam_auth[0].enabled=yes
Opt: enabled</td><td>Enables and disables TACACS configuration sections.<table><tr><td>yes</td><td>Enables following the TACACS configuration section.</td></tr><tr><td>no</td><td>Disables following the TACACS configuration section.</td></tr></table></td></tr>
<tr><td>UCI: system.@pam_auth[0].pamservice
Opt: pamservice</td><td>Selects the method which users should be authenticated by.<table><tr><td>login</td><td>User connecting over console cable.</td></tr><tr><td>sshd</td><td>User connecting over SSH.</td></tr><tr><td>luci</td><td>User connecting over web.</td></tr></table></td></tr>
<tr><td>UCI: system.@pam_auth[0].pamcontrol
Opt: pamcontrol</td><td>Specifies the authentication behaviour after authentication fails or the connection to TACACS server is broken.<table><tr><td>Sufficient</td><td>First authenticates against the remote TACACS if password authentication fails, then it tries local database (user defined in package management_users)</td></tr><tr><td>Required</td><td>If either authentication fails or the TACACS server is not reachable, then the user is not allowed to access the router.</td></tr><tr><td>[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die]</td><td>Local database is only checked if the TACACS server is not reachable.</td></tr></table></td></tr>
<tr><td>UCI: system.@pam_auth[0].pammodule.auth
Opt: pammodule</td><td>Selects which TACACS module this part of the configuration relates to.<table><tr><td>auth</td><td>Auth module provides the actual authentication and sets credentials.</td></tr><tr><td>account</td><td>Account module checks to make sure that access is allowed for the user.</td></tr><tr><td>session</td><td>Session module performs additional tasks which are needed to allow access.</td></tr></table></td></tr>
<tr><td>system.@pam_auth[0].type=tacplus
Opt: type</td><td>Specifies the authentication method.</td></tr>
</table>

UCI: system.@pam_auth[0].servers Opt: servers	Specifies TACACS servers along with port number and password. Port is optional. The default port for TACACS is 49. Multiple servers are entered using a space separator. Syntax: `<server ip address>[:<port>]|<secret>` Examples: option servers `192.168.0.1|test` option servers `192.168.0.1|test 192.168.2.5:1234|secret`
UCI: system.@pam_auth[1].args=service=ppp Opt: args	Additional arguments to pass to TACACS server.

Table7: Information table for TACACS authentication

6.11 SSH

SSH allows you to access remote machines over text-based shell sessions. SSH uses public key cryptography to create a secure connection. These connections allow you to issue commands remotely via a command line.

The router uses a package called Dropbear to configure the SSH server on the box. You can configure Dropbear using the web interface or through an SSH connection by editing the file stored on: /etc/config_name/dropbear.

6.11.1 Configuration packages used

Package	Sections
dropbear	dropbear

6.11.2 SSH access using the web interface

In the top menu, click **System -> Administration**. The Administration page appears. Scroll down to the SSH Access section.

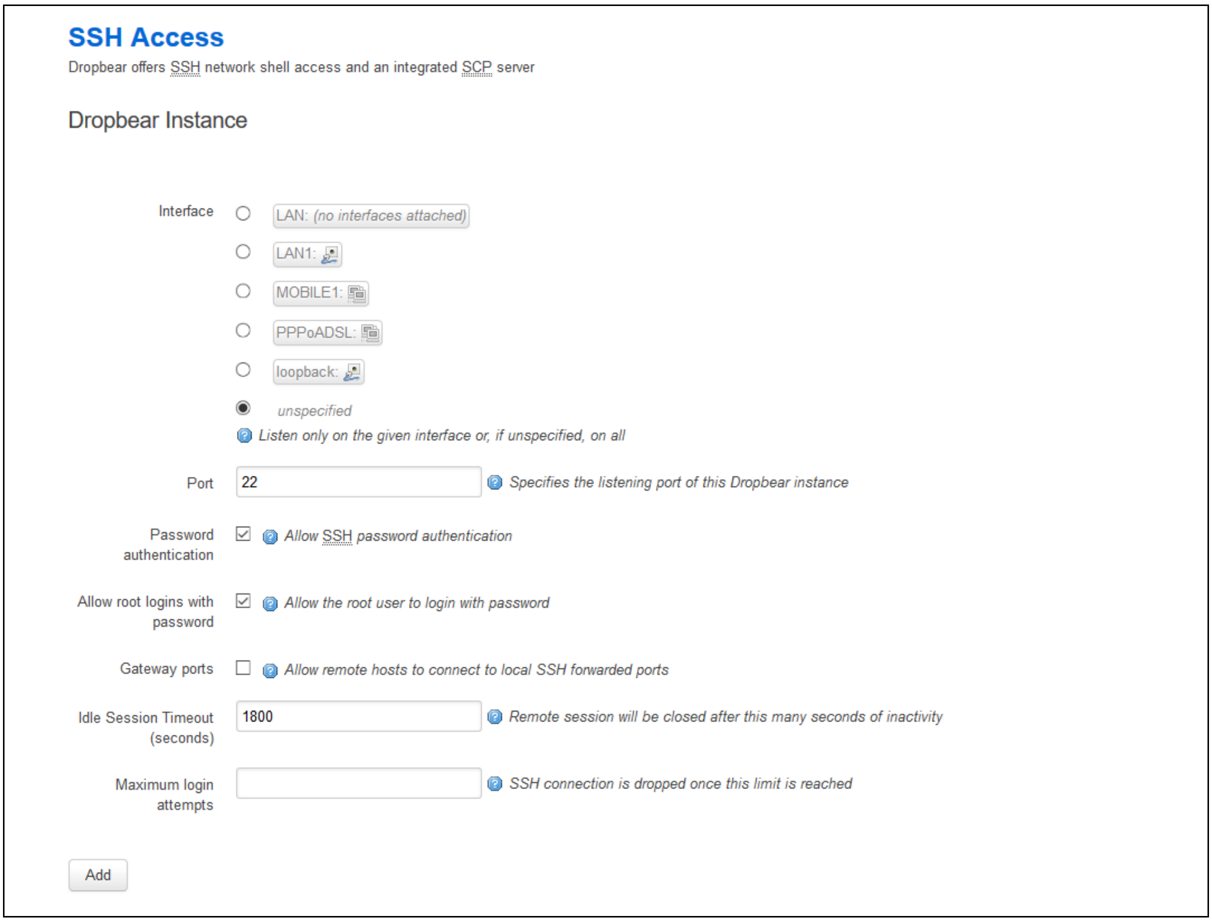

Figure 13: The SSH access section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Interface
UCI: dropbear.@dropbear[0].Interface
Opt: interface</td><td>Listens only on the selected interface. If you check unspecified, it listens on all interfaces. All configured interfaces will be displayed via the web GUI.<table><tr><td>(unspecified)</td><td>Listens on all interfaces.</td></tr><tr><td>Range</td><td>Configured interface names.</td></tr></table></td></tr>
<tr><td>Web: Port
UCI: dropbear.@dropbear[0].Port
Opt: port</td><td>Specifies the listening port of the Dropbear instance.<table><tr><td>22</td><td></td></tr><tr><td>Range</td><td>0-65535</td></tr></table></td></tr>
<tr><td>Web: Password authentication
UCI: dropbear.@dropbear[0].PasswordAuth
Opt: PasswordAuth</td><td>If enabled, allows SSH password authentication.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Allow root logins with password
UCI: dropbear.@dropbear[0].RootPasswordAuth
Opt: RootPasswordAuth</td><td>Allows the root user to login with password.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Gateway ports
UCI: dropbear.@dropbear[0].GatewayPorts
Opt: GatewayPorts</td><td>Allows remote hosts to connect to local SSH forwarded ports.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

Web: Idle Session Timeout UCI: dropbear.@dropbear[0].IdleTimeout Opt: IdleTimeout	Defines the idle period where the remote session will be closed after the allocated number of seconds of inactivity. 30 — 30 seconds. Range —
Web: n/a UCI: dropbear.@dropbear[0]. BannerFile Opt: BannerFile	Defines a banner file to be displayed during login. /etc/banner — Range —
Web: Maximum login attempts UCI: dropbear.@dropbear[0].MaxLoginAttempts Opt: MaxLoginAttempts	Specifies maximum login failures before session terminates. 10 — 0-infinite —

Table 10: Information table for SSH access settings

6.12 Package dropbear using UCI

```
root@VA_router:~# uci show dropbear
dropbear.@dropbear[0]=dropbear
dropbear.@dropbear[0].PasswordAuth=on
dropbear.@dropbear[0].RootPasswordAuth=on
dropbear.@dropbear[0].GatewayPorts=0
dropbear.@dropbear[0].IdleTimeout=30
dropbear.@dropbear[0].Port=22
dropbear.@dropbear[0].MaxLoginAttempts=3
Package dropbear using package options
root@VA_router:~# uci export dropbear
package dropbear
config dropbear'
      option PasswordAuth 'on'
      option RootPasswordAuth 'on'
      option Port '22'
      option GatewayPorts ‘0’
      option IdleTimeout ‘30’
      option MaxLoginAttempts '3'
```

6.13 Certs and private keys

Certificates are used to prove ownership of a public key. They contain information about the key, its owner’s ID, and the digital signature of an individual that has verified the content of the certificate.

In asymmetric cryptography, public keys are announced to the public, and a different private key is kept by the receiver. The public key is used to encrypt the message and the private key is used to decrypt it.

To access certs and private keys, in the top menu, click **System -> Administration**. The Administration page appears. Scroll down to the Certs & Private Keys section.

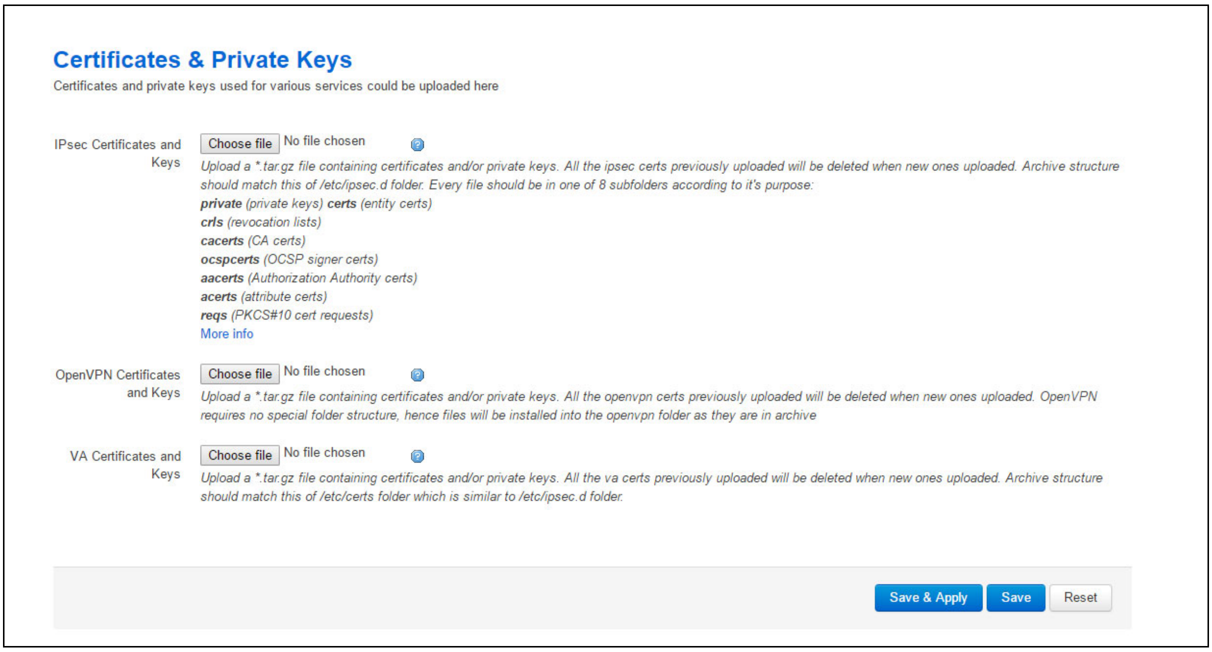

Figure 14: The certificates & private keys section

This section allows you to upload any certificates and keys that you may have stored. There is support for IPSec, OpenVPN and VA certificates and keys.

If you have generated your own SSH public keys, you can input them in the SSH Keys section, for SSH public key authentication.

Figure 15: The SSH-keys box

6.14 Configuring a router's web server

The router's web server is configured in package uhttpd. This file defines the behaviour of the server and default values for certificates generated for SSL operation. uhttpd supports multiple instances, that is, multiple listen ports, each with its own document root and other features, as well as cgi and lua. There are two sections defined:

Main: this uHTTPd section contains general server settings.

Cert: this section defines the default values for SSL certificates.

6.14.1 Configuration packages used

Package	Sections
uhttpd	main
	cert

To configure the router's HTTP server parameters, in the top menu, select **Services -> HTTP Server**. The HTTP Server page has two sections.

Main Settings	Server configurations
Certificate Settings	SSL certificates.

6.14.2 Main settings

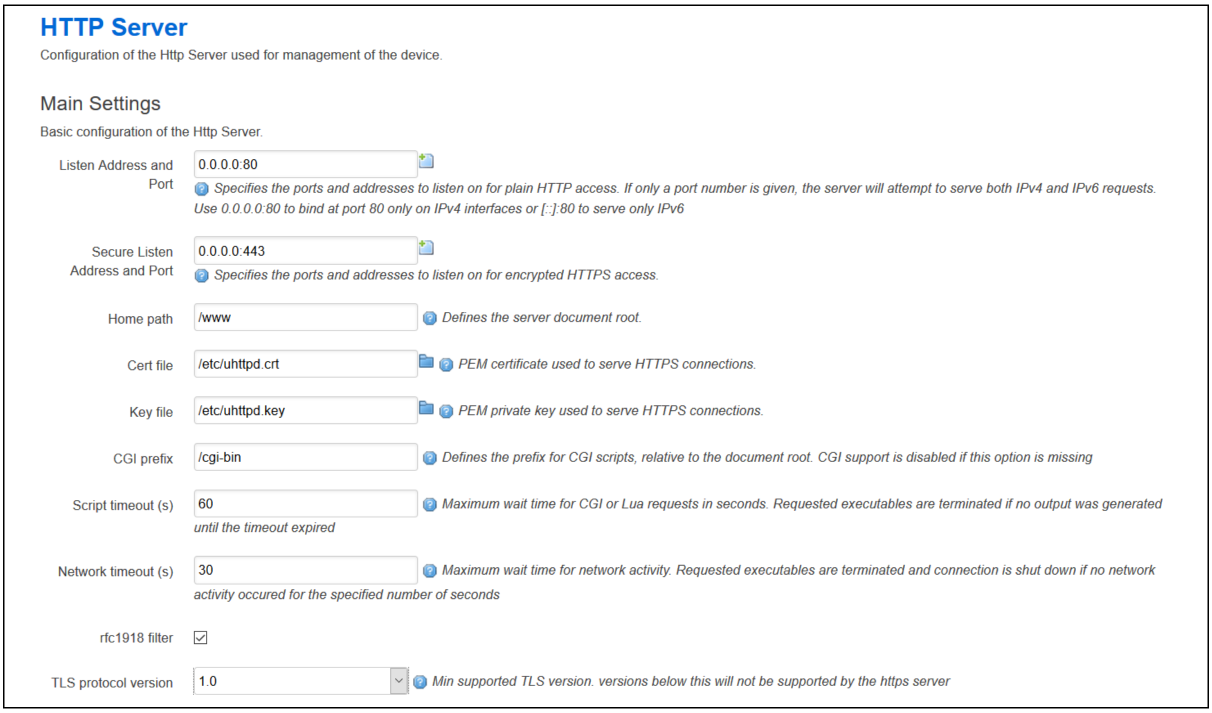

Figure 16: HTTP server settings

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Listen Address and Port
UCI: uhttpd.main.listen_http
Opt: list listen_http</td><td>Specifies the ports and addresses to listen on for plain HTTP access. If only a port number is given, the server will attempt to serve both IPv4 and IPv6 requests.
<table>
<tr><td>0.0.0.0:80</td><td>Bind at port 80 only on IPv4 interfaces.</td></tr>
<tr><td>[::]:80</td><td>Bind at port 80 only on IPv6 interfaces.</td></tr>
<tr><td>Range</td><td>IP address and/or port</td></tr>
</table></td></tr>
<tr><td>Web: Secure Listen Address and Port
UCI: uhttpd.main.listen_https
Opt: list listen_https</td><td>Specifies the ports and address to listen on for encrypted HTTPS access. The format is the same as listen_http.
<table>
<tr><td>0.0.0.0:443</td><td>Bind at port 443 only.</td></tr>
<tr><td>[::]:443</td><td></td></tr>
<tr><td>Range</td><td>IP address and/or port.</td></tr>
</table></td></tr>
</table>

Web: Home path UCI: uhttpd.main.home Opt: home	Defines the server document root. /www Range
Web: Cert file UCI: uhttpd.main.cert Opt: cert	ASN.1/DER certificate used to serve HTTPS connections. If no listen_https options are given the key options are ignored. /etc/uhttpd.crt Range
Web: Key file UCI: uhttpd.main.key Opt: key	ASN.1/DER private key used to serve HTTPS connections. If no listen_https options are given the key options are ignored. /etc/uhttpd.key Range
Web: CGI profile UCI: uhttpd.main.cgi_prefix Opt: cgi_prefix	Defines the prefix for CGI scripts, relative to the document root. CGI support is disabled if this option is missing. /cgi-bin Range
Web: N/A UCI: uhttpd.main.lua_prefix Opt: lua_prefix	Defines the prefix for dispatching requests to the embedded lua interpreter, relative to the document root. Lua support is disabled if this option is missing. /luci Range
Web: N/A UCI: uhttpd.main.lua_handler Opt: lua_handler	Specifies the lua handler script used to initialise the lua runtime on server start. /usr/lib/lua/luci/sgi/uhttpd.lua Range
Web: Script timeout UCI: uhttpd.main.script_timeout Opt: script_timeout	Sets the maximum wait time for CGI or lua requests in seconds. Requested executables are terminated if no output was generated. 60 Range
Web: Network timeout UCI: uhttpd.main.network_timeout Opt: network_timeout	Maximum wait time for network activity. Requested executables are terminated and the connection is shut down if no network activity occured for the specified number of seconds. 30 Range
Web: rfc 1918 filter UCI: uhttpd.main.rfc1918_filter Opt: rfc1918_filter	Enables option to reject requests from RFC1918 IPs to public server IPs (DNS rebinding counter measure). 0 Disabled. 1 Enabled.
Web: TLS protocol version UCI: uhttpd.main.tls_version Opt: tls_version	Defines the minimum supported TLS version for the https server. 1.0 1.1 1.2
Web: N/A UCI: uhttpd.main.realm Opt: realm	Defines basic authentication realm when prompting the client for credentials (HTTP 400). OpenWrt Range

<table>
<tr><td>Web: N/A
UCI: uhttpd.main.config
Opt: config</td><td>Config file in Busybox httpd format for additional settings. Currently only used to specify basic auth areas.<table><tr><td>/etc/http.conf</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: N/A
UCI: uhttpd.main.index_page
Opt: index_page</td><td>Index file to use for directories, for example, add index.php when using php.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: N/A
UCI: httpd.main.error_page
Opt: error_page</td><td>Virtual URL of file of CGI script to handle 404 requests. Must begin with '/' (forward slash).<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: N/A
UCI: uhttpd.main.no_symlinks
Opt: no_symlinks</td><td>Does not follow symbolic links if enabled.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: N/A
UCI: uhttpd.main.no_dirlists
Opt: no_symlinks</td><td>Does not generate directory listings if enabled.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

Table 11: Information table for http server basic settings

6.14.3 HTTP server using command line

Multiple sections of the type uhttpd may exist. The init script will launch one webserver instance per section.

A standard uhttpd configuration is shown below.

6.14.3.1 HTTP Server using UCI

```
root@VA_router:~# uci show uhttpd
uhttpd.main=uhttpd
uhttpd.main.listen_http=0.0.0.0:80
uhttpd.main.listen_https=0.0.0.0:443
uhttpd.main.home=/www
uhttpd.main.rfc1918_filter=1
uhttpd.main.cert=/etc/uhttpd.crt
uhttpd.main.key=/etc/uhttpd.key
uhttpd.main.cgi_prefix=/cgi-bin
uhttpd.main.script_timeout=60
uhttpd.main.network_timeout=30
uhttpd.main.config=/etc/http.conf
uhttpd.main.tls_version=1.0
```

6.14.3.2 HTTP server using package options

```
root@VA_router:~# uci export uhttpd

config uhttpd 'main'
        list listen_http '0.0.0.0:80'
        list listen_https '0.0.0.0:443'
        option home '/www'
        option rfc1918_filter '1'
        option cert '/etc/uhttpd.crt'
        option key '/etc/uhttpd.key'
        option cgi_prefix '/cgi-bin'
        option script_timeout '60'
        option network_timeout '30'
        option config '/etc/http.conf'
        option tls_version '1.0'
```

6.14.4 HTTPs server certificate settings

To configure HTTPs server certificate settings, in the top menu, select **Services -> HTTP Server**. Scroll down to the Certificate Settings section.

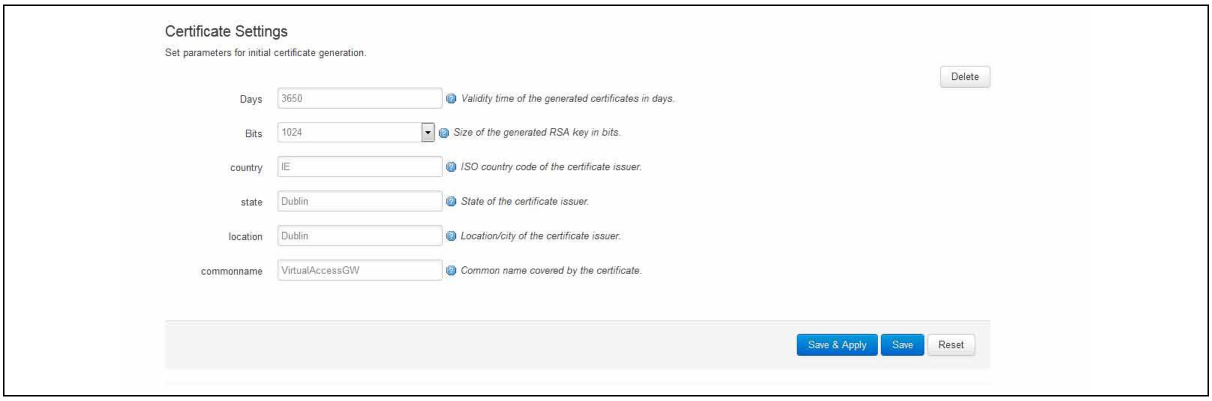

Figure 17: HTTP server certificate settings

Web Field/UCI/Package Option	Description
Web: Days UCI: uhttpd.px5g.days Opt: days	Validity time of the generated certificates in days. 730 Range
Web: Bits UCI: uhttpd.px5g.bits Opt: bits	Size of the generated RSA key in bits. 1024 Range
Web: Country UCI: uhttpd.px5g.country Opt: country	ISO code of the certificate issuer.
Web: State UCI: uhttpd.px5g.state Opt: state	State of the certificate issuer.
Web: Location UCI: uhttpd.px5g.location Opt: location	Location or city of the certificate user.
Web: Commonname UCI: uhttpd.commonname Opt: commonname	Common name covered by the certificate. For the purposes of secure activation, this must be set to the serial number (Eth0 MAC address) of the device.

Table 12: Information table for HTTP server certificate settings

6.14.5 HTTPs server using UCI

```
root@VA_router:~# uci show uhttpd.px5g
uhttpd.px5g=cert
uhttpd.px5g.days=3650
uhttpd.px5g.bits=1024
uhttpd.px5g.country=IE
uhttpd.px5g.state=Dublin
uhttpd.px5g.location=Dublin
uhttpd.px5g.commonname=00E0C8000000
HTTPs server using package options
root@VA_router:~# uci export uhttpd
package uhttpdconfig 'cert' 'px5g'
      option 'days' '3650'
      option 'bits' '1024'
      option 'state' 'Dublin'

      option 'location' 'Dublin'
      option 'commonname' '00E0C8000000'
```

6.15 Basic authentication (httpd conf)

For backward compatibility reasons, uhttpd uses the file /etc/httpd.conf to define authentication areas and the associated usernames and passwords. This configuration file is not in UCI format.

Authentication realms are defined in the format prefix:username:password with one entry and a line break.

Prefix is the URL part covered by the realm, for example, cgi-bin to request basic auth for any CGI program.

Username specifies the username a client has to login with.

Password defines the secret password required to authenticate.

The password can be either in plain text format, MD5 encoded or in the form $p$user where the user refers to an account in /etc/shadow or /etc/passwd.

If you use p… format, uhttpd will compare the client provided password against the one stored in the shadow or passwd database.

6.16 Securing uhttpd

By default, uhttpd binds to 0.0.0.0 which also includes the WAN port of your router. To bind uhttpd to the LAN port only you have to change the listen_http and listen_https options to your LAN IP address.

To get your current LAN IP address, enter:

```
uci get network.lan.ipaddr
```

Then modify the configuration appropriately:

```
uci set uhttpd.main.listen_http='192.168.1.1:80'

uci set uhttpd.main.listen_https='192.168.1.1:443'


config 'uhttpd' 'main'

        list listen_http        192.168.1.1:80

        list listen_https       192.168.1.1:443
```

6.17 Displaying custom information via login screen

The login screen, by default, shows the hostname of the router in addition to the username and password prompt. However, the router can be configured to show some other basic information if required using a UDS script.

Note: this can only be configured via the command line.

6.17.1 Configuration packages used

Package	Sections
luci	main
uds	script

6.17.2 Configuring login screen custom information

The luci package option `login_page_info_template` is configured with the path to a UDS script that would render the required information on the right side of the login page.

The following example shows how to display serial number and mobile signal strength.

Note: this can only be configured via the command line.

Figure 18: Example login screen displaying serial and signal strength

6.17.2.1 Login screen custom information using UCI

```
root@VA_router:~# uci show luci
luci.main=core
luci.main.login_page_info_template=/tmp/uds/sysauth_template

root@VA_router:~# uci show uds
uds.sysauth_template=script
uds.sysauth_template.enabled=1
uds.sysauth_template.exec_type=none
uds.sysauth_template.fname=sysauth_template.htm
uds.sysauth_template.type=none
uds.sysauth_template.text=Serial: <%=pcdata(luci.version.serial)%><br/> <%
local sig = luci.dispatcher.uci.cursor_state():get("mobile", "3g_1_1",
"sig_dbm") or -113 sig = tonumber(sig) local hue = (sig + 113) * 2 local
hue = math.min(math.max(hue, 0), 120) %> Signal strength: <h3
style="color:hsl(<%=hue%>, 90%, 50%); display:inline;"><%=sig%></h3> dBm
```

6.17.2.2 Login screen custom information using package options

```
root@VA_router:~# uci export luci
package luci
config core ‘main’
      option login_page_info_template ‘/tmp/uds/sysauth_template’
root@VA_router:~# uci export uds
package uds
config script 'sysauth_template'
        option enabled '1'
        option exec_type 'none'
        option fname 'sysauth_template.htm'
        option type 'none'
        list text 'Serial: <%=pcdata(luci.version.serial)%><br/>'
        list text '<% local sig =
luci.dispatcher.uci.cursor_state():get("mobile", "3g_1_1", "sig_dbm") or -
113'
        list text 'sig = tonumber(sig)'
        list text 'local hue = (sig + 113) * 2'
        list text 'local hue = math.min(math.max(hue, 0), 120) %>'
        list text 'Signal strength: <h3 style="color:hsl(<%=hue%>, 90%,
50%); display:inline;"><%=sig%></h3> dBm
```

7 Router file structure

This section describes the file structure and location of essential directories and files on Virtual Access routers.

Throughout this document, we use information tables to show the different ways to configure the router using the router's web interface and command line interface (CLI).

When showing examples of the command line interface we use the host name 'VA_router' to indicate the system prompt. For example, the table below displays what the user should see when entering the command to show the current configuration in use on the router:

```
root@VA_router:~# va_config.sh
```

7.1 System information

General information about software and configuration used by the router is displayed on the Status page. To view the running configuration file status on the web interface, in the top menu, select **Status -> Overview**. This page also appears immediately after you have logged in.

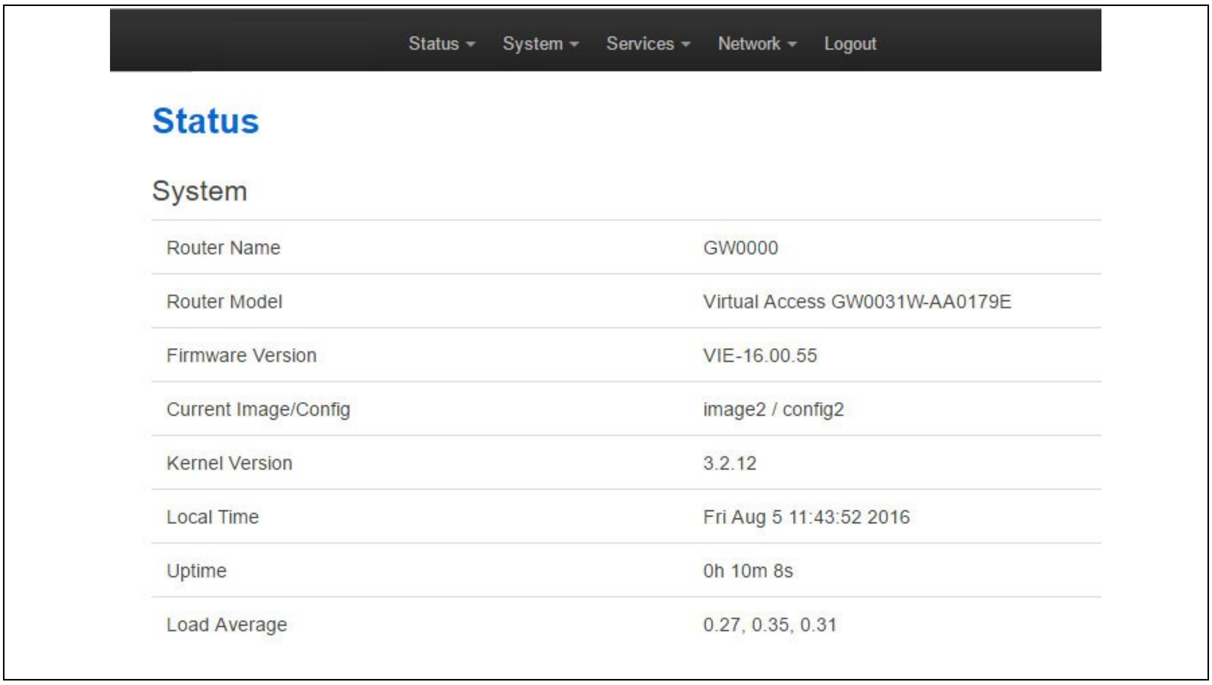

Figure 19: Example of the status page

System information is also available from the CLI if you enter the following command:

```
root@VA_router:~# va_vars.sh
```

The example below shows the output from the above command.

```
VA_SERIAL:              00E0C8121215
VA_MODEL:               GW0000
VA_ACTIVEIMAGE:         image2
VA_ACTIVECONFIG:        config1
VA_IMAGE1VER:           VIE-16.00.44
VA_IMAGE2VER:           VIE-16.00.44
```

7.2 Identify your software version

To check which software version your router is running, in the top menu, browse to **Status -> Overview**.

Status

System

Router Name	GW0000
Router Model	Virtual Access GW0031W-AA0179E
Firmware Version	VIE-16.00.55
Current Image/Config	image2 / config2
Kernel Version	3.2.12
Local Time	Fri Aug 5 11:43:52 2016
Uptime	0h 10m 8s
Load Average	0.27, 0.35, 0.31

Figure 20: The status page showing a software version prior to 72.002

Status

System

Router Name	dmvpn
Router Model	GW2028
Firmware Version	LIS-15.00.72.002rc4
Current Image/Config	image1 / config1
Kernel Version	3.2.12
Local Time	Thu Jan 26 14:46:03 2017
Uptime	0h 39m 37s
Load Average	1.02, 0.53, 0.48

Figure 21: The status page showing software version 72.002

In the Firmware Version row, the first two digits of the firmware version identify the hardware platform, for example LIS-15; while the remaining digits: .00.72.002, show the software version.

7.3 Image files

The system allows for two firmware image files:

- image1, and
- image2

Two firmware images are supported to enable the system to rollback to a previous firmware version if the upgrade of one image fails.

The image names (image1, image2) themselves are symbols that point to different partitions in the overall file system. A special image name “altimage” exists which always points to the image that is not running.

The firmware upgrade system always downloads firmware to “altimage”.

7.4 Directory locations for UCI configuration files

Router configurations files are stored in folders on:

- /etc/factconf,
- /etc/config1, and
- /etc/config2

Multiple configuration files exist in each folder. Each configuration file contains configuration parameters for different areas of functionality in the system.

A symbolic link exists at /etc/config, which always points to one of factconf, config1 or config2 is the active configuration file.

Files that appear to be in /etc/config are actually in /etc/factconf|config1|config2 depending on which configuration is active.

If /etc/config is missing on start-up, for example on first boot, the links and directories are created with configuration files copied from /rom/etc/config/.

At any given time, only one of the configurations is the active configuration. The UCI system tool (Unified Configuration Interface) only acts upon the currently active configuration.

7.5 Viewing and changing current configuration

To show the configuration currently running, enter:

```
root@VA_router:~# va_config.sh
```

To show the configuration to run after the next reboot, enter:

```
root@VA_router:~# va_config.sh next
```

To set the configuration to run after the next reboot, enter:

```
root@VA_router:~# va_config.sh -s [factconf|config1|config2|altconfig]
```

7.6 Configuration file syntax

The configuration files consist of sections – or packages - that contain one or more config statements. These optional statements define actual values.

Below is an example of a simple configuration file.

```
package 'example'
config 'example' 'test'
        option   'string'      'some value'
        option   'boolean'     '1'
        list     'collection'  'first item'
        list     'collection'  'second item'
```

The config 'example' 'test' statement defines the start of a section with the type example and the name test.

Command	Target	Description
export	[<config>]	Exports the configuration in a machine readable format. It is used internally to evaluate configuration files as shell scripts.
import	[<config>]	Imports configuration files in UCI syntax.
add	<config> <section-type>	Adds an anonymous section of type-section type to the given configuration.
add_list	<config>.<section>.<option>=<string>	Adds the given string to an existing list option.
show	[<config>[.<section>[.<option>]]]	Shows the given option, section or configuration in compressed notation.
get	<config>.<section>[.<option>]	Gets the value of the given option or the type of the given section.
Set	<config>.<section>[.<option>]=<value>	Sets the value of the given option, or adds a new section with the type set to the given value.
delete	<config>[.<section[.<option>]]	Deletes the given section or option.

Table 1: Common commands, target and their descriptions

7.7 Managing configurations

7.7.1 Managing sets of configuration files using directory manipulation

Configurations can also be managed using directory manipulation.

To remove the contents of the current folder, enter:

```
root@VA_router:/etc/config1# rm -f *
```

Warning: the above command makes irreversible changes.

To remove the contents of a specific folder regardless of the current folder (config2), enter:

```
root@VA_router:/ # rm -f /etc/config1/*
```

Warning: the above command makes irreversible changes.

To copy the contents of one folder into another (config2 into config1), enter:

```
root@VA_router:/etc/config1# cp /etc/config2/* /etc/config1
```

7.8 Exporting a configuration file

If you have software versions prior to 72.002, to export a configuration file using the web interface, go to section 7.8.1.

If you have software version 72.002 or above, export a configuration file using the web interface go to section 7.8.2.

To export a configuration file using UCI, for any software version, go to section 7.8.3.

7.8.1 Exporting a configuration file using the web interface for software versions pre- 72.002

The current running configuration file may be exported using the web interface.

In the top menu, select **System -> Backup/Flash Firmware**. The Flash operations page appears.

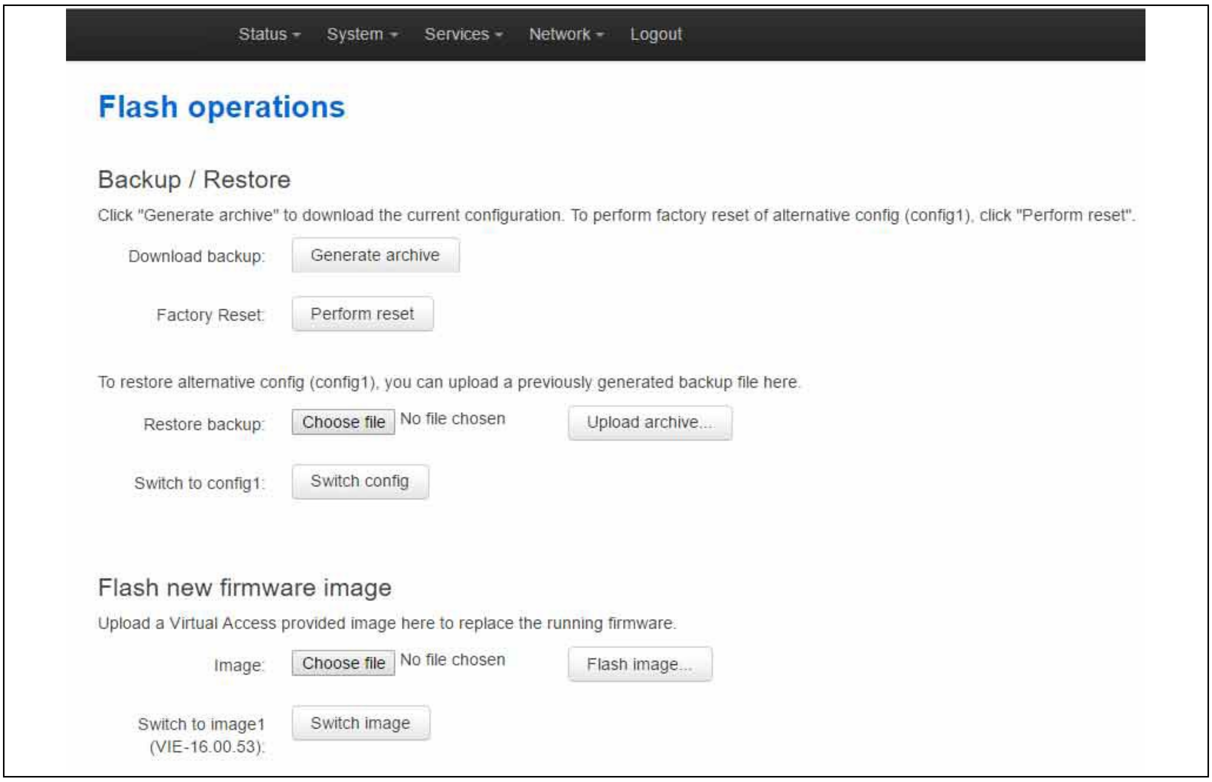

Figure 22: The flash operations page

In the Backup/Restore section, select **Generate Archive**.

7.8.2 Exporting a configuration file using the web interface for software version 72.002 and above

The current running configuration file may be exported using the web interface.

In the top menu, select **System -> Flash Operations**. The Flash operations page appears.

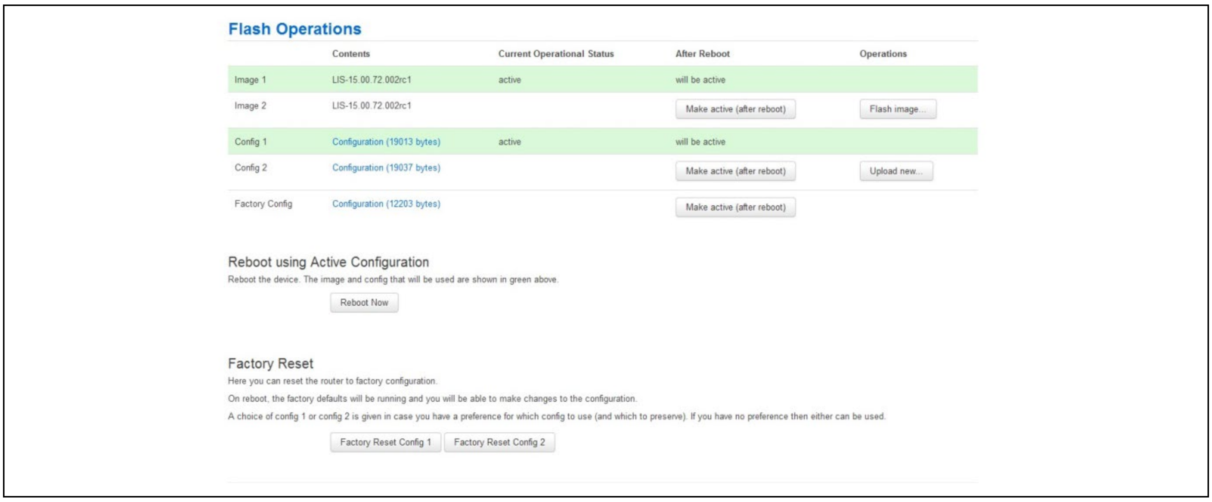

Figure 23: The flash operations page

In the **Flash Operation** section, click the configuration file in the Contents column to download it.

7.8.3 Exporting a configuration file using UCI

You can view any configuration file segment using UCI.

To export the running configuration file, enter:

```
root@VA_router:~# uci export
```

To export the factory configuration file, enter:

```
root@VA_router:~# uci -c /etc/factconf/ export
```

To export config1 or config2 configuration file, enter:

```
root@VA_router:~# uci -c /etc/config1/ export

root@VA_router:~# uci -c /etc/config2/ export
```

7.9 Importing a configuration file

If you have software versions prior to 72.002, to import a configuration file using the web interface, go to section 7.9.1.

If you have software version 72.002 or above, to import a configuration file using the web interface go to section 7.9.2.

To import a configuration file using UCI, for any software version, go to section 7.9.3.

7.9.1 Importing a configuration file using the web interface for software versions pre- 72.002

You can import a configuration file to the alternate configuration segment using the web interface. This will automatically reboot the router into this configuration file.

In the top menu, select **System -> Backup/Flash Firmware**. The Flash operations page appears.

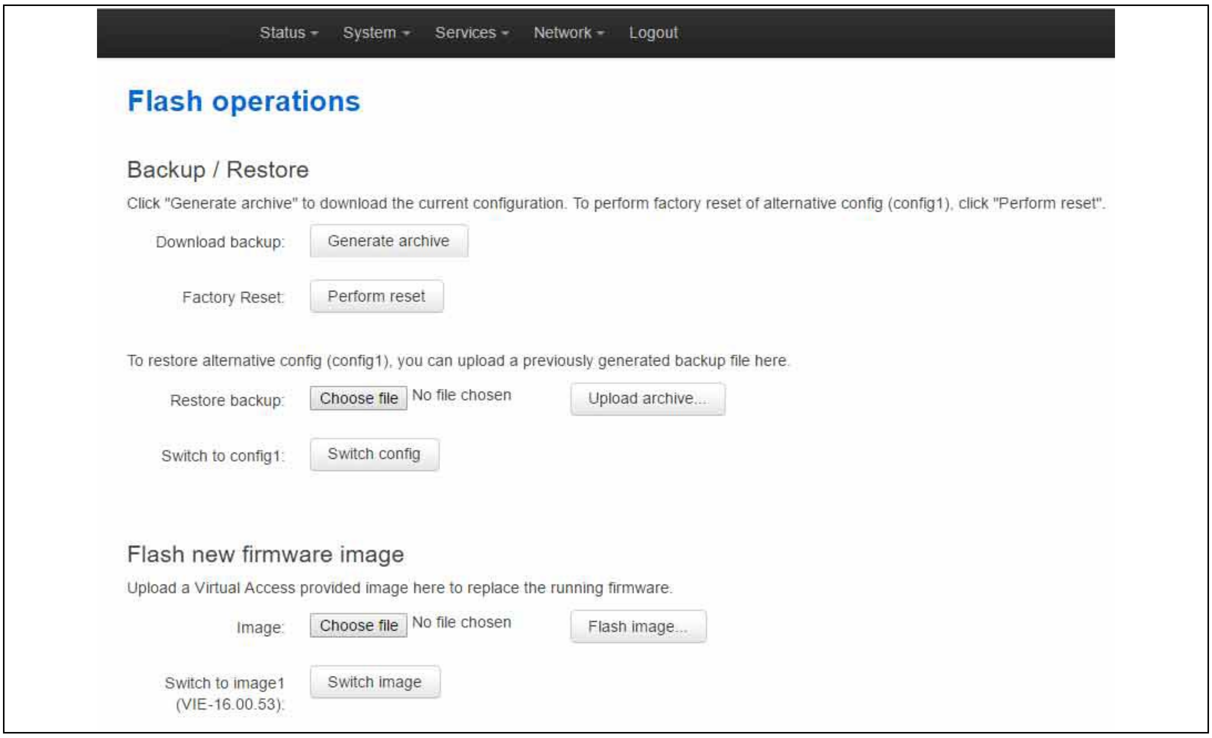

Figure 24: The flash operations page

Under Backup/Restore, choose **Restore Backup: Choose file**. Select the appropriate file and then click **Upload archive**.

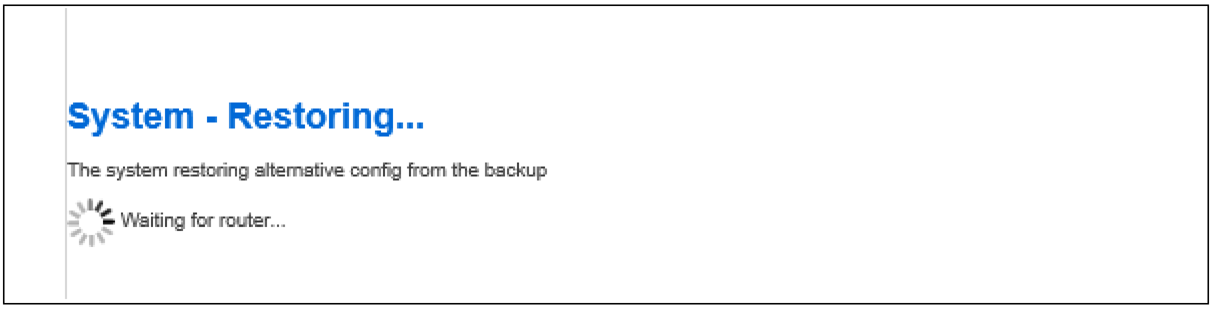

Figure 25: The system – restoring…page

When the 'waiting for router' icon disappears, the upgrade is complete, and the login homepage appears.

7.9.2 Importing a configuration file using the web interface for software version 72.002 and above

You can import a configuration file to the alternate configuration segment using the web interface.

In the top menu, select **System -> Flash Operations**. The Flash operations page appears.

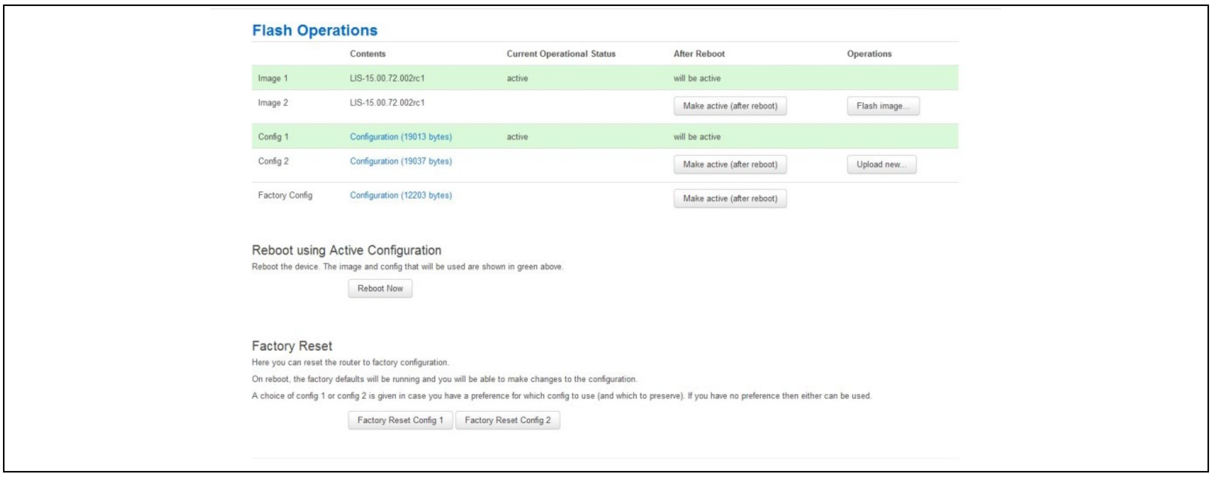

Figure 26: The flash operations page

In the Operations column, click **Upload new**. Select the appropriate file.

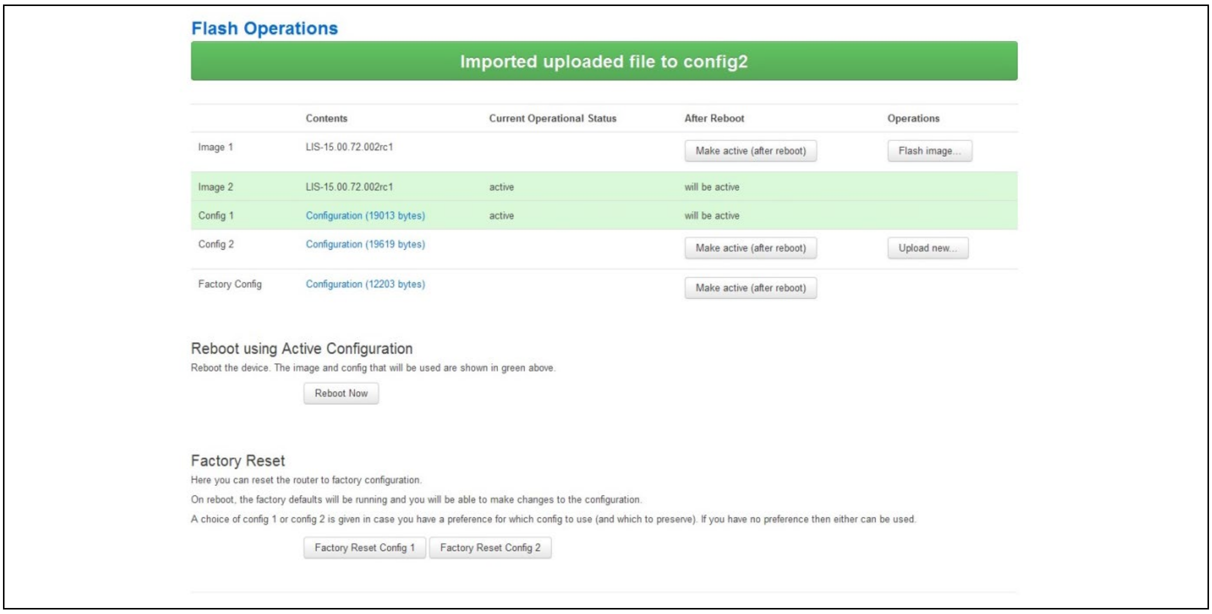

Figure 27: The flash operations succeed upload configuration page

If you select 'Flash image and do not reboot', the router will only run this configuration if you click **OK** to return to the Flash Operations page. There you can manually select **Made Active (after reboot)**. Then click **Reboot Now** in the 'Reboot using Active Configuration' section.

7.9.3 Importing a configuration file using UCI

You can import a configuration file to any file segment using UCI.

To import to config1, enter:

```
root@VA_router:~# uci -c /etc/config1/ import
<paste in config file>
<CTRL-D>
```

Note: it is very important that the config file is in the correct format otherwise it will not import correctly.

8 Using the Command Line Interface

This chapter explains how to view Virtual Access routers' log files and edit configuration files using a Command Line Interface (CLI) and the Unified Configuration Interface (UCI) system. Some commands may vary between router models.

8.1 Overview of some common commands

Virtual Access routers’ system has an SSH server typically running on port 22.

The factconf default password for the root user is **admin**.

To change the factconf default password, enter:

```
root@VA_router:/# uci set system.main.password=”******”

root@VA_router:/# uci commit system
```

To reboot the system, enter:

```
root@VA_router:/# reboot
```

The system provides a Unix-like command line. Common Unix commands are available such as `ls`, `cd`, `cat`, `top`, `grep`, `tail`, `head`, `more` and `less`.

Typical pipe and redirect operators are also available, such as: `>`, `>>`, `<`, `|`

The system log can be viewed using any of the following commands:

```
root@VA_router:/# logread


root@VA_router:/# logread | tail


root@VA_router:/# logread –f
```

These commands will show the full log, end of the log (tail) and continuously (-f). Enter **Ctrl-C** to stop the continuous output from logread -f.

To view and edit configuration files, the system uses the Unified Configuration Interface (UCI) which is described further on in this chapter. This is the preferred method of editing configuration files. However, you can also view and edit these files using some of the standard Unix tools.

For example, to view a text or configuration file in the system, enter:

```
root@VA_router:/# cat /etc/passwd
```

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The command output information shows the following, or similar output.

```
root:x:0:0:root:/root:/bin/ash
daemon:*:1:1:daemon:/var:/bin/false
ftp:*:55:55:ftp:/home/ftp:/bin/false
sftp:*:56:56:sftp:/var:/usr/lib/sftp-server
network:*:101:101:network:/var:/bin/false
nobody:*:65534:65534:nobody:/var:/bin/false
```

To view files in the current folder, enter:

```
root@VA_router:/# ls

 bin      etc      lib      opt      sbin     usr
 bkrepos  home     linuxrc  proc     sys      var
 dev      init     mnt      root     tmp      www
```

For more details add the -l argument:

```
root@VA_router:/# ls -l

drwxrwxr-x    2 root     root   642 Jul 16  2012 bin
drwxr-xr-x    5 root     root  1020 Jul  4 01:27 dev
drwxrwxr-x    1 root     root     0 Jul  3 18:41 etc
drwxr-xr-x    1 root     root     0 Jul  9  2012 lib
drwxr-xr-x    2 root     root     3 Jul 16  2012 mnt
drwxr-xr-x    7 root     root     0 Jan  1  1970 overlay
dr-xr-xr-x   58 root     root     0 Jan  1  1970 proc
drwxr-xr-x   16 root     root   223 Jul 16  2012 rom
drwxr-xr-x    1 root     root     0 Jul  3 22:53 root
drwxrwxr-x    2 root     root   612 Jul 16  2012 sbin
drwxr-xr-x   11 root     root     0 Jan  1  1970 sys
drwxrwxrwt   10 root     root   300 Jul  4 01:27 tmp
drwxr-xr-x    1 root     root     0 Jul  3 11:37 usr
lrwxrwxrwx    1 root     root     4 Jul 16  2012 var -> /tmp
drwxr-xr-x    4 root     root    67 Jul 16  2012 www
```

To change the current folder, enter **cd** followed by the desired path:

```
root@VA_router:/# cd /etc/config1

root@VA_router:/etc/config1#
```

Note: if the specified directory is actually a link to a directory, the real directory will be shown in the prompt.

To view scheduled jobs, enter:

```
root@VA_router:/# crontab –l


 0 * * * * slaupload 00FF5FF92752 TFTP 1 172.16.250.100 69
```

To view currently running processes, enter:

```
root@VA_router:/# ps


 PID  Uid     VmSize Stat Command
    1 root        356 S   init
    2 root            DW  [keventd]
    3 root            RWN [ksoftirqd_CPU0]
    4 root            SW  [kswapd]
    5 root            SW  [bdflush]
    6 root            SW  [kupdated]
    8 root            SW  [mtdblockd]
   89 root        344 S   logger -s -p 6 -t
   92 root        356 S   init
   93 root        348 S   syslogd -C 16
   94 root        300 S   klogd
  424 root        320 S   wifi up
  549 root        364 S   httpd -p 80 -h /www -r VA_router
  563 root        336 S   crond -c /etc/crontabs
 6712 root        392 S   /usr/sbin/dropbear
 6824 root        588 S   /usr/sbin/dropbear
 7296 root        444 S   -ash
  374 root        344 R   ps ax
  375 root        400 S   /bin/sh /sbin/hotplug button
  384 root        396 R   /bin/sh /sbin/hotplug button
  385 root            RW  [keventd]
```

To search for a process, enter: pgrep -fl '<process name or part of name>':

```
root@VA_router:/# pgrep -fl 'wifi'


424 root        320 S   wifi up
```

To kill a process, enter the PID:

```
root@VA_router:~# kill 424
```

8.2 Using Unified Configuration Interface (UCI)

The system uses Unified Configuration Interface (UCI) for central configuration management. Most common and useful configuration settings can be accessed and configured using the UCI system.

UCI consists of a Command Line Utility (CLI), the files containing the actual configuration data, and scripts that take the configuration data and apply it to the proper parts of the system, such as the networking interfaces. Entering the command 'uci' on its own will display the list of valid arguments for the command and their format.

```
root@VA_router:/lib/config# uci
```

Usage: uci [<options>] <command> [<arguments>]

```
Commands:
export     [<config>]
import     [<config>]
changes    [<config>]
commit     [<config>]
add        <config> <section-type>
add_list   <config>.<section>.<option>=<string>
show       [<config>[.<section>[.<option>]]]
get        <config>.<section>[.<option>]
set        <config>.<section>[.<option>]=<value>
delete     <config>[.<section[.<option>]]
rename     <config>.<section>[.<option>]=<name>
revert     <config>[.<section>[.<option>]]
Options:
-c <path>  set the search path for config files (default: /etc/config)
-d <str>   set the delimiter for list values in uci show
-f <file>  use <file> as input instead of stdin
-m         when importing, merge data into an existing package
```

```
-n          name unnamed sections on export (default)
-N          don't name unnamed sections
-p <path>   add a search path for config change files
-P <path>   add a search path for config change files and use as default
-q          quiet mode (don't print error messages)
-s          force strict mode (stop on parser errors, default)

-S          disable strict mode
-X          do not use extended syntax on 'show'
```

The table below describes commands for the UCI command line and some further examples of how to use this utility.

Command	Target	Description
commit	[<config>]	Writes changes of the given configuration file, or if none is given, all configuration files, to the filesystem. All "uci set", "uci add", "uci rename" and "uci delete" commands are staged into a temporary location and written to flash at once with "uci commit". This is not needed after editing configuration files with a text editor, but for scripts, GUIs and other programs working directly with UCI files.
export	[<config>]	Exports the configuration in a UCI syntax and does validation.
import	[<config>]	Imports configuration files in UCI syntax.
changes	[<config>]	Lists staged changes to the given configuration file or if none given, all configuration files.
add	<config> <section-type>	Adds an anonymous section of type section-type to the given configuration.
add_list	<config>.<section>.<option>=<string>	Adds the given string to an existing list option.
show	[<config>[.<section>[.<option>]]]	Shows the given option, section or configuration in compressed notation.
get	<config>.<section>[.<option>]	Gets the value of the given option or the type of the given section.
set	<config>.<section>[.<option>]=<value>	Sets the value of the given option, or add a new section with the type set to the given value.
delete	<config>[.<section[.<option>]]	Deletes the given section or option.
rename	<config>.<section>[.<option>]=<name>	Renames the given option or section to the given name.
revert	<config>[.<section>[.<option>]]	Deletes staged changes to the given option, section or configuration file.

Table 13: Common commands, target and their descriptions

Note: all operations do not act directly on the configuration files. A commit command is required after you have finished your configuration.

```
root@VA_router:~# uci commit
```

8.2.1 Using uci commit to avoid router reboot

After changing the port, uhttpd listens on from 80 to 8080 in the file /etc/config/uhttpd; save it, then enter:

```
root@VA_router:~# uci commit uhttpd
```

Then enter:

```
root@VA_router:~# /etc/init.d/uhttpd restart
```

For this example, the router does not need to reboot as the changes take effect when the specified process is restarted.

8.2.2 Export a configuration

Using the uci export command it is possible to view the entire configuration of the router or a specific package. Using this method to view configurations does not show comments that are present in the configuration file:

```
root@VA_router:~# uci export httpd


package 'httpd'
config 'httpd'
option 'port' '80'
option 'home' '/www'
```

8.2.3 Show a configuration tree

The configuration tree format displays the full path to each option. This path can then be used to edit a specific option using the `uci set` command.

To show the configuration 'tree' for a given config, enter:

```
root@VA_router:/# uci show network


network.loopback=interface
network.loopback.ifname=lo
network.loopback.proto=static
network.loopback.ipaddr=127.0.0.1
network.loopback.netmask=255.0.0.0
network.lan=interface
network.lan.ifname=eth0
network.lan.proto=dhcp
network.wan=interface
network.wan.username=foo
```

```
network.wan.password=bar
network.wan.proto=3g
network.wan.device=/dev/ttyACM0
network.wan.service=umts
network.wan.auto=0
network.wan.apn=arkessa.com
network.@va_switch[0]=va_switch
network.@va_switch[0].eth0=A B C
network.@va_switch[0].eth1=D
```

It is also possible to display a limited subset of a configuration:

```
root@VA_router:/# uci show network.wan
network.wan=interface
network.wan.username=foo
network.wan.password=bar
network.wan.proto=3g
network.wan.device=/dev/ttyACM0
network.wan.service=umts
network.wan.auto=0
network.wan.apn=hs.vodafone.ie
```

8.2.4 Display just the value of an option

To display a specific value of an individual option within a package, enter:

```
root@VA_router:~# uci get httpd.@httpd[0].port
80
root@VA_router:~#
```

8.2.5 High level image commands

To show the image running currently, enter:

```
root@VA_router:~# vacmd show current image
```

To set the image to run on next reboot, enter:

```
root@VA_router:~# vacmd set next image [image1|image2|altimage]
root@VA_router:~# reboot
```

8.2.6 Format of multiple rules

When there are multiple rules next to each other, UCI uses array-like references for them. For example, if there are 8 NTP servers, UCI will let you reference their sections as `timeserver.@timeserver[0]` for the first section; or `timeserver.@timeserver[7]` for the last section.

You can also use negative indexes, such as `timeserver.@timeserver[-1]` '-1' means the last one, and '-2' means the second-to-last one. This is useful when appending new rules to the end of a list.

```
root@VA_router:/# uci show va_eventd
va_eventd.main=va_eventd
va_eventd.main.enabled=yes
va_eventd.main.event_queue_file=/tmp/event_buffer
va_eventd.main.event_queue_size=128K
va_eventd.@conn_tester[0]=conn_tester
va_eventd.@conn_tester[0].name=Pinger
va_eventd.@conn_tester[0].enabled=yes
va_eventd.@conn_tester[0].type=ping
va_eventd.@conn_tester[0].ping_dest_addr=192.168.250.100
va_eventd.@conn_tester[0].ping_success_duration_sec=5
va_eventd.@target[0]=target
va_eventd.@target[0].name=MonitorSyslog
va_eventd.@target[0].enabled=yes
va_eventd.@target[0].type=syslog
va_eventd.@target[0].target_addr=192.168.250.100
va_eventd.@target[0].conn_tester=Pinger
va_eventd.@target[0].suppress_duplicate_forwardings=no
va_eventd.@forwarding[0]=forwarding
va_eventd.@forwarding[0].enabled=yes
va_eventd.@forwarding[0].className=ethernet
va_eventd.@forwarding[0].target=MonitorSyslog
va_eventd.@forwarding[1]=forwarding
va_eventd.@forwarding[1].enabled=yes
va_eventd.@forwarding[1].className=auth
va_eventd.@forwarding[1].target=MonitorSyslog
va_eventd.@forwarding[2]=forwarding
va_eventd.@forwarding[2].enabled=yes
va_eventd.@forwarding[2].className=adsl
```

```
va_eventd.@forwarding[2].target=MonitorSyslog
va_eventd.@forwarding[3]=forwarding
va_eventd.@forwarding[3].enabled=yes
va_eventd.@forwarding[3].className=ppp
va_eventd.@forwarding[3].target=MonitorSyslog
```

8.3 Configuration files

The table below lists common package configuration files that can be edited using uci commands. Other configuration files may also be present depending on the specific options available on the Virtual Access router.

File	Description
Management	
/etc/config/autoload	Boot up Activation behaviour (typically used in factconf)
/etc/config/httpclient	Activator addresses and urls
/etc/config/monitor	Monitor details
Basic	
/etc/config/dropbear	SSH server options
/etc/config/dhcp	Dnsmasq configuration and DHCP settings
/etc/config/firewall	NAT, packet filter, port forwarding, etc.
/etc/config/network	Switch, interface, L2TP and route configuration
/etc/config/system	Misc. system settings including syslog
Other	
/etc/config/snmpd	SNMPd settings
/etc/config/uhttpd	Web server options (uHTTPd)
/etc/config/strongswan	IPSec settings

8.4 Configuration file syntax

The configuration files usually consist of one or more config statements, so-called sections with one or more option statements defining the actual values.

Below is an example of a simple configuration file.

```
package 'example'
config 'example' 'test'
        option   'string'      'some value'
        option   'boolean'     '1'
        list     'collection'  'first item'
        list     'collection'  'second item'
```

The config `'example' 'test'` statement defines the start of a section with the type example and the name test. There can also be so-called anonymous sections with only a type, but no name identifier. The type is important for the processing programs to decide how to treat the enclosed options.

The option `'string' 'some value'` and option `'boolean' '1'` lines define simple values within the section.

Note: there are no syntactical differences between text and boolean options. Per convention, boolean options may have one of the values '`0`', '`no`', '`off`' or '`false`' to specify a false value or '`1`' , '`yes`', '`on`' or '`true`' to specify a true value.

In the lines starting with a list keyword, an option with multiple values is defined. All list statements that share the same name collection in our example will be combined into a single list of values with the same order as in the configuration file.

The indentation of the option and list statements is a convention to improve the readability of the configuration file but it is not syntactically required.

Usually you do not need to enclose identifiers or values in quotes. Quotes are only required if the enclosed value contains spaces or tabs. Also it is legal to use double-quotes instead of single-quotes when typing configuration options.

All of the examples below are valid syntax.

```
option example value

option 'example' value

option example "value"

option "example"    'value'

option   'example' "value"
```

In contrast, the following examples are not valid syntax.

```
option 'example" "value'
```

Quotes are unbalanced.

```
option example some value with space
```

Missing quotes around the value.

It is important to note that identifiers and config file names may only contain the characters a-z, A-Z, 0-9 and _. However, option values may contain any character, as long they are properly quoted.

9 Upgrading router firmware

This chapter describes how to upgrade router firmware. The upgrade process is as follows:

- Firmware is transferred to the device.
- Firmware is checked to ensure there are no corruptions.
- Firmware is saved to persistent storage.
- Data in persistent storage is validated.

To avoid any unrecoverable errors during the process, you must follow several safety steps described in this chapter.

On successful completion of the process, you can restart the device running the new firmware.

9.1 Software versions

If you have software versions prior to 72.002, to upgrade firmware using the web interface, go to section 9.1.2.

If you have software version 72.002 or above, to upgrade firmware using the web interface go to section 9.1.3.

To upgrade firmware using CLI, for any software version, go to section 9.2.

9.1.1 Identify your software version

To check which software version your router is running, in the top menu, browse to **Status -> Overview**.

Figure 28: The status page showing a software version prior to 72.002

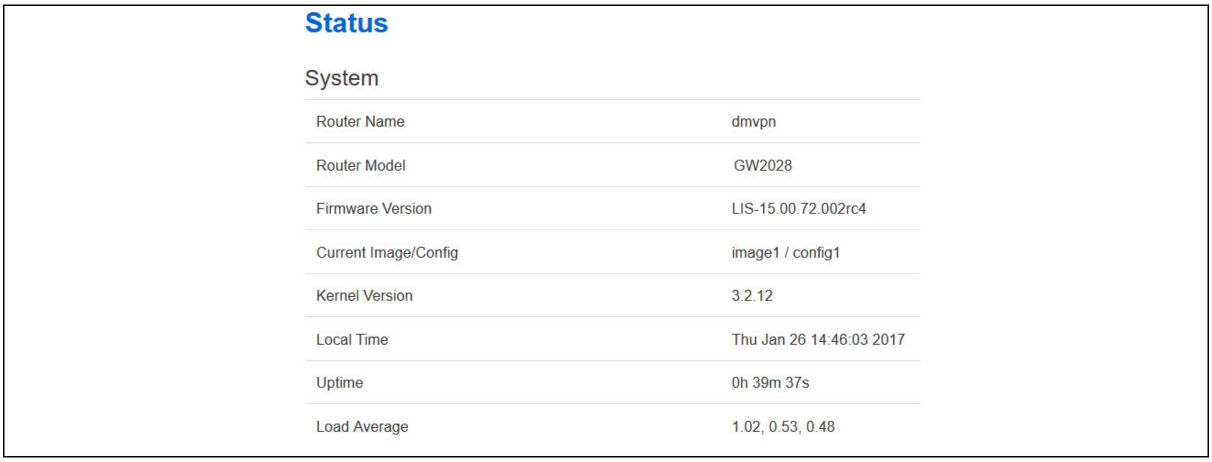

Figure 29: The status page showing software version 72.002

In the Firmware Version row, the first two digits of the firmware version identify the hardware platform, for example LIS-15; while the remaining digits: .00.72.002, show the software version.

9.1.2 Upgrading router firmware for software versions pre- 72.002

Copy the new firmware issued by Virtual Access to a PC connected to the router.

In the top menu, select **System tab -> Backup/Flash Firmware**. The Flash operations page appears.

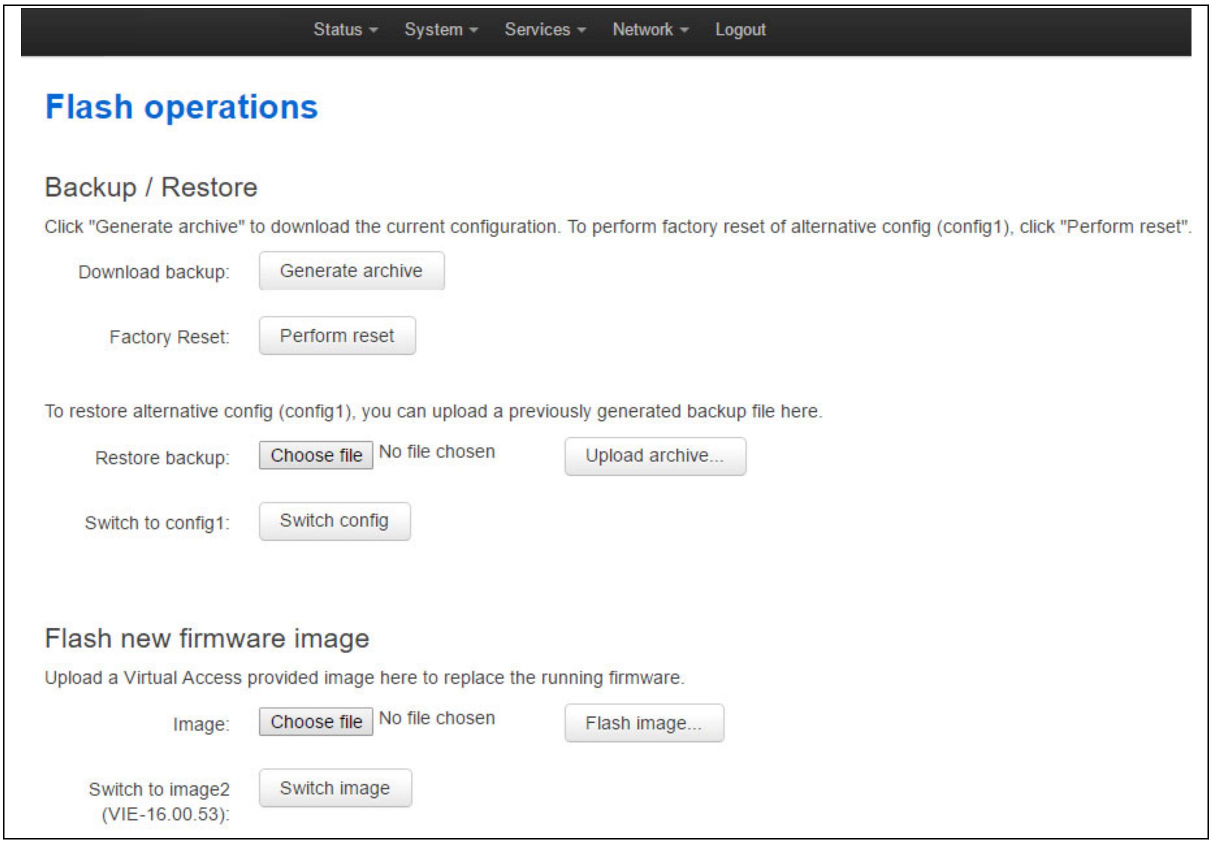

Figure 30: The flash operations page

Under Flash new firmware image, click **Choose File** or **Browse**.

Note: the button will vary depending on the browser you are using.

Select the appropriate image and then click **Flash Image**. The Flash Firmware – Verify page appears.

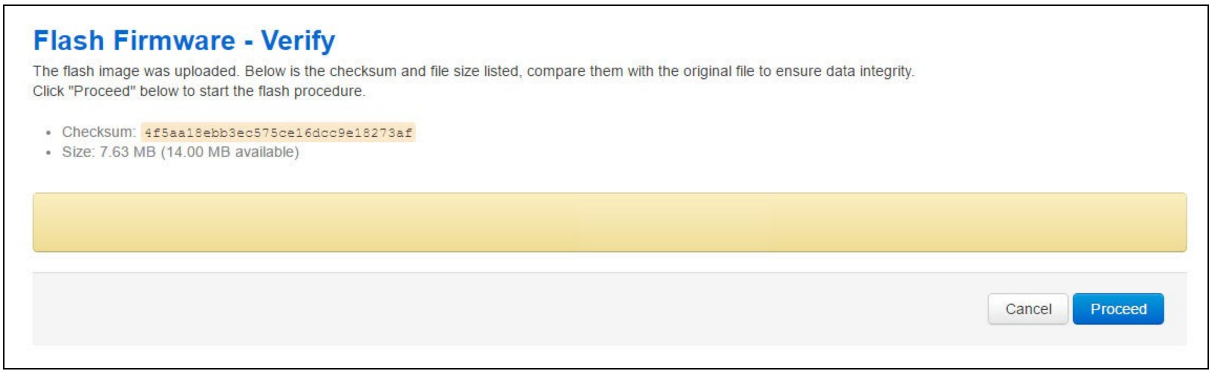

Figure 31: The flash firmware - verify page

Click **Proceed**. The System – Flashing… page appears.

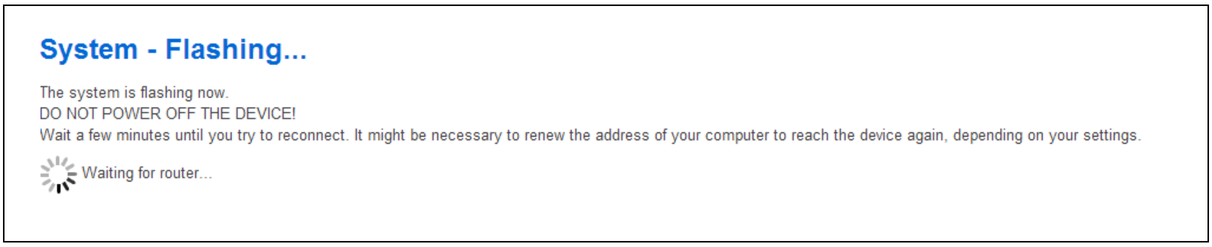

Figure 32: The system – flashing…page

When the 'waiting for router' icon disappears, the upgrade is complete, and the login homepage appears.

To verify that the router has been upgraded successfully, click **Status** in the top menu. The Firmware Version shows in the system list.

Figure 33: The system status list

9.1.3 Upgrading router firmware for software version 72.002 and above

Copy the new firmware issued by Virtual Access to a PC connected to the router.

In the top menu, select **System tab -> Flash operations**. The Flash operations page appears.

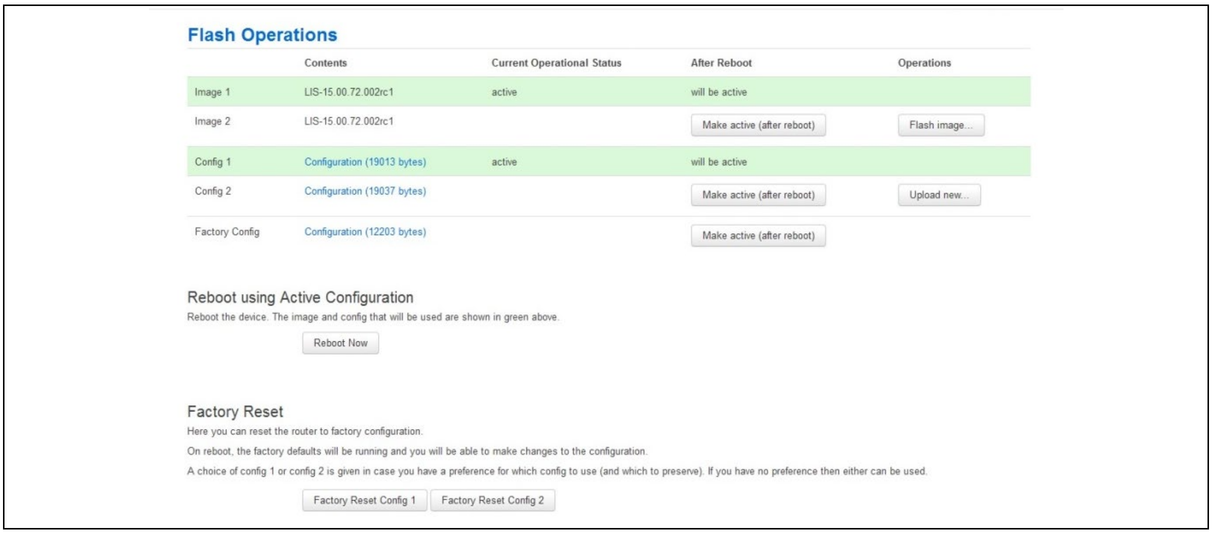

Figure 34: The flash operations page

Under Flash Operations, click **Flash Image**. Only the inactive image is available to flash.

Select the appropriate image and then wait until image has loaded.

Note: this process may take a while depending on the available connection speed.

When the image has loaded, the Update Firmware page appears.

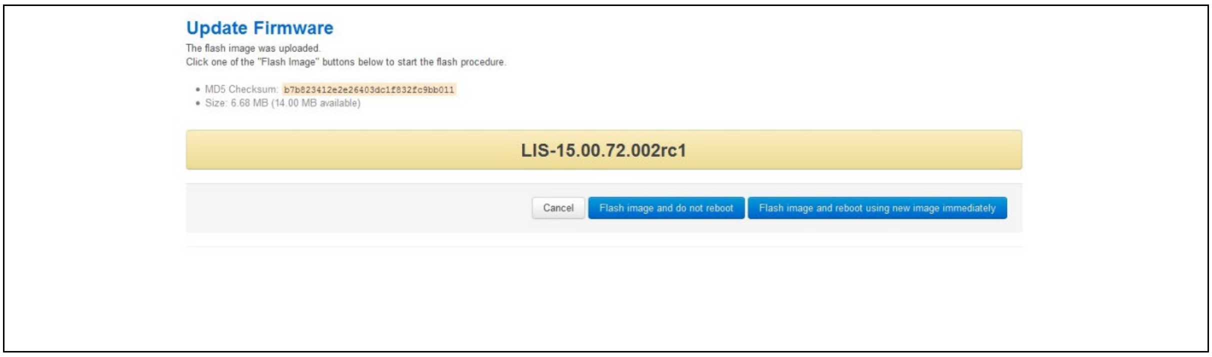

Figure 35: The flash firmware - verify page

Click either: **Flash image and do not reboot**, or **Flash image and reboot using new image immediately**. The 'Firmware update is being applied' message appears.

When the firmware update is complete, the Update Firmware page appears. There are various messages, depending on which option you selected, or if any corruptions have occurred.

9.1.4 Flash image and do not reboot option

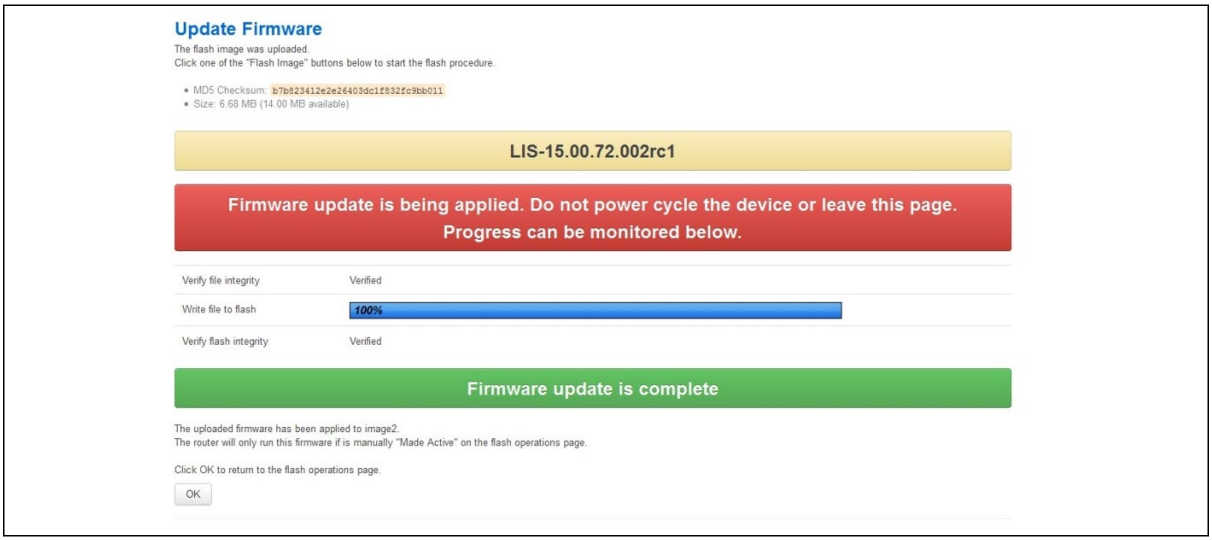

Figure 36: The firmware update page after '…do not reboot' option selected

If you select 'Flash image and do not reboot', the router will only run the firmware if you click **OK** to return to the Flash Operations page. There you can manually select **Made Active (after reboot)**. Then click **Reboot Now** in the 'Reboot using Active Configuration' section.

9.1.5 Update flash image and reboot using new image immediately option

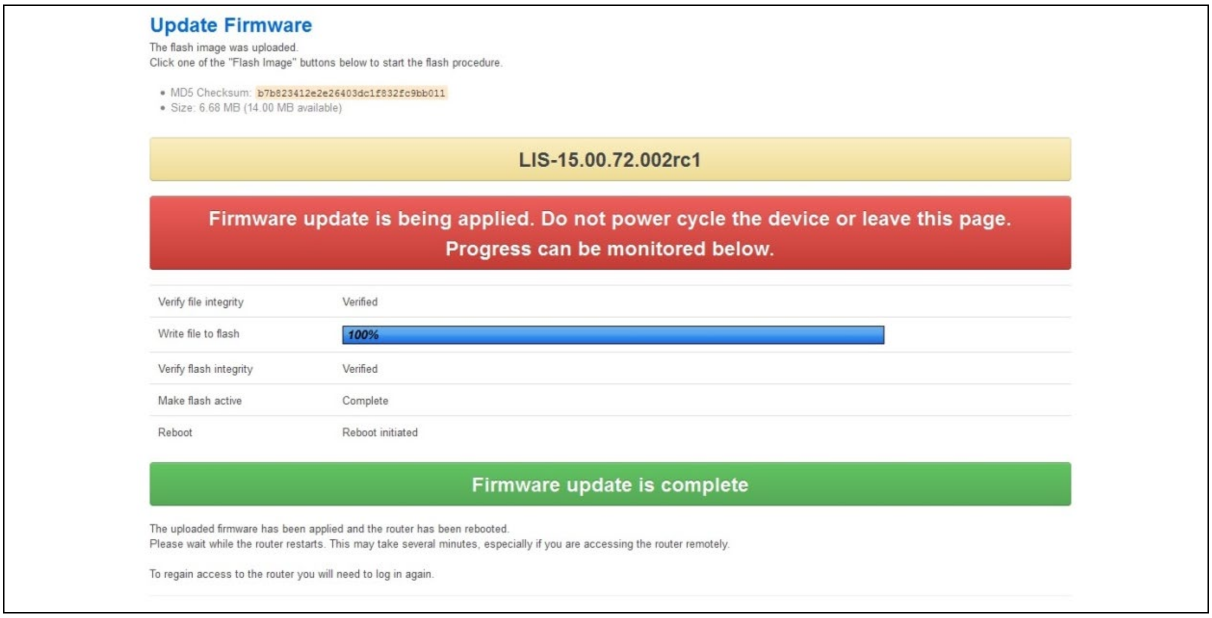

Figure 37: The firmware update page after 'update flash image and reboot…' option selected

If you select 'Update flash image and reboot using new image immediately' and the overall validation and flashing process has succeeded, the router will reboot immediately. To regain access to the router you must login again. If any part of the processes encounters an error the reboot does **not** occur and a report is given.

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9.1.6 Possible file corruption

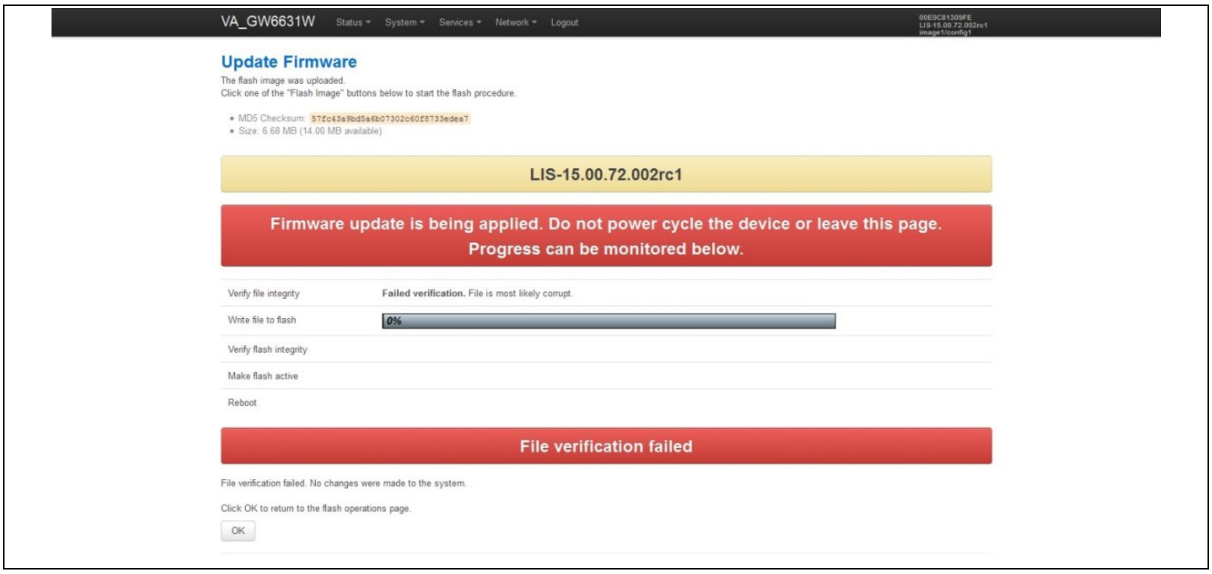

Figure 38: The firmware update failure page

In the unfortunate event that the firmware upgrade fails, the 'Failed verification File is most likely corrupt' or similar message will appear in the Verify file integrity row. No changes will be made to the system and the general message **File verification failed** appears.

9.1.7 Verify the firmware has been upgraded successfully

To check the firmware version, in the top menu, browse to **System -> Flash Operations**, or after router reboots, in the top menu, click **Status**. The Firmware Version shows in the system list and also in the right top corner of the menu bar.

Figure 39: The system status list showing current firmware version

9.2 Upgrading firmware using CLI

9.2.1 Transfer file to router

To upgrade firmware using CLI, you will need a TFTP server on a connected PC or SCP available.

Open up an SSH session to the router.

Enter in the relevant username and password.

To access the temp folder, enter **cd /tmp**

TFTP using curl

Enter the following command:

```
curl tftp://x.x.x.x/LIS-15.00.72.002.image -o /tmp/LIS-15.00.72.002.image
```

where x.x.x.x is the IP of your PC, **-o** is local file name to store.

SCP

Secure Copy (SCP) is a part of Secure Shell (SSH) and enables file transfers to the router using authentication and encryption. It is different to TFTP, which uses UDP, while SCP uses a TCP connection. On Unix machines, SCP is a standard part of the system; on Windows it requires an additional application.

The usage example below is for a Unix machine and therefore assumes the image file is in the current folder.

```
scp LIS-15.00.72.002.image root@x.x.x.x:/tmp/LIS-15.00.72.002.image
```

Where the first argument 'LIS-15.00.72.002.image' in SCP is the source and the second argument 'tmp/LIS-15.00.72.002.image' is the destination path, enter **root** as the username to connect to x.x.x.x IP address.

After you execute the above command you will be asked to provide a root password.

At this stage the output shows the process of copying the software file into destination directory.

```
root@192.168.100.1's password:

LIS-15.00.72.000.image               100%  6812KB   2.2MB/s        00:03
```

9.2.2 Image verification before flashing

To verify the integrity of the image, firmware version xx.yy.72.002 and later uses an image-check application.

Note: it is the user's responsibility to verify the image before starting to write the image to flash process.

To use the image-check on downloaded image, enter:

```
image-check /tmp/LIS-15.00.72.002.image
```

In the case of any image corruption, an appropriate error message appears:

```
Error: no SquashFS filesystem after CRC'd section - data length 3
Error: read failed, expected at least 3 more bytes
```

or similar.

Note: the image is valid only if no error message appears. This process is done automatically during Web UI firmware update.

9.2.3 Flashing

When downloaded firmware verification succeeds, the new image can be written to flash.

To write the image into the alternative image, enter:

```
mtd write LIS-15.00.72.002.image altimage
```

Note: this is an example, substitute the correct file name.

9.2.4 Flash verification after flashing

After the write process has finished, you must complete a post verification of the firmware.

To verify the checksum of downloaded firmware, enter:

```
va_image_csum.sh /tmp/LIS-15.00.72.002.image
```

The checksum of the downloaded binary is shown:

```
08761cd03e33c569873bcc24cf2b7389  7006920  LIS-15.00.72.002 This MD5
```

To verify the checksum of written firmware, enter:

```
va_image_csum.sh alt
```

After a while the checksum will be calculated:

```
Calculating checksum.........
```

```
08761cd03e33c569873bcc24cf2b7389  7006920  LIS-15.00.72.002 This MD5
```

Verify and compare the checksum with the MD5 sum of the downloaded image.

If the checksum of the written firmware in altimage matches the one from the downloaded image in /tmp, the new firmware has been programmed successfully.

9.2.5 Setup an alternative image

Provided the programming has succeeded, you can set it as the next image to use after reboot; enter:

```
vacmd set next image altimage
```

To reboot using the new firmware, enter:

```
reboot
```

9.3 Firmware recovery

The router has an automatic boot recovery feature that will

- revert the active firmware to the alternate firmware segment on three consecutive failed software restarts.
- Change the boot configuration to factory configuration after ten failed restarts

By design this feature is intended to allow recovery from firmware problems and therefore excludes restarts due to power loss.

10 System settings

The system section contains settings that apply to the most basic operation of the system, such as the host name, time zone, logging details, NTP server, language and style.

The host name appears in the top left-hand corner of the interface menu bar. It also appears when you open a Telnet or SSH session.

Note: this document shows no host name in screen shots. Throughout the document we use the host name 'VA_router'.

The system configuration contains a logging section for the configuration of a syslog client.

10.1 Syslog overview

Most syslog settings appear in the main System Configuration page.

Syslog messages have a timestamp, source facility, priority, and message section. Often the message section begins with an optional tag identifying the usermode program name and process ID responsible for the message.

Messages can be stored locally and also forwarded remotely. Separate filter options apply to each case. At a broad level, you can set the minimum severity level for local and remote targets; only messages with a priority more severe than the configured level will be recorded.

Kernel messages are recorded separately in their own buffer. However, for convenience, these are copied to the system log automatically so that a unified system log is available.

In addition, you can also define filter rules to determine how particular log messages are handled. For example, you may decide that certain debug messages are directed into their own log file, to avoid cluttering up the main system log, and to save bandwidth if delivering to a remote syslog server. You can define filters to be applied to local and remote targets, or both. A filter matches specific log messages and then determines an action for them.

10.2 Configuration package used

Package	**Sections**
system	main
	syslog_fillter
	timeserver
luci	main

10.3 Configuring system properties

To set your system properties, select **System -> System**. There are five sections in the System page.

Section	Description
General settings	Configure host name, local time and time zone.
Logging	Configure a router to log to a server. You can configure a syslog client in this section.
Language and style	Configure the router's web language and style.
Time synchronization	Configure the NTP server in this section.
Audit configuration	Configures auditing of configuration changes and shell execution.

10.3.1 General settings

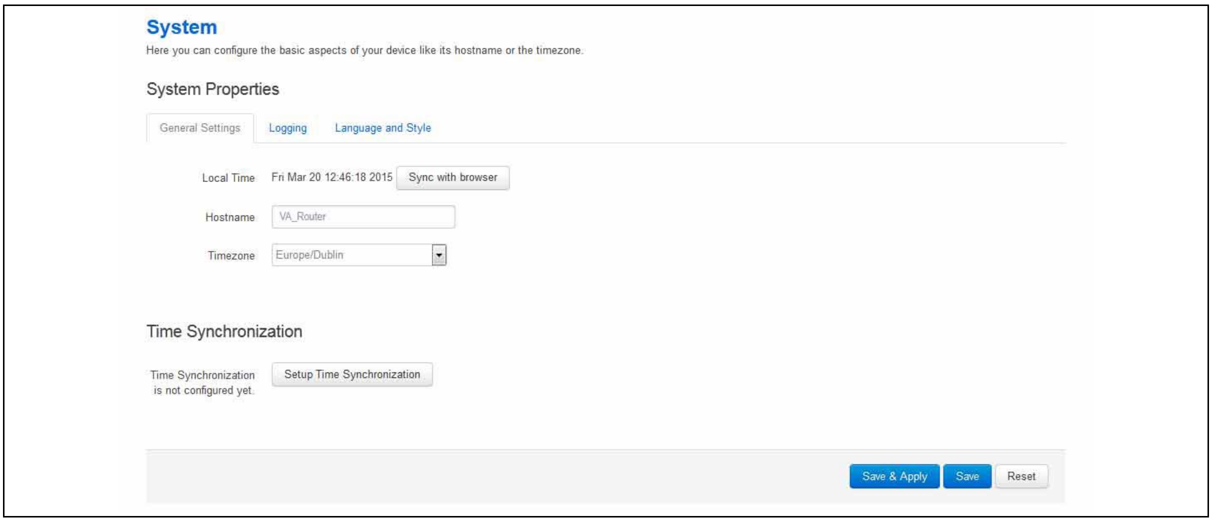

Figure 40: General settings in system properties

Web Field/UCI/Package Option	Description
Web: Local Time	Sets the local time and syncs with browser. You can manually configure on CLI, using: `date -s YYYY.MM.DD-hh:mm:ss`
Web: hostname UCI: system.main.hostname Opt: hostname	Specifies the hostname for this system.
Web: Timezone UCI: system.main.timezone Opt: timezone	Specifies the time zone that the date and time should be rendered in by default.
Web: n/a UCI: system.main.timezone Opt: time_save_interval_min	Defines the interval in minutes to store the local time for use on next reboot. 10m

Table 14: Information table for general settings section

10.3.2 Logging

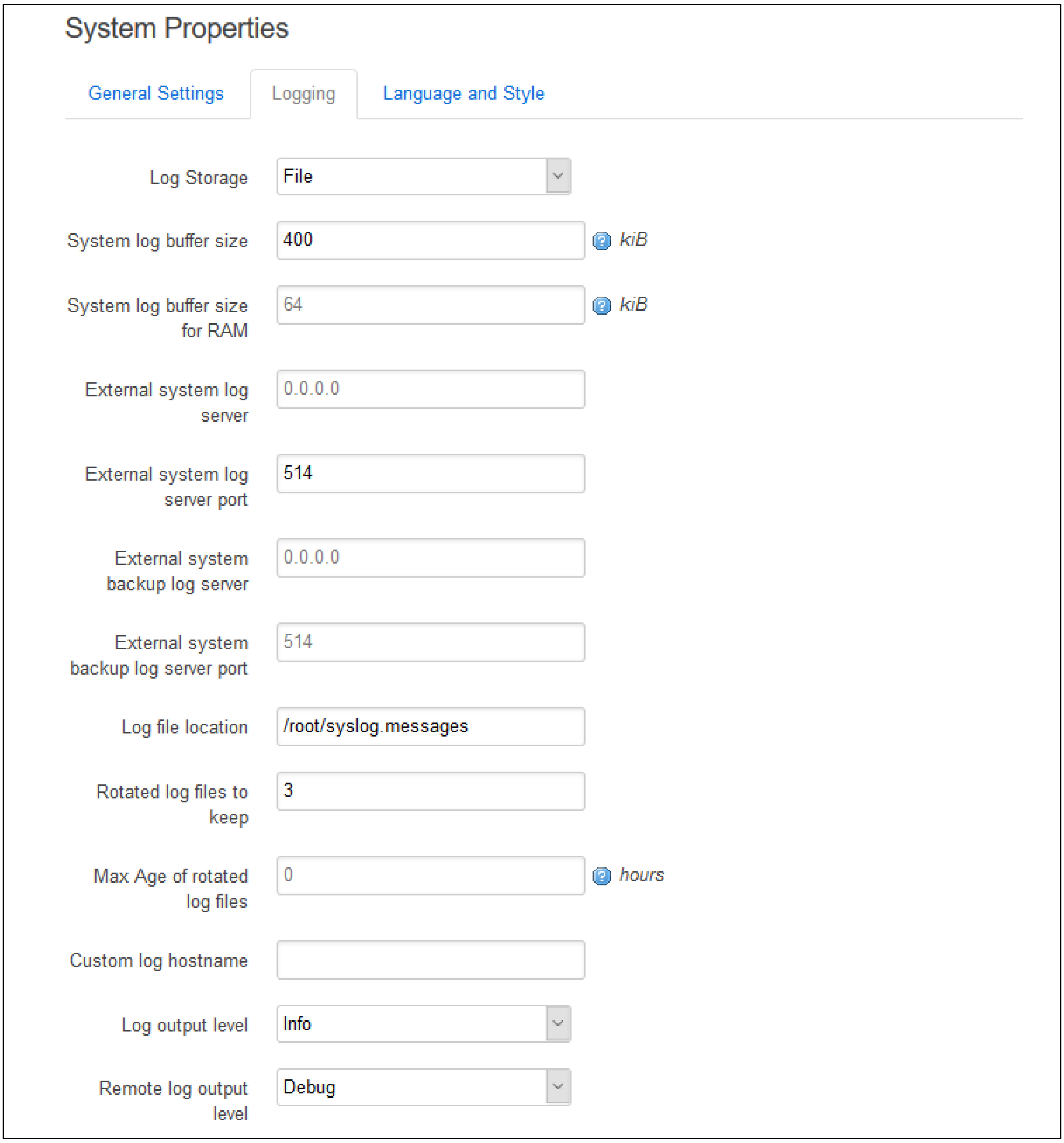

Figure 41: The logging section in system properties

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Log storage
UCI: system.main.log_type
Opt: log_type</td><td>Defines the system log storage type. Messages stored in RAM can be seen using logread.
Note: system log stored in RAM will be lost on reboot.
<table>
<tr><th>Web value</th><th>Description</th><th>UCI</th></tr>
<tr><td>RAM</td><td>Store system log in RAM. Lost on reboot. Viewed using <code>logread</code></td><td>circular</td></tr>
<tr><td>File</td><td>Store system log in flash. Maintained through reboot. Viewed using <code>cat /log_file</code></td><td>file</td></tr>
</table></td></tr>
</table>

Web: System log buffer size UCI: system.main.log_size Opt: log_size	File log buffer size in KB. **Note**: when the file reaches the configured size it is copied to the archive file (`log_file_name.0`). Range 16 — 16 KB
Web: System log buffer size for RAM UCI: system.main.log_size_ram Opt: log_size_ram	RAM log buffer size in KB. Range 16 — 16 KB
Web: External system log server UCI: system.main.log_ip Opt: log_ip	External syslog server IP address. If defined, syslog messages will be sent in addition to local storage. Range — IP of FQDN 0.0.0.0
Web: External system log server port UCI: system.main.log_port Opt: log_port	External syslog server port number. Range 514
Web: External system backup log server UCI: system.main.log_ip_backup Opt: log_ip_backup	Backup external syslog server IP address. If defined, syslog messages will be sent here in addition to the main log server. Range — IP or FQDN 0.0.0.0
Web: External system backup log server port UCI: system.main.log_port_backup Opt: log_port_backup	External syslog server port number for use with backup server. Range 514
Web: Log file location UCI: system.main.log_file Opt: log_file	Defines the file path for log storage when log storage is set to 'file'. **Note**: when the file reaches the configured size it is copied to the archive file (`log_file_name.0`). Set to: `root/syslog.messages` Range /root/syslog
Web: Rotated log files to keep UCI: system.main.log_file_count Opt: log_file_count	Defines the file number of archive files for storage in flash when Log Storage is set to 'file'. When the system log file reaches the configured size it is copied to the archive file (log_file_name.0). Existing archive files are copied to log_file_name.(x+1). Range 1 — Store 1 archive log file in flash.
Web: Max Age of rotated log files UCI: system.main.log_age Opt: log_age	Defines the maximum duration in hours before archive syslog files are deleted. Set to **0** to define no age limit. Range 0 — No age limit
Web: Custom log hostname UCI: system.main.log_hostname Opt: log_hostname	Defines a custom host name for syslog messages. Magic values %hostname (system hostname), %ser (serial), and %mon (Monitor dev_reference) are also recognised. Range Empty — Use router hostname for syslog messages.

<table>
<tr><td>Web: Log output level
UCI: system.main.conloglevel
Opt: conloglevel</td><td>Sets the maximum log output level severity for system events. System events are written to the system log. Messages with a lower level or level equal to the configured level are displayed on the console using the logread command, or alternatively written to a flash file, if configured to do so.
<table>
<tr><th>Web value</th><th>Description</th><th>UCI</th></tr>
<tr><td>Debug</td><td>Information useful to developers for debugging the application.</td><td>8</td></tr>
<tr><td>Info</td><td>Normal operational messages that require no action.</td><td>7</td></tr>
<tr><td>Notice</td><td>Events that are unusual, but not error conditions.</td><td>6</td></tr>
<tr><td>Warning</td><td>May indicate that an error will occur if action is not taken.</td><td>5</td></tr>
<tr><td>Error</td><td>Error conditions</td><td>4</td></tr>
<tr><td>Critical</td><td>Critical conditions</td><td>3</td></tr>
<tr><td>Alert</td><td>Should be addressed immediately</td><td>2</td></tr>
<tr><td>Emergency</td><td>System is unusable</td><td>1</td></tr>
</table></td></tr>
<tr><td>Web: Remote log output level
UCI: system.main. remoteloglevel
Opt: remoteloglevel</td><td>Sets the maximum log output level severity for system events sent to remote syslog server.
<table>
<tr><th>Web value</th><th>Description</th><th>UCI</th></tr>
<tr><td>Debug</td><td>Information useful to developers for debugging the application.</td><td>8</td></tr>
<tr><td>Info</td><td>Normal operational messages that require no action.</td><td>7</td></tr>
<tr><td>Notice</td><td>Events that are unusual, but not error conditions.</td><td>6</td></tr>
<tr><td>Warning</td><td>May indicate that an error will occur if action is not taken.</td><td>5</td></tr>
<tr><td>Error</td><td>Error conditions.</td><td>4</td></tr>
<tr><td>Critical</td><td>Critical conditions.</td><td>3</td></tr>
<tr><td>Alert</td><td>Should be addressed immediately.</td><td>2</td></tr>
<tr><td>Emergency</td><td>System is unusable.</td><td>1</td></tr>
</table></td></tr>
<tr><td>Web: n/a
UCI: system.main.audit_shell
Opt: audit_shell</td><td>Log every command executed in shell.
<table>
<tr><td>1</td><td>Enable</td></tr>
<tr><td>0</td><td>Disable</td></tr>
</table></td></tr>
<tr><td>Web: n/a
UCI: system.main.audit_cfg
Opt: audit_cfg</td><td>Log changes made to configuration file through any interface.
<table>
<tr><td>1</td><td>Enable</td></tr>
<tr><td>0</td><td>Disable</td></tr>
</table></td></tr>
<tr><td>Web: n/a
UCI: system.main.audit_cfg_hul_interval_hours
Opt: audit_cfg_hul_interval_hours</td><td>Defines the interval, in hours, at which configuration changes are uploaded to Activator.
Set to 0 to disable.
<table>
<tr><td>Range</td><td></td></tr>
<tr><td>6</td><td>6 hours</td></tr>
</table></td></tr>
<tr><td>Web: n/a
UCI: system.main.audit_cfg_max_size_kb
Opt: audit_cfg_max_size_kb</td><td>Defines the maximum size audit data can take in flash in 1024 byte units.
<table>
<tr><td>Range</td><td></td></tr>
<tr><td>1024</td><td>6 hours</td></tr>
</table></td></tr>
</table>

Table 15: Information table for the logging section

10.3.3 Language and style

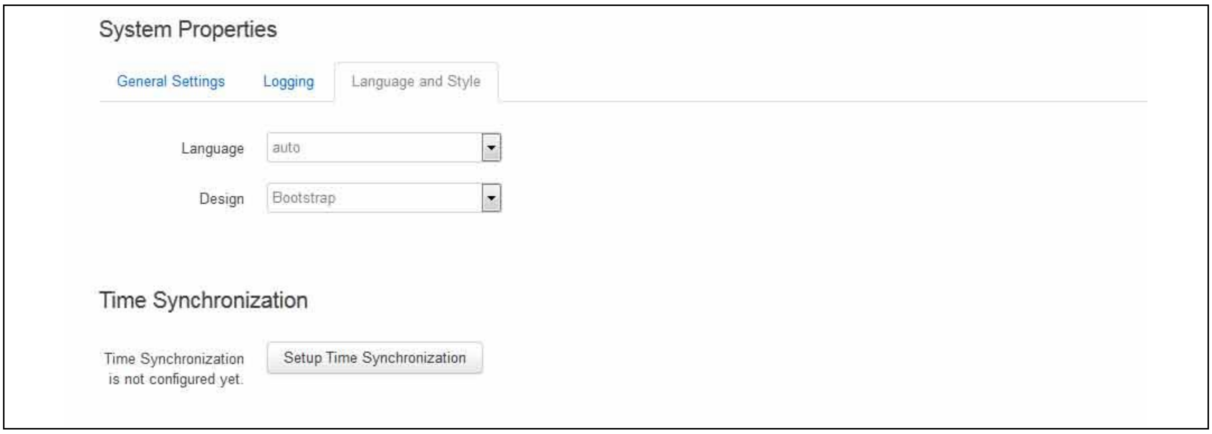

Figure 42: The language and style section in system properties

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Language</td><td>Sets the language to 'auto' or 'English'.<table><tr><td>Auto</td><td></td></tr><tr><td>English</td><td></td></tr></table></td></tr>
<tr><td>Design</td><td>Sets the router's style.</td></tr>
</table>

Table 16: Information table for the language and style page

10.3.4 Audit configuration

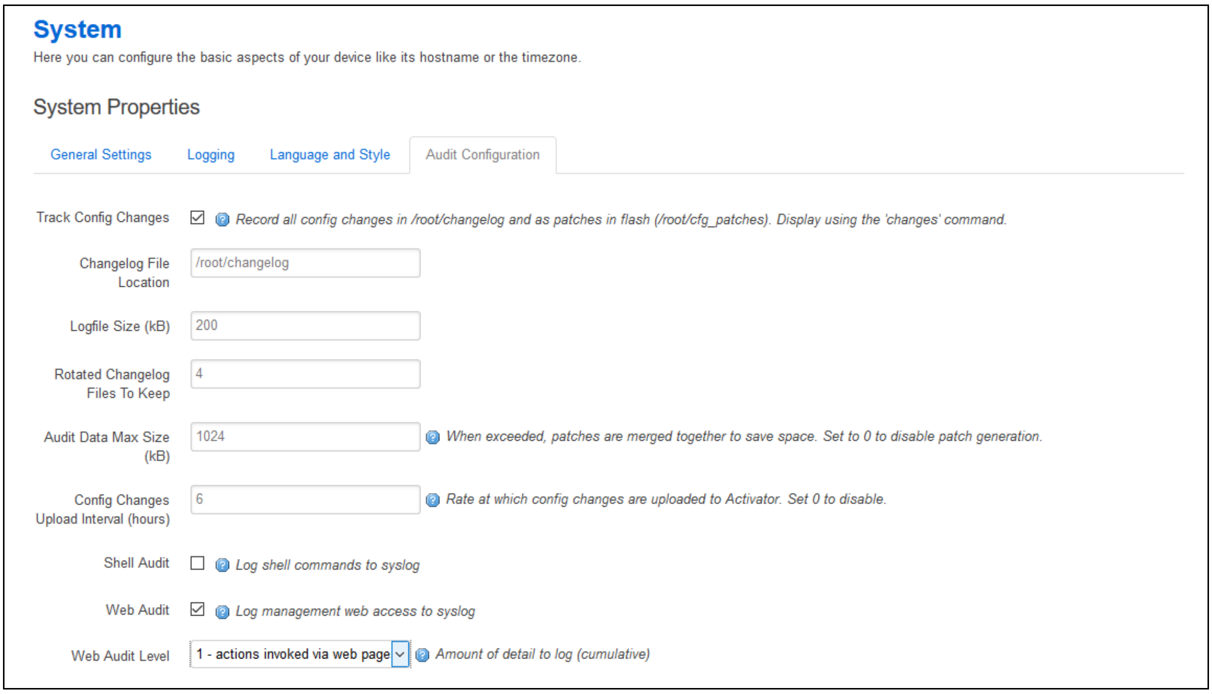

Figure 43: The audit configuration section in system properties

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<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Track Config Changes
UCI: system.main.audit_cfg
Opt: audit_cfg</td><td>Any changes made to configuration file through any interface are logged to syslog.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
<tr><td>Web: Changelog File Location
UCI: system.main.audit_cfg_log_file
Opt: audit_cfg_log_file</td><td>Defines the location of the configuration change log<table><tr><td>Range</td><td></td></tr><tr><td>/root/changelog</td><td></td></tr></table></td></tr>
<tr><td>Web: Logfile Size (kB)
UCI: system.main.audit_cfg_log_size
Opt: audit_cfg_log_size</td><td>Defines the maximum size of the configuration change log file in kB<table><tr><td>Range</td><td></td></tr><tr><td>200</td><td>200 kB</td></tr></table></td></tr>
<tr><td>Web: Rotated Changelog Files to Keep
UCI: system.main.audit_cfg_log_count
Opt: audit_cfg_log_count</td><td>Defines the maximum number of configuration change log files to store<table><tr><td>Range</td><td></td></tr><tr><td>4</td><td>Store 4 changelog files before rotating</td></tr></table></td></tr>
<tr><td>Web: Audit Data Max Size (kB)
UCI: system.main.audit_cfg_max_size_kb
Opt: audit_cfg_max_size_kb</td><td>Defines the maximum size audit data can take in flash in kB.<table><tr><td>Range</td><td></td></tr><tr><td>1024</td><td></td></tr></table></td></tr>
<tr><td>Web: Config Changes Upload Interval
UCI: system.main.audit_cfg_hul_interval_hours
Opt: audit_cfg_hul_interval_hours</td><td>Defines the interval, in hours, at which configuration change messages are uploaded to Activator.
Set to 0 to disable.<table><tr><td>Range</td><td></td></tr><tr><td>6</td><td>6 hours</td></tr></table></td></tr>
<tr><td>Web: Shell Audit
UCI: system.main.audit_shell
Opt: audit_shell</td><td>Every command executed in shell is logged to syslog.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
<tr><td>Web: Web Audit
UCI: luci.main.audit_req
Opt: audit_req</td><td>Enables logging management web access to syslog.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
<tr><td>Web: Web Audit Level
UCI: luci.main.audit_shell
Opt: audit_level</td><td>Defines the type of web operation to be logged to syslog.<table><tr><th>Web value</th><th>Description</th><th>UCI</th></tr><tr><td>1 – actions invoked via web page</td><td></td><td>1</td></tr><tr><td>2 – config and status pages</td><td></td><td>2</td></tr><tr><td>3 – config, status and polled pages</td><td></td><td>3</td></tr><tr><td>4 – comprehensive URL logging</td><td></td><td>4</td></tr></table></td></tr>
</table>

Table 17: Information table for the audit configuration page

10.3.5 Time synchronization

The router time must be synchronized using NTP. The router can act as both an NTP client and an NTP server. It is enabled as an NTP client by default and individual interfaces can be configured to respond to NTP requests.

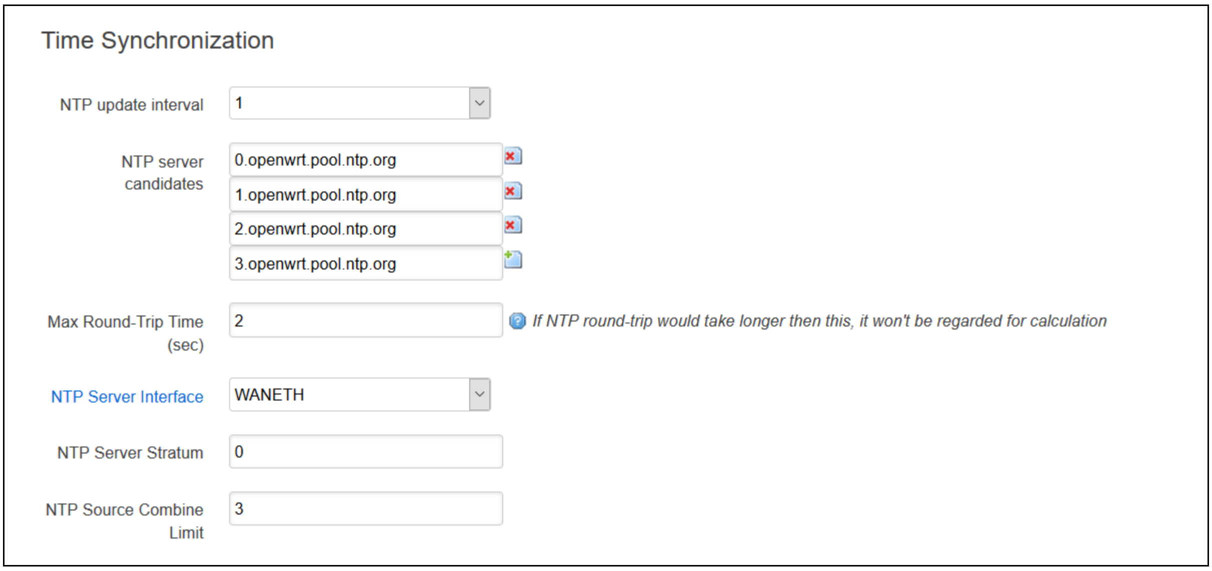

Figure 44: The time synchronization section in system properties

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: NTP update interval
UCI: system.ntp.interval_hours
Opt: interval_hours</td><td>Specifies interval of NTP requests in hours. Default value set to auto.<table><tr><td>Auto</td><td></td></tr><tr><td>Range</td><td>auto; 1-23</td></tr></table></td></tr>
<tr><td>Web: NTP server candidates
UCI: system.ntp.server
Opt: list server</td><td>Defines the list of NTP servers to poll the time from. If the list is empty, the built-in NTP daemon is not started. Multiple servers can be configured and are separated by a space if using UCI.
By default all fields are set to 0.0.0.0.</td></tr>
<tr><td>Web: Max Round-Tip Time (secs)
UCI: system.ntp.max_ntp_roundtrip_sec
Opt: max_ntp_roundtrip_sec</td><td>Defines the maximum time in seconds for an NTP poll. Any polls that take longer than this will be not be used for NTP calculation.<table><tr><td>2</td><td>Two seconds.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: NTP Server Interface
UCI: system.ntp.listen
Opt: listen</td><td>Defines a list of interfaces that respond to NTP requests. Interfaces should be delimited using space. Example:
option <code>listen 'LAN1 LAN2'</code><table><tr><td>Blank</td><td>Do not respond to NTP requests.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: NTP Server Stratum
UCI: system.ntp.stratum
Opt: stratum</td><td>Defines how far this NTP server is from the reference clock. For example, an NTP server getting time directly from the reference clock will have a stratum of 1. In general, this should be left blank, which means that the router NTP server will derive the stratum from the NTP dialogue.<table><tr><td>Blank</td><td>NTP server will derive stratum</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Web: NTP Source Combine Limit UCI: system.ntp. combinelimit Opt: combinelimit	Defines whether to limit sources included in the combining algorithm. When chronyd has multiple sources available for synchronization, it has to select one source as the synchronization source. The measured offsets and frequencies of the system clock relative to the other sources, however, can be combined with the selected source to improve the accuracy of the system clock. The combinelimit directive limits which sources are included in the combining algorithm. Their synchronization distance has to be shorter than the distance of the selected source multiplied by the value of the limit. Also, their measured frequencies have to be close to the frequency of the selected source. <table><tr><td>3</td><td></td></tr><tr><td>Range</td><td></td></tr></table>

Table 18: Information table for time synchronization section

10.3.6 Console login banner

To configure a message that is displayed after login via SSH, telnet or console, in the top menu, select **System -> Administration.** Navigate to the Console login banner section.

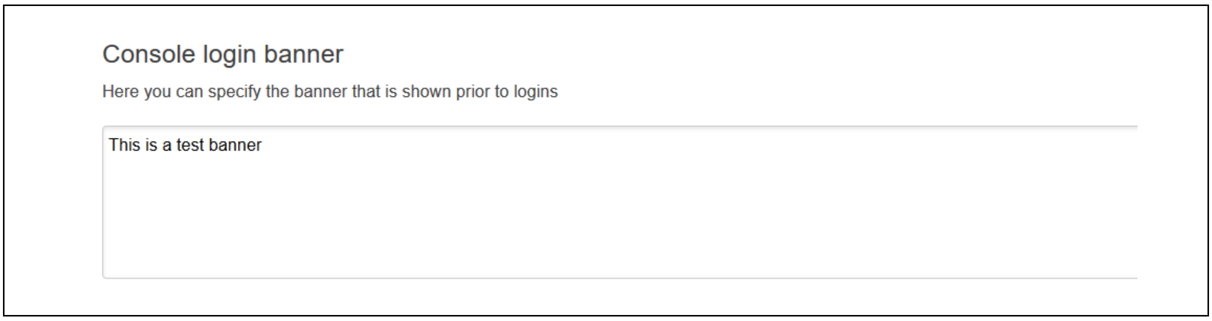

Figure 45: The console login banner in system section

Web Field/UCI/Package Option	Description
Web: Console login banner UCI: system.main.banner list: banner	Defines a login banner that is displayed after log in via SSH, telnet or console <table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table>

Figure 46: Information table for console login banner

10.3.7 System reboot

The router can be configured to reboot immediately, or scheduled to reboot a configured time in the future.

In the top menu, select **System -> Reboot**. The System page appears.

Ensure you have saved all your configuration changes before you reboot.

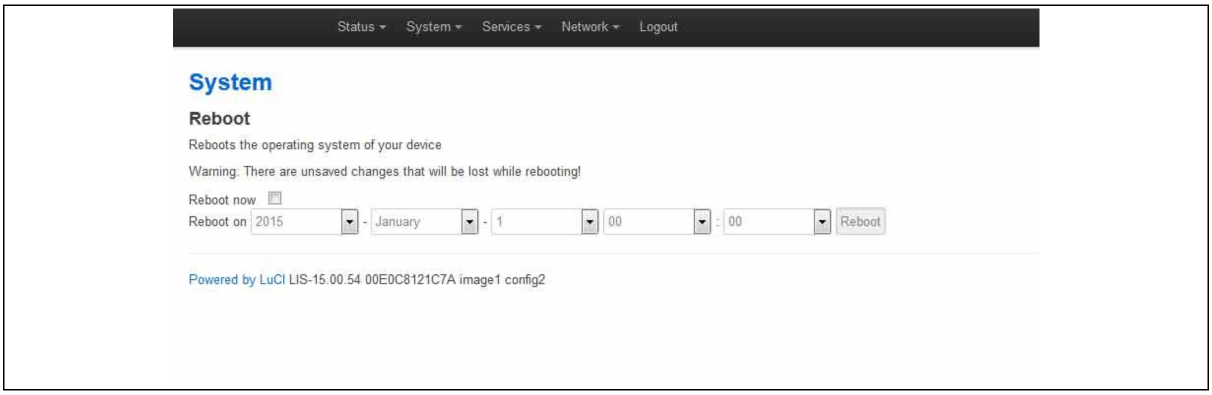

Figure 47: The reboot page

Check the **Reboot now** check box and then click **Reboot**.

10.4 System settings using command line

System settings are configured under the system package **/etc/config/system**. There are several configuration sections.

Section	Description
system	General system configuration options
timeserver	Router time and NTP configuration options
syslog_filter	Advanced filter rules (see Advanced filter section)

10.4.1 System settings using UCI

```
root@VA_router:~# uci show system
system.main=system
system.main.hostname=VA_router
system.main.timezone=UTC
system.main.log_ip=1.1.1.1
system.main.log_port=514
system.main.remoteloglevel=8
system.main.log_file=/root/syslog.messages
system.main.log_size=400
system.main.log_type=file
system.main.log_file_count=3
system.main.conloglevel=8
system.main.cronloglevel=8
system.main.banner=This is a test banner
system.ntp.interval_hours=auto
system.ntp.server=0.VA_router.pool.ntp.org 10.10.10.10
system.ntp.combinelimit=3
```

10.4.2 System settings using package options

```
root@VA_router:~# uci export system
package 'system'

config 'system' 'main'
      option 'hostname' "VA_router"
      option 'timezone' "UTC"
      option 'log_ip' "1.1.1.1"
      option 'log_port' "514"
      option remoteloglevel '8'
      option log_file '/root/syslog.messages'
      option log_size '400'
      option log_type 'file'
      option log_file_count '3'
      option time_save_interval_min "10"
      option conloglevel '8'
      option cronloglevel '8'
      list banner `This is a test banner`

config 'timeserver' 'ntp'
      option interval_hours 'auto'
      list server "0.VA_router.pool.ntp.org"
      list server ’10.10.10.10’
      option listen ‘LAN1 LAN2’
      option combinelimit ‘3’
```

10.5 System diagnostics

10.5.1 System log messages

System log messages comprise of a date, source facility, hostname, severity and message description in the form tag: message.

10.5.1.1 Source facility list

Facility	Description
auth	Authorisation/security
authpriv	Authorisation (private)
cron	Scheduled jobs
daemon	Background daemons
kern	Kernel messages

local0	hotplug scripts
security	Same as auth
syslog	Internal syslog events
user	General user-mode application messages

Table 19: Syslog message severity list

10.5.1.2 Event severity list

The severities are ordered from most severe to least severe.

Level	Name	Description
0	emerg	System is unusable
1	alert	Immediate action required
2	crit	Critical conditions
3	error	Error conditions
4	warning	Warning conditions
5	notice	Normal but significant
6	info	Informational
7	debug	Debug-level messages
-	none	No priority

Table 20: Syslog message severity list

10.5.1.3 System log messages in RAM

By default, system log messages are stored in the system log in RAM.

To view the system log in RAM, enter:

```
root@VA_router:~# logread
```

Shows the log.

```
root@VA_router:~# logread |tail
```

Shows end of the log.

```
root@VA_router:~# logread | more
```

Shows the log page by page.

```
root@VA_router:~# logread -f
```

Shows the log on an ongoing basis. To stop this option, press **ctrl-c**.

```
root@VA_router:~# logread -f &
```

Shows the log on an ongoing basis while in the background. This allows you to run other commands while still tracing the event logs. To stop this option, type **fg** to view the current jobs, then press **ctrl-c** to kill those jobs.

10.5.1.4 System log messages in flash

Since logread is limited by memory size and does not survive a reset, it is beneficial to write system messages to flash memory. To do this, modify the system config under the system package. Set the options '**log_file**', '**log_size**', '**log_type**' and '**log_file_count**' as shown below:

```
root@VA_router:~# uci export system
package system
config system 'main'
        option hostname 'VA_router'
        option zonename 'UTC'
        option timezone 'GMT0'
        option conloglevel '8'
        option cronloglevel '8'
        option time_save_interval_hour '10'
        option log_hostname '%serial'
        option log_ip '1.1.1.1'
        option log_port '514'
        option log_file '/root/syslog.messages'
        option log_size '400'
        option log_type 'file'
        option log_file_count '3'
```

The above commands will take effect after a reboot, or by running the console command:

```
root@VA_router:~# /etc/init.d/syslogd restart
```

```
root@VA_router:~# cat /root/syslog.messages
```

Shows all the system events stored in flash.

```
root@VA_router:~# tail /root/syslog.messages
```

Shows end of the events stored flash.

```
root@VA_router:~# tail –f /root/syslog.messages &
```

Shows the log on an ongoing basis. To stop this option, press **ctrl-c**.

10.5.2 Kernel messages

To view kernel messages, enter `dmesg`

```
root@VA_router:~# dmesg
[    0.000000] Linux version 3.10.12 (info@virtualaccess.com) (gcc version 4.8.1 20130401 (prerelease) (Linaro GCC 4.8-2013.04) ) #130 PREEMPT 1970-01-01T00:00:00Z
```

```
[    0.000000] SoC: xRX330 rev 1.1
[    0.000000] bootconsole [early0] enabled
[    0.000000] CPU0 revision is: 00019556 (MIPS 34Kc)
[    0.000000] adding memory size:267386880 from DT
[    0.000000] MIPS: machine is Virtual Access GW6600V series
[    0.000000] Determined physical RAM map:
[    0.000000]  memory: 0ff00000 @ 00000000 (usable)
[    0.000000] User-defined physical RAM map:
[    0.000000]  memory: 07200000 @ 00000000 (usable)
```

Note: kernel messages are also copied to the main system log by default.

10.5.3 Syslog process

To check the syslog process is running correctly, enter `pgrep –fl syslogd`

```
root@VA_router:~# pgrep -fl syslogd
5409 /sbin/syslogd -h VARouter -L -R 192.168.14.202:514 -l 7 -r 8 -s 400 -O
/root/syslog.messages -b 3 -C64 -R localhost:2048
```

Changes to the syslog configuration will take effect with a restart of `syslogd`

```
root@VA_router:~# /etc/init.d/syslogd restart
```

10.5.4 NTP process

To check the NTP process is running correctly, enter `pgrep –fl chrony`

```
root@VA_router:~# pgrep -fl chrony
2553 /usr/sbin/chronyd -f /etc/chrony.conf
```

Changes to the NTP configuration will take effect with a restart of `chrony`

```
root@VA_router:~# /etc/init.d/chrony restart
```

10.6 Advanced filtering of syslog messages

Syslog messages can be filtered against a series of rules that are checked for each message generated. If a match is found, then the specified action is taken. If no match occurs, then the default action is taken, as defined in the main system logging settings.

A message may match multiple filters. They are processed in the order listed. For example, you may wish to record authorisation messages in the main system log, but also make a copy in a separate authorisation log which can span a much longer period of time.

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By default, all matching filters will be applied to each message. However, you can mark a filter to indicate that after it matches, no further filter processing should take place.

The filter rules are defined in a free-form text list in the syslog_filter configuration section. There are two section types, one for messages to be stored locally, and one for messages delivered remotely.

Configuring advanced filters on the web interface is not currently supported; they must be edited using the command line interface.

10.6.1 Advanced filtering using command line

Filters are defined in the syslog_filter configuration section of the system package. A set of filters can be either local or remote.

- All messages are matched against both local and remote filter rules, if configured.
- Each local filter matched is executed; if there is no match, then the default local logging action applies.
- Any remote filter matched is executed; if there is no match, then the default remote logging action applies.

```
root@VA_router:~# uci export system
package system
……
config syslog_filter 'local'
      list text "...line 1..."
      list text "...line 2..."
      list text "...line 3..."
      ...

config syslog_filter 'remote'
      list text "...line 1..."
      list text "...line 2..."
      list text "...line 3..."
      ...
```

Lines defined here are copied to the router runtime file **/var/conf/syslog.conf** which may be reviewed to determine current rules in use.

10.6.2 Filter definitions

Each filter ruleset is a series of lines. Each line can be:

- A filter pattern, of the form `facility.[op]severity(pattern) target [~]`
- A blank line, or comment line, starting with hash (***#***).

If a message does not match any of the filter lines for a destination, local or remote, the default action for that destination is taken.

The sections of a filter pattern break down as follows:

<table>
<tr><th>Section</th><th>Description</th></tr>
<tr><td>facility</td><td>Any keyword or comma-separated list of keywords from the source facility list. See the Source Facilities table above in section 10.5.1.1.
Use the wildcard '*' to match all facilities.</td></tr>
<tr><td>severity</td><td>Any keyword from the event severity list (see Event Severity table above). The rule will match all severities more urgent f the message severity level is at least as urgent as this.
Use the wildcard '*' to match all facilities.</td></tr>
<tr><td>op</td><td>Defines an optional severity condition.
<table>
<tr><td>(empty)</td><td>match listed severity, and also anything more severe</td></tr>
<tr><td>!</td><td>match on less urgent severities than that listed</td></tr>
<tr><td>=</td><td>severity must match exactly</td></tr>
<tr><td>!=</td><td>match any severity other than the listed severity</td></tr>
</table>
Examples:
*.debug matches all messages of debug severity and greater (i.e. debug, info, warning, etc.
*.=debug matches all debug messages.</td></tr>
<tr><td>pattern</td><td>Defines an optional pattern to match against the message text. The pattern is used to restrict the number of log messages matching this filter.
The pattern syntax is a simple case-insensitive regular expression, using these characters:
<table>
<tr><td>*</td><td>Matches zero or more characters.</td></tr>
<tr><td>?</td><td>Matches any single character (use this for spaces).</td></tr>
<tr><td>!</td><td>Matches anything not matching the following pattern.</td></tr>
<tr><td>^</td><td>Matches the start of a message.</td></tr>
<tr><td>$</td><td>Matches the end of a message.</td></tr>
</table>
Examples:
<table>
<tr><td>(firewall:)</td><td>Match any message containing the string 'firewall:'</td></tr>
<tr><td>(up*eth1)</td><td>Match any UP message referencing eth1</td></tr>
<tr><td>(!mobile)</td><td>Match only messages that do not include the string 'mobile'</td></tr>
<tr><td>(^mobile)</td><td>Match only messages beginning with the string 'mobile'</td></tr>
</table></td></tr>
<tr><td>target</td><td>Defines what to do with the log message when a match occurs. It is optional for remote filters. It can be the name of a disk file, or one of the special target keywords listed below.
<table>
<tr><td>default</td><td>Do whatever the default action is, as if not the filter rule is matched.</td></tr>
<tr><td>ignore</td><td>Never log this message (useful for remote filtering).</td></tr>
<tr><td>console</td><td>Log this message to the console. To view the console use <code>cat /proc/conlog</code> For GW6600/GW6600V Series routers only.</td></tr>
<tr><td>mem</td><td>Log this message to the memory buffer (logread), if configured.
Note: logread is not stored through reboot.</td></tr>
</table></td></tr>
<tr><td>~</td><td>Optional flag to indicate no further filters should be checked if this filter matches. This prevents later filters from acting on the same message. For convenience this is automatically implied when a target of ignore is used. A space must be present before the ~ character.
<table>
<tr><td>~</td><td>No further filters should be checked after a match.</td></tr>
<tr><td>(empty)</td><td>Continue checking other filters after a match.</td></tr>
</table></td></tr>
</table>

Table 21: Filter syntax definitions

10.6.3 Filter examples

10.6.3.1 Example 1

Log all debug messages to memory buffer. Do not log anywhere else locally.

Log all authorisation facility messages to filepath 'var/log/auth'. Do not log anywhere else locally.

Log all ipsec messages to filepath 'va/log/ipsec'. Do not log anywhere else locally.

For everything else, apply default local logging.

No remote filter rules defined, so apply default remote logging to all messages.

```
config syslog_filter 'local'
      list text '*.=debug mem ~'
      list text 'auth,authpriv.*  /var/log/auth  ~'
      list text '*.*(ipsec:) /var/log/ipsec ~'
```

10.6.3.2 Example 2

As Example 1 but in addition to specified local files, copy auth, authpriv and ipsec to local default log.

```
config syslog_filter 'local'
      list text '*.=debug mem ~'
      list text 'auth,authpriv.*  /var/log/auth'
      list text '*.*(ipsec:) /var/log/ipsec'
      list text '*.* default'
```

10.6.3.3 Example 3

As in Example 2, except **do not** send any auth or auth priv messages remotely.

```
config syslog_filter 'local'
      list text '*.=debug mem ~'
      list text 'auth,authpriv.*  /var/log/auth'
      list text '*.*(ipsec:) /var/log/ipsec'
      list text '*.* default'

config syslog_filter 'remote'
      list text 'auth,authpriv.* ignore'
```

10.6.3.4 Example 4

As in Example 3, except **only** send auth or auth priv messages remotely.

```
config syslog_filter 'local'
        list text '*.=debug mem ~'
        list text 'auth,authpriv.*  /var/log/auth'
```

```
        list text '*.*(ipsec:) /var/log/ipsec'
        list text '*.* default'

config syslog_filter 'remote'
        list text 'auth,authpriv.* ~'
        list text '*.* ignore'
```

10.6.4 Filter diagnostics

To view configured filters, enter `cat /var/conf/syslog.conf`

```
root@VA_router:~# cat  /var/conf/syslog.conf
[local]
auth,authpriv.* /var/log/auth
*.*(ipsec:)     /var/log/ipsec
*.*             default

[remote]
auth,authpriv.info
*.* ignore
```

11 Configuring an Ethernet interface on a GW1000M router

This section describes how to configure an Ethernet interface on a GW1000M router, including configuring the interface as a DHCP server, adding the interface to a firewall zone and mapping the physical switch ports.

11.1 Configuration packages used

Package	Sections
network	interface
	route
	alias
firewall	zone
dhcp	dhcp

11.2 Configuring an Ethernet interface using the web interface

To create and edit interfaces via the web interface, in the top menu, click **Network -> Interfaces**. The Interfaces overview page appears.

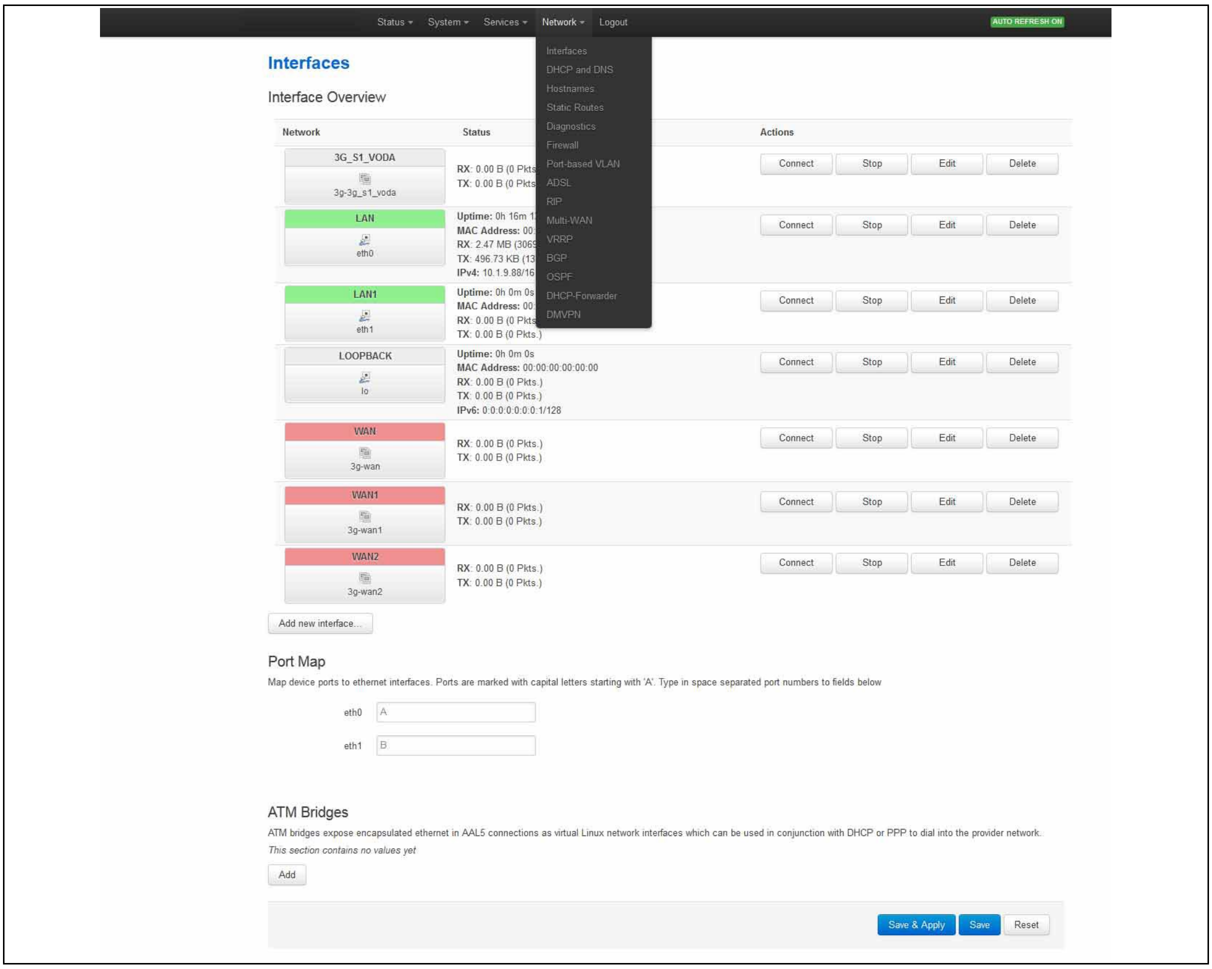

Figure 48: The interfaces overview page

There are two sections in the Interfaces page.

Section	Description
Interface Overview	Shows existing interfaces and their status. You can create new and edit existing interfaces here.
ATM Bridges	ATM bridges expose encapsulated Ethernet in AAL5 connections as virtual Linux network interfaces, which can be used in conjunction with DHCP or PPP to dial into the provider network.

11.3 Interface overview: editing an existing interface

To edit an existing interface, from the interface tabs at the top of the page, select the interface you wish to configure. Alternatively, click **Edit** in the interface’s row.

11.3.1 Interface overview: creating a new interface

To create a new interface, in the Interface Overview section, click **Add** new interface. The Create Interface page appears.

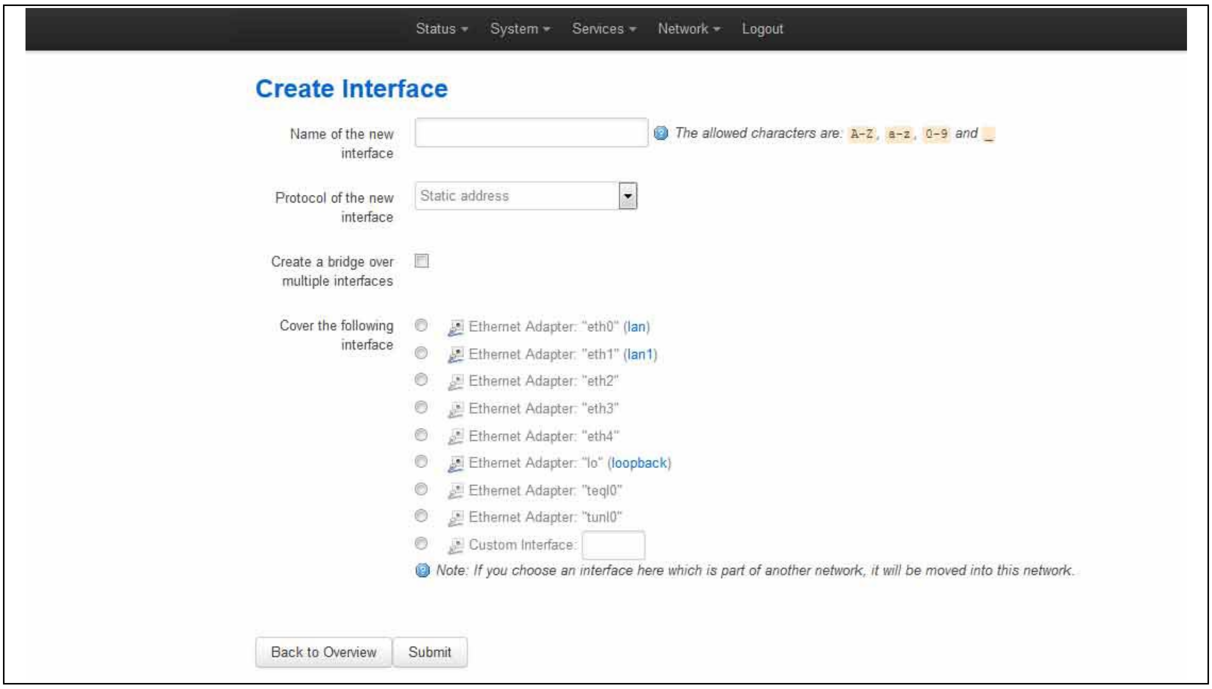

Figure 49: The create interface page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name of the new interface
UCI: network.<if name>
Opt: config interface</td><td>Assigns a logical name to the interface. The network interface section will assign this name (<if name>).
Type the name of the new interface.
Allowed characters are A-Z, a-z, 0-9 and _</td></tr>
<tr><td>Web: Protocol of the new interface
UCI: network.<if name>.proto
Opt: proto</td><td>Specifies what protocol the interface will operate on. Select Static.
<table>
<tr><th>Web</th><th>Description</th><th>UCI</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td><td>static</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td><td>dhcp</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td><td>none</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td><td></td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td><td></td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol.</td><td>gre</td></tr>
<tr><td>IOT</td><td>IOT</td><td>iot</td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td><td>l2tp</td></tr>
<tr><td>L2TPv3</td><td>L2TPv3 Tunnelling Protocol</td><td>l2tpv3</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol</td><td>ppp</td></tr>
<tr><td>PPtP</td><td>Point to Point Tunnelling Protocol</td><td>pptp</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td><td>pppoe</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td><td>pppoa</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td><td>3g</td></tr>
<tr><td>PPP(PSTN-Modem)</td><td>PPP v90 modem</td><td>pppmodem</td></tr>
</table></td></tr>
<tr><td>Web: Create a bridge over multiple interfaces
UCI: network.<if name>.type
Opt: type</td><td>If you select this option the new logical interface created will act as a bridging interface between the chosen existing physical interfaces.
<table>
<tr><td>Empty</td><td></td></tr>
<tr><td>Bridge</td><td>Configures a bridge over multiple interfaces.</td></tr>
</table></td></tr>
<tr><td>Web: Cover the following interface
UCI: network.<if name>.ifname
Opt: ifname</td><td>The physical interface name to assign to this logical interface. If creating a bridge over multiple interfaces, select two interfaces to bridge. When using UCI, separate the interface names by a space e.g. option ifname 'eth2 eth3'.</td></tr>
</table>

Table 22: Information table for the create new interface page

Click **Submit**. The Interface configuration page appears. There are three sections:

Section	Description
Common Configuration	Configure the interface settings such as protocol, IP address, gateway, netmask, custom DNS servers, MTU and firewall configuration.
IP-Aliases	Assigning multiple IP addresses to the interface.
DHCP Server	Configuring DHCP server settings for this interface.

11.3.2 Interface overview: common configuration

The common configuration section has four sub sections:

Section	Description
General Setup	Configure the basic interface settings such as protocol, IP address, gateway, netmask, custom DNS servers.
Advanced Settings	'Bring up on boot', 'Monitor interface state', Override MAC address, Override MTU and 'Use gateway metric'.
Physical Settings	Bridge interfaces, VLAN PCP to SKB priority mapping.
Firewall settings	Assign a firewall zone to the interface.

11.3.2.1 Common configuration – general setup

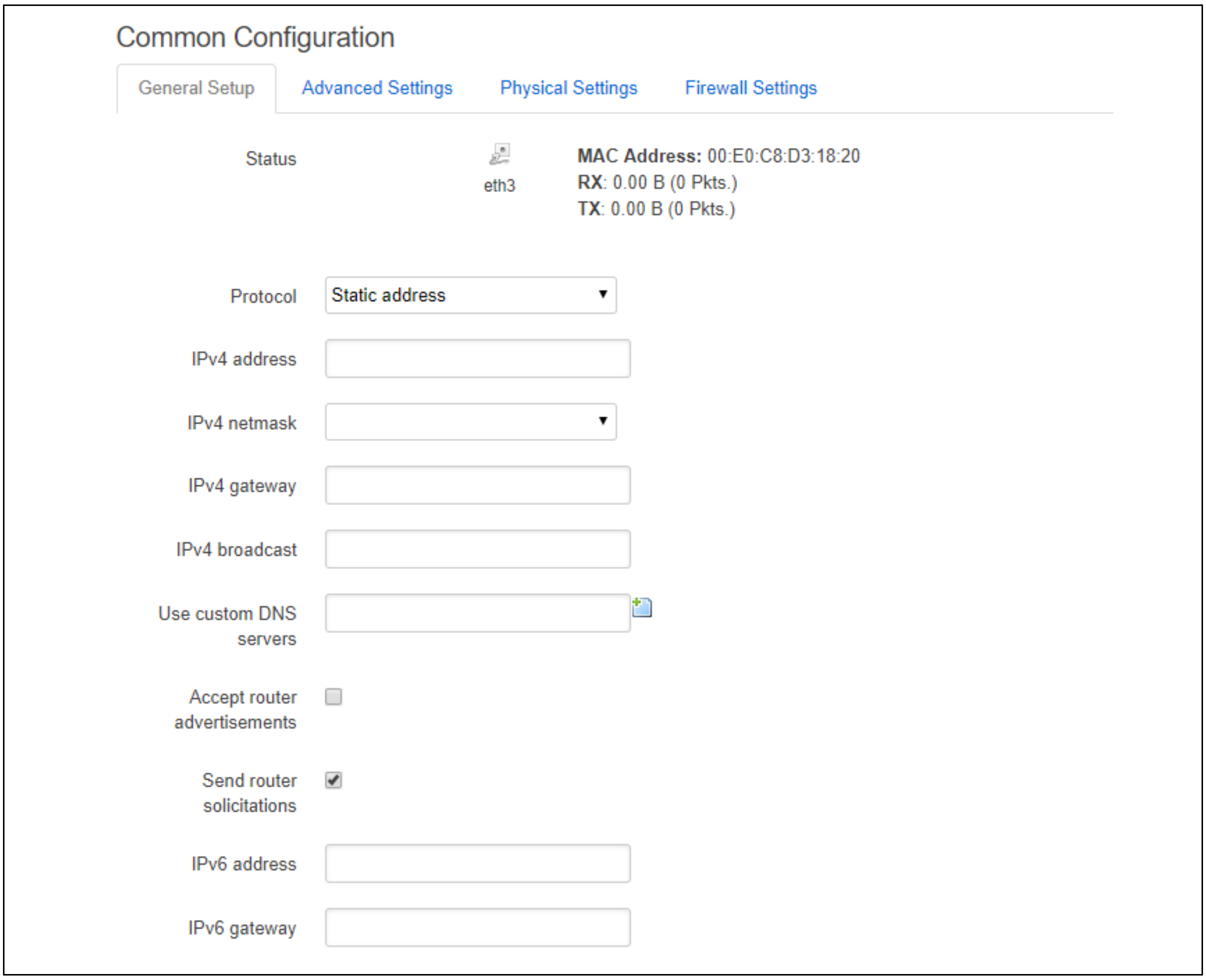

Figure 50: The Ethernet connection common configuration settings page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: status</td><td>Shows the current status of the interface.</td></tr>
<tr><td>Web:Protocol
UCI: nework.<if name>.proto
Opt:proto</td><td>Protocol type. The interface protocol may be one of the options shown below. The protocol selected in the previous step will be displayed as default but can be changed if required.
<table>
<tr><th>Web</th><th>Description</th><th>UCI</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td><td>static</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td><td>dhcp</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td><td>none</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td><td></td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td><td></td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td><td>gre</td></tr>
<tr><td>IOT</td><td>IOT</td><td>iot</td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol.</td><td>l2tp</td></tr>
<tr><td>L2TPv3</td><td>L2TPv3 Tunnelling Protocol</td><td>l2tpv3</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol.</td><td>ppp</td></tr>
<tr><td>PPtP</td><td>Point to Point Tunnelling Protocol.</td><td>pptp</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td><td>pppoe</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td><td>pppoa</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td><td>3g</td></tr>
<tr><td>PPP(PSTN-Modem)</td><td>PPP v90 modem</td><td>pppmodem</td></tr>
</table></td></tr>
<tr><td>Web: IPv4 address
UCI: network.<if name>.ipaddr
Opt: ipaddr</td><td>The IPv4 address of the interface. This is optional if an IPv6 address is provided.</td></tr>
<tr><td>Web:IPv4 netmask
UCI: network.<if name> .netmask
Opt: netmask</td><td>Subnet mask to be applied to the IP address of this interface.</td></tr>
<tr><td>Web:IPv4 gateway
UCI: network.<if name> .gateway
Opt: gateway</td><td>IPv4 default gateway to assign to this interface (optional).</td></tr>
<tr><td>Web:IPv4 broadcast
UCI: network.<if name> .broadcast
Opt: broadcast</td><td>Broadcast address. This is automatically generated if no broadcast address is specified.</td></tr>
<tr><td>Web:Use custom DNS servers
UCI: network.<if name> .dns
Opt: dns</td><td>List of DNS server IP addresses (optional). Multiple DNS Servers are separated by a space when using UCI or CLI.</td></tr>
<tr><td>Web:Accept router advertisements
UCI: network.<if name> .accept_ra
Opt: accept_ra</td><td>Specifies whether to accept IPv6 Router Advertisements on this interface (optional).
Note: default is 1 if protocol is set to DHCP, otherwise defaults to 0.</td></tr>
<tr><td>Web:Send router solicitations
UCI: network.<if name>
Opt:send_rs</td><td>Specifies whether to send Router Soliticitations on this interface (optional).
Note: defaults to 1 for static protocol, otherwise defaults to 0.</td></tr>
<tr><td>Web:IPv6 address
UCI: network.<if name> .ip6addr
Opt: ip6addr</td><td>The IPv6 IP address if the interface. Optional if an IPv4 address is provided.
CIDR notation for the IPv6 address is required.</td></tr>
</table>

Web:IPv6 gateway UCI: network.<if name> .ip6gw Opt:ip6gw	Assign given IPv6 default gateway to this interface (optional).

Table 23: Information table for LAN interface common configuration settings

11.3.2.2 Common configuration: advanced settings

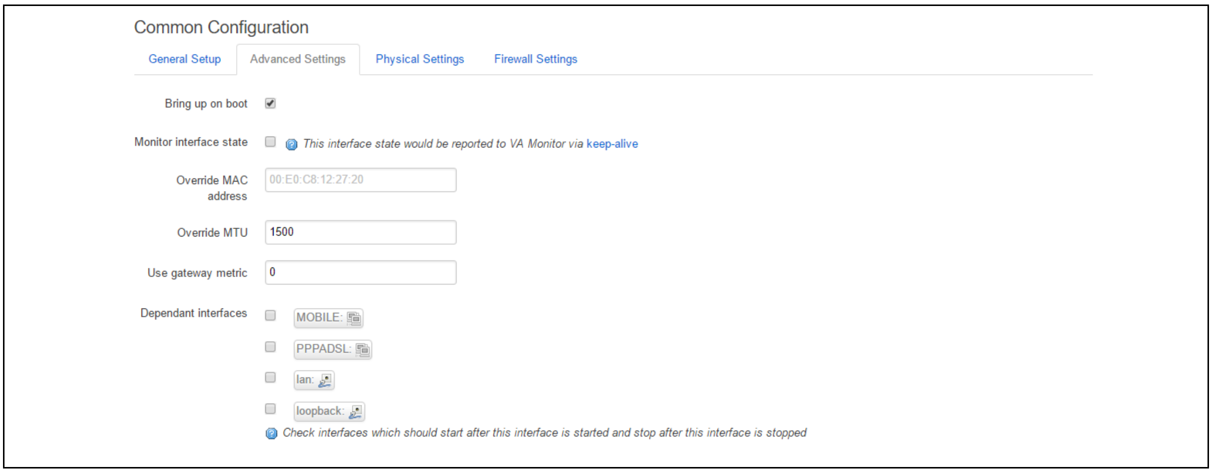

Figure 51: The Ethernet connection advanced settings page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Bring up on boot
UCI: network.<if name>.auto
Opt: auto</td><td>Enables the interface to connect automatically on boot up.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Monitor interface state
UCI: network.<if name>.monitored
Opt: monitored</td><td>Enabled if status of interface is presented on Monitoring platform.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Override MAC address
UCI: network.<if name>.macaddr
Opt: macaddr</td><td>Override the MAC address assigned to this interface. Must be in the form: hh:hh:hh:hh:hh:hh, where h is a hexadecimal number.</td></tr>
<tr><td>Web: Override MTU
UCI: network.<if name>.mtu
Opt: mtu</td><td>Defines the value to override the default MTU on this interface.<table><tr><td>1500</td><td>1500 bytes</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Use gateway metric
UCI: network.<if name>.metric
Opt: metric</td><td>Specifies the default route metric to use for this interface (optional).<table><tr><td>0</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Dependant Interfaces
UCI: network.[..x..].dependants
Opt: dependants</td><td>Lists interfaces that are dependent on this parent interface. Dependent interfaces will go down when the parent interface is down and will start or restart when parent interface starts.
Separate multiple interfaces by a space when using UCI.
Example: <code>option dependants 'PPPADSL MOBILE'</code>
This replaces the following previous options in child interfaces.<table><tr><td>gre</td><td>option local_interface</td></tr><tr><td>lt2p</td><td>option src_ipaddr</td></tr><tr><td>iot</td><td>option wan1 wan2</td></tr><tr><td>6in4</td><td>option ipaddr</td></tr><tr><td>6to4</td><td>option ipaddr</td></tr></table></td></tr>
</table>

Web: SNMP Alias ifindex UCI: network.[..x..].snmp_alias_ifindex Opt: snmp_alias_ifindex	Defines a static SNMP interface alias index for this interface, that can be polled via the SNMP interface index (snmp_alias_ifindex+1000). Read the chapter, 'Configuring SNMP' for more information. Blank: No SNMP interface alias index Range: 0 - 4294966295

Table 24: Information table for common configuration advanced settings

11.3.2.3 Common configuration: physical settings

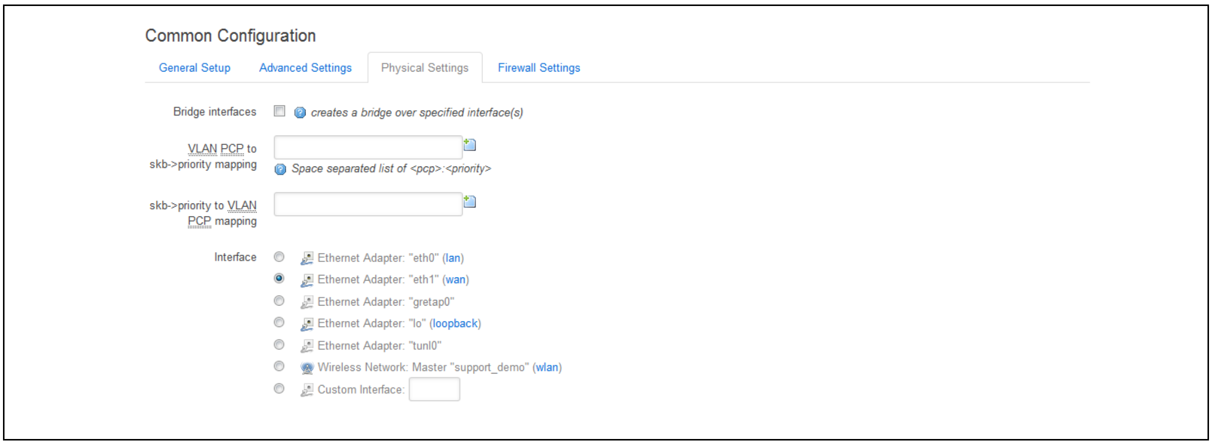

Figure 52: The common configuration physical settings page

Web Field/UCI/Package Option	Description
Web: Bridge interfaces UCI: network.<if name>.type Opt: type	Sets the interface to bridge over a specified interface(s). The physical interfaces can be selected from the list and are defined in network.<if name>.ifname. Blank: Bridge: Configures a bridge over multiple interfaces.
Web: Enable STP UCI: network.<if name>.stp Opt: stp	Enable Spanning Tree Protocol. This option is only available when the Bridge Interfaces option is selected. 0: Disabled. 1: Enabled.
Web: VLAN PCP to skb>priority mapping UCI: network.<if name>.vlan_qos_map_ingress Opt: list vlan_qos_map_ingress	VLAN priority code point to socket buffer mapping. Multiple priority mappings are entered with a space between them when using UCI. Example: network.<if name>. vlan_qos_map_ingress =1:2 2:1
Web: skb priority to >VLAN PCP mapping UCI: network.<if name>.vlan_qos_map_egress Opt: list vlan_qos_map_egress	Socket buffer to VLAN priority code point mapping. Multiple priority mappings are entered with a space between them when using UCI. Example: network.<if name>. vlan_qos_map_egress =1:2 2:1
Web: Interface UCI: network.<if name>.ifname Opt: ifname	Physical interface to assign the logical interface to. If mapping multiple interfaces for bridging the interface names are separated by a space when using UCI and package options. Example: option ifname 'eth2 eth3' or network.<if name>.ifname=eth2 eth 3
Web: Auto Negotiation UCI: network.<if name>.autoneg Opt: autoneg	Specifies if sspeed and duplex mode should be autonegotiated. 0: Disabled. 1: Enabled.
Web: Full Duplex UCI: network.<if name>.fullduplex Opt: fullduplex	Ability to change duplex mode. 0: Disabled. 1: Enabled.

Web: Ethernet Speed UCI: network.<if name>.speed Opt: speed	Sets Ethernet speed. Available options are: Eth0:10,100,1000 Eth1:10,100

Table 25: Information table for physical settings page

11.3.2.4 Common configuration: firewall settings

Use this section to select the firewall zone you want to assign to this interface.

Select unspecified to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.

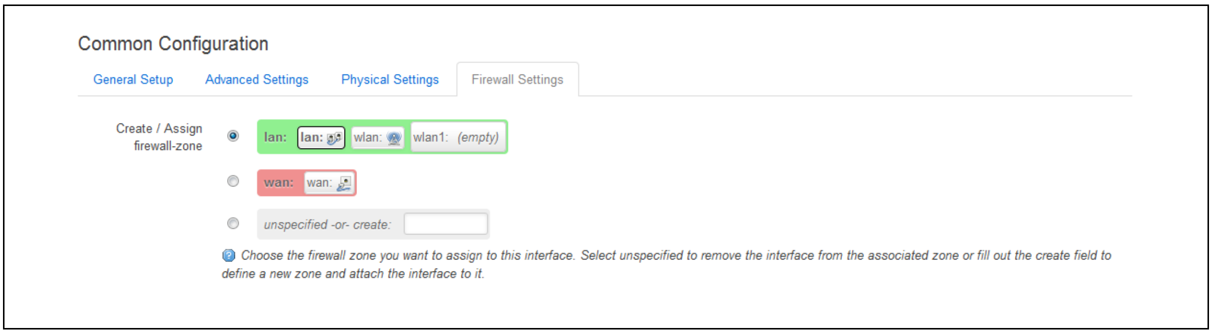

Figure 53: GRE firewall settings

11.3.3 Interface overview: IP-aliases

IP aliasing is associating more than one IP address to a network interface. You can assign multiple aliases.

11.3.3.1 IP-alias packages used

Package	Sections
Network	alias

11.3.3.2 Configuring IP-alias using the web

To use IP-aliases, enter a name for the alias and click **Add**. This name will be assigned to the alias section for this IP-alias. In this example the name ethalias1 is used.

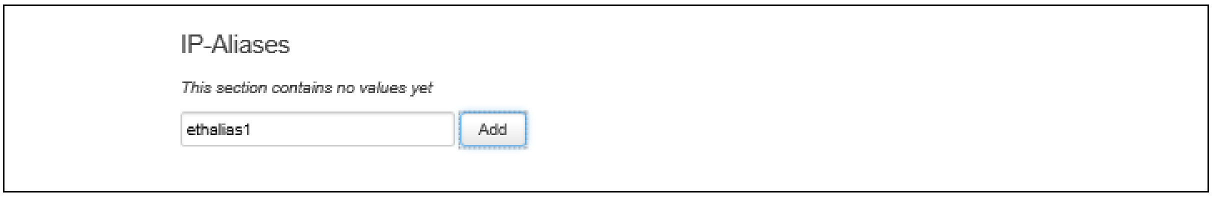

Figure 54: The IP-Aliases section

Web Field/UCI/Package Option	Description
UCI: network.<alias name>=alias Opt: config alias 'aliasname'	Assigns the alias name.
UCI: network.<alias name>.interface Opt: interface	This maps the IP-Alias to the interface.
UCI: network.<alias name>.proto Opt: proto	This maps the interface protocol to the alias.

Table 26: Information table for IP-Aliases name assignment

After you click **Add**, the IP-Aliases configuration options page appears. The IP-Aliases page is divided into two sub sections: General Setup and Advanced Settings.

11.3.3.3 IP-aliases: general setup

Figure 55: The IP-Aliases general setup section

Web Field/UCI/Package Option	Description
Web: IPv4-Address UCI: network.<alias name>.ipaddr Opt: ipaddr	Defines the IP address for the IP alias.
Web: IPv4-Netmask UCI: network.<alias name>.netmask Opt: netmask	Defines the netmask for the IP alias.
Web: IPv4-Gateway UCI: network.<alias name>.gateway Opt: gateway	Defines the gateway for the IP alias.

Table 27: Information table for IP-Alias general setup page

11.3.3.4 IP-aliases: advanced settings

Figure 56: The IP-Aliases advanced settings section

Web Field/UCI/Package Option	Description
Web: IPv4-Broadcast UCI: network.<alias name>.bcast Opt: bcast	Defines the IP broadcast address for the IP-alias.
Web: DNS-Server UCI: network.<alias name>.dns Opt: dns	Defines the DNS server for the IP-alias.

Table 28: Information table for IP-Alias advanced settings page

11.3.4 Interface overview: DHCP server

11.3.4.1 DHCP server: packages used

Package	Sections
dhcp	dhcp

To assign a DHCP Server to the interface, uncheck the **Ignore Interface** box.

Figure 57: The DHCP Server settings section

The DHCP Server configuration options will appear. The DHCP Server section is divided into two sub sections: General Setup and Advanced Settings.

11.3.4.2 DHCP server: general setup

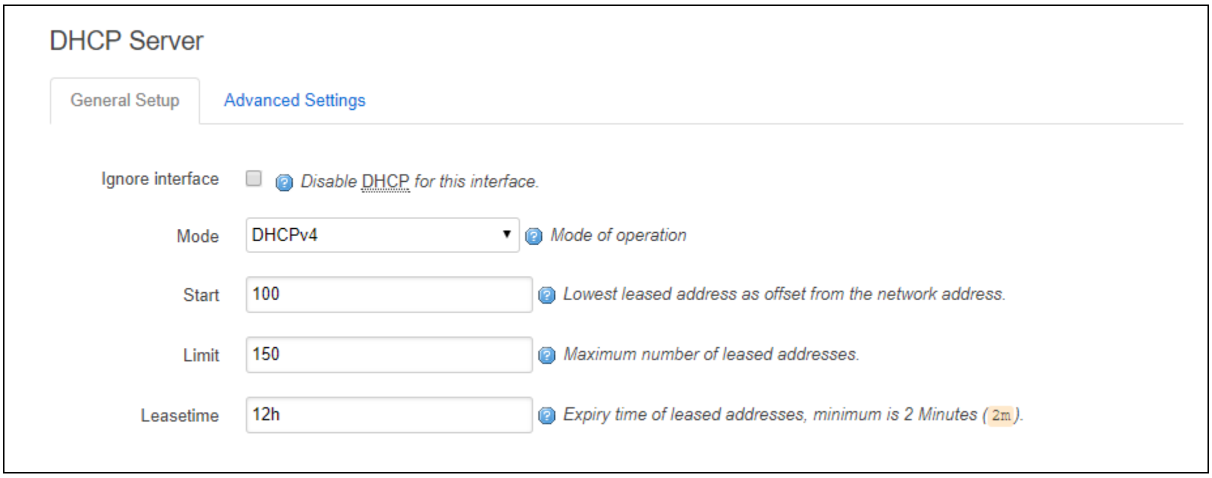

Figure 58: The DHCP server general setup section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Ignore interface
UCI: dhcp.@dhcp[x].ignore
Opt: ignore</td><td>Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then the default is disabled i.e. dhcp pool enabled.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Mode
UCI: dhcp.@dhcp[x].mode
Opt: mode</td><td>Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then the default is disabled i.e. dhcp pool enabled.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>DHCPv4</td><td>DHCP for IPv4</td><td>ipv4</td></tr><tr><td>DHCPv6</td><td>DHCP for IPv6</td><td>ipv6_dhcp</td></tr><tr><td>IPv6 Router Advertisements</td><td>IPv6 RA</td><td>ipv6_ra</td></tr><tr><td>DHCPv6 Prefix Delegation</td><td>DHCPv6 prefix delegation</td><td>ipv6_pd</td></tr></table></td></tr>
</table>

<table>
<tr><td>Web: Start
UCI: dhcp.@dhcp[x].start
Opt: start</td><td>Defines the offset from the network address for the start of the DHCP pool.
Example: for network address 192.168.100.10/24, start=100, DHCP allocation pool will start at 192.168.100.100.
For subnets greater than /24, it may be greater than 255 to span subnets. Alternatively, specify in IP address notation using the wildcard ‘0’ where the octet is required to inherit bits from the interface IP addess.
Example: to define a DHCP scope starting from 10.1.20.0 on an interface with 10.1.0.0/16 address, set start to 0.0.20.1<table><tr><td>100</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Limit
UCI: dhcp.@dhcp[x].limit
Opt: limit</td><td>Defines the size of the address pool.
Example: for network address 192.168.100.10/24, start=100, limit=150, DHCP allocation pool will be .100 to .249<table><tr><td>150</td><td></td></tr><tr><td>Range</td><td>0 – 255</td></tr></table></td></tr>
<tr><td>Web: leasetime
UCI: dhcp.@dhcp[x].leasetime
Opt: leasetime</td><td>Defines the lease time of addresses handed out to clients, for example 12h or 30m.<table><tr><td>12h</td><td>12 hours</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: n/a
UCI: dhcp.@dhcp[x].interface
Opt: interface</td><td>Defines the interface that is served by this DHCP pool. This must be one of the configured interfaces.
When configured through the web UI this will be automatically populated with the interface name.<table><tr><td>lan</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 29: Information table for DHCP server general setup page

11.3.4.3 DHCP Server: advanced settings

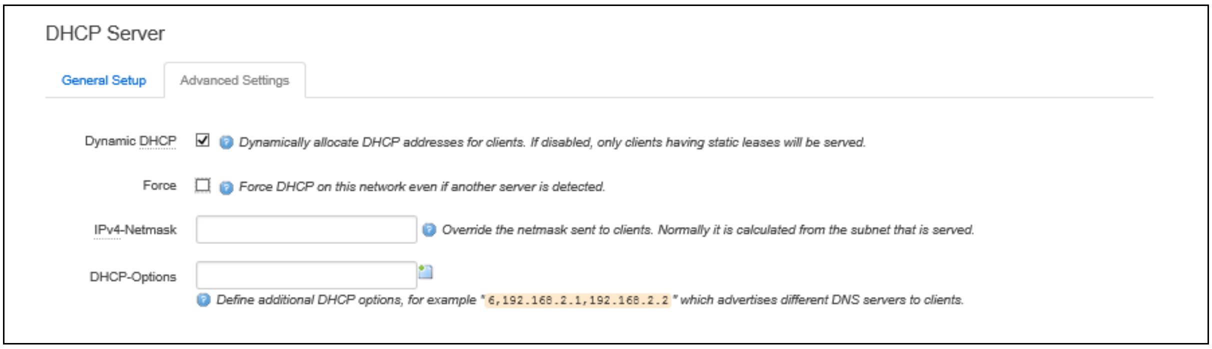

Figure 59: The DHCP server advanced settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Dynamic DHCP
UCI: dhcp.@dhcp[x].dynamicdhcp
Opt: dynamicdhcp</td><td>Defines whether to dynamically allocate DHCP leases.<table><tr><td>1</td><td>Dynamically allocate leases.</td></tr><tr><td>0</td><td>Use /etc/ethers file for serving DHCP leases.</td></tr></table></td></tr>
<tr><td>Web: Force
UCI: dhcp.@dhcp[x].force
Opt: force</td><td>Forces DHCP serving on the specified interface even if another DHCP server is detected on the same network segment.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

Web: IPv4-Netmask UCI: dhcp.@dhcp[x].netmask Opt: netmask	Defines a netmask sent to clients that overrides the netmask as calculated from the interface subnet. (default): Use netmask from interface subnet Range:
Web: DHCP-Options UCI: dhcp.@dhcp[x].dhcp_option Opt: list dhcp_option	Defines additional options to be added for this dhcp pool. For example with 'list dhcp_option 26,1470' or 'list dhcp_option mtu, 1470' you can assign a specific MTU per DHCP pool. Your client must accept the MTU option for this to work. Options that contain multiple vales should be separated by a comma. Example: list dhcp_option 6,192.168.2.1,192.168.2.2 (default): No options defined. Syntax: Option_number, option_value
Web: n/a UCI: dhcp.@dhcp[x].networkid Opt: networked	Assigns a network-id to all clients that obtain an IP address from this pool. (default): Use network from interface subnet. Range:

Table 30: Information table for DHCP advanced settings page

For more advanced configuration on the DHCP server, read ‘DHCP server and DNS configuration section.

11.4 Configuring an Ethernet interface using command line

The configuration files are stored at **/etc/config/network**, **/etc/config/firewall** and **/etc/config/dhcp**

11.4.1 Interface configuration using UCI

```
root@VA_router:~# uci show network
      …..
network.newinterface=interface
network.newinterface.proto=static
network.newinterface.ifname=eth0
network.newinterface.monitored=0
network.newinterface.ipaddr=2.2.2.2
network.newinterface.netmask=255.255.255.0
network.newinterface.gateway=2.2.2.10
network.newinterface.broadcast=2.2.2.255
network.newinterface.vlan_qos_map_ingress=1:2 2:1
network.ethalias1=alias
network.ethalias1.proto=static
network.ethalias1.interface=newinterface
network.ethalias1.ipaddr=10.10.10.1
network.ethalias1.netmask=255.255.255.0
network.ethalias1.gateway=10.10.10.10
```

```
network.ethalias1.bcast=10.10.10.255
network.ethalias1.dns=8.8.8.8

root@VA_router:~# uci show firewall
      …..
firewall.@zone[0]=zone
firewall.@zone[0].name=lan
firewall.@zone[0].input=ACCEPT
firewall.@zone[0].output=ACCEPT
firewall.@zone[0].forward=ACCEPT
firewall.@zone[0].network=lan newinterface

root@VA_router:~# uci show dhcp
      …
dhcp.@dhcp[0]=dhcp
dhcp.@dhcp[0].interface=newinterfacedhcp@dhcp[0].mode=ipv4
dhcp.@dhcp[0].start=100
dhcp.@dhcp[0].leasetime=12h
dhcp.@dhcp[0].limit=150
To change any of the above values use uci set command.
```

11.4.2 Interface common configuration using package options

```
root@VA_router:~# uci export network
package network
      ……
config interface 'newinterface'
        option proto 'static'
        option ifname 'eth0'
        option monitored '0'
        option ipaddr '2.2.2.2'
        option netmask '255.255.255.0'
        option gateway '2.2.2.10'
        option broadcast '2.2.2.255'
        list vlan_qos_map_ingress '1:2'
        list vlan_qos_map_ingress '2:1'
config alias 'ethalias1'
```

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```
        option proto 'static'
        option interface 'newinterface'
        option ipaddr '10.10.10.1'
        option netmask '255.255.255.0'
        option gateway '10.10.10.10'
        option bcast '10.10.10.255'
        option dns '8.8.8.8'

root@VA_router:~# uci export firewall
package firewall
config zone
      option name 'lan'
      option input 'ACCEPT'
      option output 'ACCEPT'
      option network 'lan newinterface'

root@VA_router:~# uci export dhcp
package dhcp
      ……
config dhcp
        option interface 'newinterface'
        option mode ‘ipv4’
        option start '100'
        option leasetime '12h'
        option limit '150'
```

To change any of the above values use `uci set` command.

11.4.3 Configuring ATM bridges

The ATM bridges section is not used when configuring an Ethernet interface on a GW1000M router.

11.5 Interface diagnostics

11.5.1 Interfaces status

To show the current running interfaces, enter:

```
root@VA_router:~# ifconfig
3g-CDMA   Link encap:Point-to-Point Protocol
```

```
          inet addr:10.33.152.100  P-t-P:178.72.0.237  Mask:255.255.255.255
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1400  Metric:1
          RX packets:6 errors:0 dropped:0 overruns:0 frame:0
          TX packets:23 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:3
          RX bytes:428 (428.0 B)  TX bytes:2986 (2.9 KiB)
eth0      Link encap:Ethernet  HWaddr 00:E0:C8:12:12:15
          inet addr:192.168.100.1  Bcast:192.168.100.255
Mask:255.255.255.0
          inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:6645 errors:0 dropped:0 overruns:0 frame:0
          TX packets:523 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:569453 (556.1 KiB)  TX bytes:77306 (75.4 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:385585 errors:0 dropped:0 overruns:0 frame:0
          TX packets:385585 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:43205140 (41.2 MiB)  TX bytes:43205140 (41.2 MiB)
```

To display a specific interface, enter:

```
root@VA_router:~# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:E0:C8:12:12:15
          inet addr:192.168.100.1  Bcast:192.168.100.255
Mask:255.255.255.0
          inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:7710 errors:0 dropped:0 overruns:0 frame:0
          TX packets:535 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:647933 (632.7 KiB)  TX bytes:80978 (79.0 KiB)
```

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11.5.2 Route status

To show the current routing status, enter:

```
root@VA_router:~# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.100.0   *               255.255.255.0   U     0      0        0 eth0
```

Note: a route will only be displayed in the routing table when the interface is up.

11.5.3 Switch duplex and speed

To show the Ethernet switch duplex and speed for a port, use the `ethtool` command with the required Ethernet port as a parameter. To view eth0, enter:

```
root@VA_router:~# ethtool eth0
Settings for eth0:
        Supported ports: [ TP MII ]
        Supported link modes:   10baseT/Half 10baseT/Full
                                100baseT/Half 100baseT/Full
                                1000baseT/Full
        Supported pause frame use: No
        Supports auto-negotiation: Yes
        Advertised link modes:  10baseT/Half 10baseT/Full
                                100baseT/Half 100baseT/Full
                                1000baseT/Full
        Advertised pause frame use: No
        Advertised auto-negotiation: Yes
        Link partner advertised link modes:  10baseT/Half 10baseT/Full
                                             100baseT/Half 100baseT/Full
        Link partner advertised pause frame use: No
        Link partner advertised auto-negotiation: Yes
        Speed: 100Mb/s
        Duplex: Full
        Port: MII
        PHYAD: 0
        Transceiver: external
        Auto-negotiation: on
        Current message level: 0x000000ff (255)
```

```
                                drv probe link timer ifdown ifup rx_err
tx_err
```

12 Configuring VLAN

12.1 Maximum number of VLANs supported

Virtual Access' routers support up to 4095 VLANs.

12.2 Configuration package used

Package	Sections
Network	

12.3 Configuring VLAN using the web interface

12.3.1 Create a VLAN interface

To configure VLAN using the web interface, in the top menu, select **Network -> Interfaces**.

Click **Add** new interface. The Create Interface page appears.

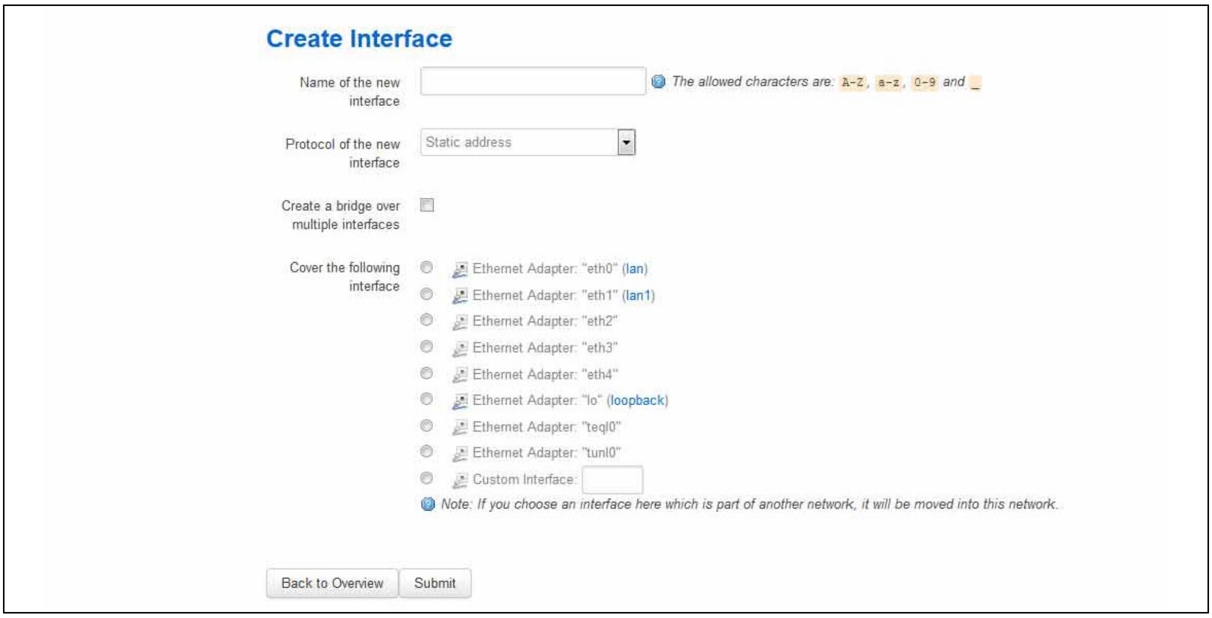

Figure 60: The create interface page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name of the new interface
UCI: network.vlan1=interface
Opt: interface</td><td>Type the name of the new interface. For example, VLAN1.</td></tr>
<tr><td>Web: Protocol of the new interface
UCI: network.vlan_test.proto
Opt: proto</td><td>Protocol type. Select Static.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
<tr><td>Web: Create a bridge over multiple interfaces
UCI: network.vlan1.type
Opt: type</td><td>Create a bridge over multiple interfaces.</td></tr>
<tr><td>Web: Cover the following interface
UCI: network.vlan1.ifname
Opt: ifname</td><td>Check the Custom Interface radio button.
Enter a name, for example eth0.100. This will assign VLAN 100 to the eth0 interface.</td></tr>
</table>

Table 31: Information table for the create interface page

Click **Submit**. The Interfaces page for VLAN1 appears.

12.3.2 General setup: VLAN

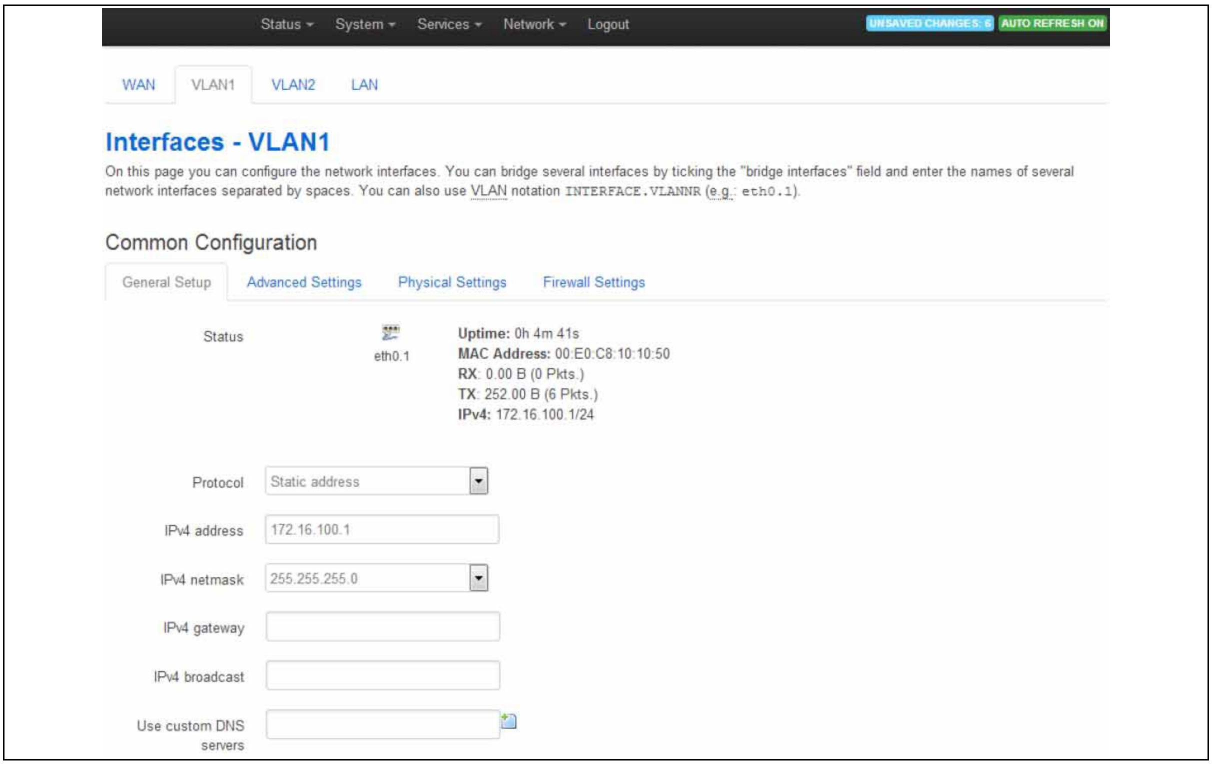

Figure 61: The VLAN 1 interface page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Protocol
UCI: network.VLAN1.proto
Opt: proto</td><td>Protocol type.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
<tr><td>Web: IPv4 address
UCI: network.VLAN1.ipaddr
Opt: ipaddr</td><td>The IPv4 address of the interface. This is optional if an IPv6 address is provided.</td></tr>
<tr><td>Web: IPv4 netmask
UCI: network.VLAN1.netmask
Opt: netmask</td><td>Subnet mask to be applied to the IP address of this interface.</td></tr>
</table>

Web: IPv4 gateway UCI: network.VLAN1.gateway Opt: gateway	IPv4 default gateway to assign to this interface (optional).
Web: Use custom DNS servers UCI: network.VLAN1.dns Opt: dns	List of DNS server IP addresses (optional).

Table 32: Information table for VLAN general settings

12.3.3 Firewall settings: VLAN

Use this section to select the firewall zone you want to assign to the VLAN interface.

Select **unspecified** to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.

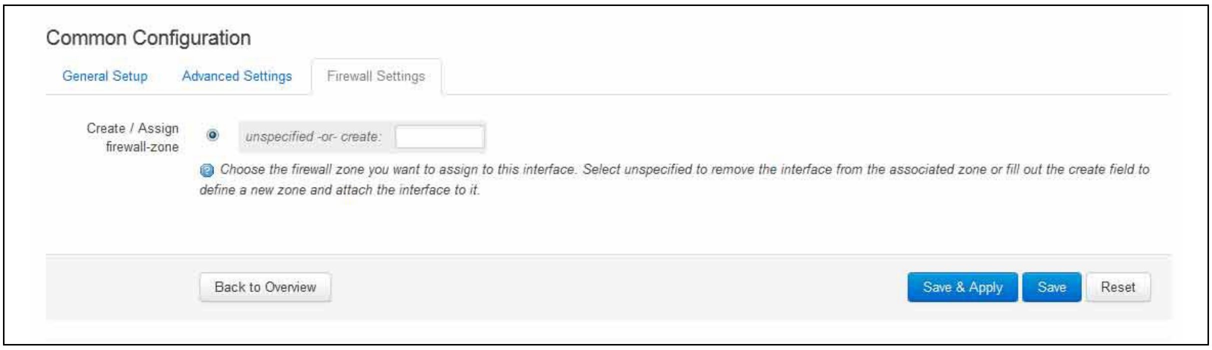

Figure 62: Firewall settings page

When you have added all the VLAN interfaces you require, click **Save & Apply**.

12.4 Viewing VLAN interface settings

To view the new VLAN interface settings, in the top menu, select **Network -> Interfaces**. The Interfaces Overview page appears.

The example below shows two VLAN interfaces configured.

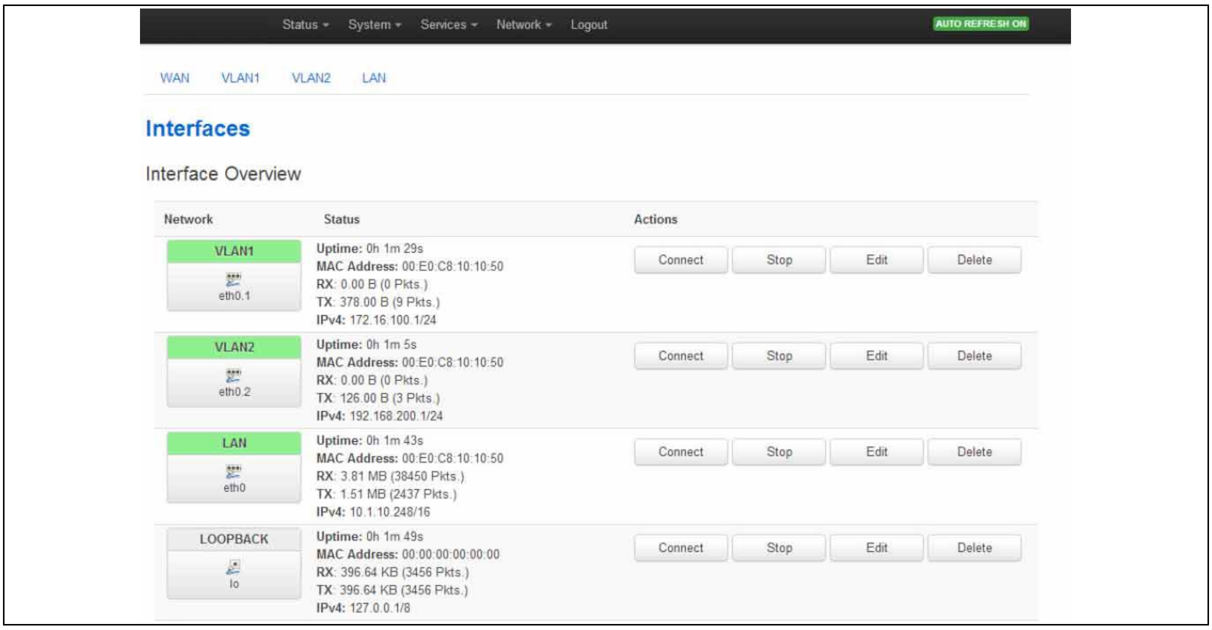

Figure 63: The interface overview page showing two VLAN interfaces

12.5 Configuring VLAN using the UCI interface

You can configure VLANs through CLI. The VLAN configuration file is stored on: **/etc/config/network**

```
# uci export network
package network
config interface 'vlan100'
        option proto 'static'
        option ifname 'eth0.100'
        option monitored '0'
        option ipaddr '192.168.100.1'
        option netmask '255.255.255.0'
        option gateway '192.168.100.10'
        option broadcast '192.168.100.255'
        option dns '8.8.8.8'
```

Modify these settings by running `uci set <parameter>` command.

When specifying the ifname ensure that it is written in dotted mode, that is, eth1.100 where eth1 is the physical interface assigned to VLAN tag 100.

Note: VLAN1 is, by default, the native VLAN and will not be tagged.

13 Configuring AC power sense

AC to DC power adapters can store enough power to supply the router for a short period of time after the main AC supply has failed, so AC power sense allows the router to smoothly power down on supply failure. You can configure the time delay between sensed power failure and initiation of power down, so that very short power dropouts do not trigger an unnecessary shutdown.

Routers for AC power sense applications are supplied with a power lead with 3 connectors:

- A 12V signal that goes low as soon as AC power is lost and returns high when it is restored,
- A 12V main power connection, and
- Ground.

13.1 Configuration packages used

Package	Sections
vapowermond	main

13.2 Configuring vapowermond using the web interface

You can configure the Vapowermond package using the web interface. In the top menu, click **Services -> Power Monitor**. The basic settings page appears.

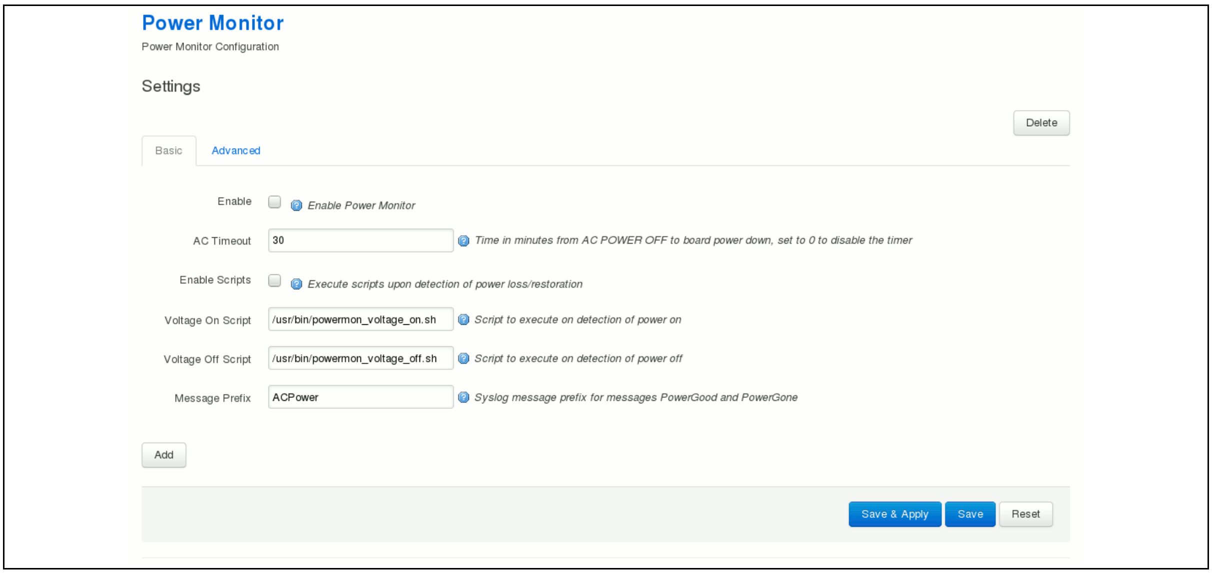

Figure 64: Power monitor basic settings page

13.2.1 Power monitor basic settings

Web field/UCI/Package Option	Description
Web field: Enable UCI: vapowermond.main.enabled Opt: enabled	Enables vapowermond package on a router. 0 Range 0-1
Web field: Ignition Timeout UCI: vapowermond.main.timeout Opt: timeout	Time in minutes from ignition power off to router power down. Set to **0** to disable the timer. 30 Range 0-infinite
Web field: Enable Scripts UCI: vapowermond.main.voltage_sense_scripts_enable Opt:voltage_sense_scripts_enable	Execute scripts upon detection of power loss/restoration. 0 Disabled Range 0-1
Web field: Voltage On Script UCI: vapowermond.main.voltage_on_script Opt: voltage_on_script	Script to execute on detection of power on. /usr/bin/powermon_voltage_on.sh
Web field: Voltage Off Script UCI: vapowermond.main.voltage_off_script Opt: voltage_off_script	Script to execute on detection of power off. /usr/bin/powermon_voltage_off.sh
Web field: Message Prefix UCI: vapowermond.main.voltage_msg Opt: voltage_msg	Syslog message prefix for messages IgnitionPowerOn, IgnitionPowerOff.

Table 33: Information table for power monitor basic settings

13.2.2 Power monitor advanced settings

Click the **Advance** tab to access advanced settings.

Figure 65: Power monitor advanced settings page

<table>
<tr><th>Web field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web field: Syslog Severity
UCI: vapowermond.main.log_severity
Opt: log_severity</td><td>Specifies the lowest severity to be logged by Power Monitor.
<table>
<tr><td>0</td><td>Emergency</td></tr>
<tr><td>1</td><td>Alert</td></tr>
<tr><td>2</td><td>Critical</td></tr>
<tr><td>3</td><td>Error</td></tr>
<tr><td>4</td><td>Warning</td></tr>
<tr><td>5</td><td>Notice</td></tr>
<tr><td>6</td><td>Informational</td></tr>
<tr><td>7</td><td>Debug</td></tr>
</table></td></tr>
</table>

Table 34: Information table for power monitor advanced settings

13.3 Configuring vapowermond using the command line

13.3.1 UCI

```
root@VA_router:~# uci show vapowermond
vapowermond.main=vapowermond
vapowermond.main.enabled=1
vapowermond.main.timeout=30
vapowermond.main.voltage_sense_scripts_enable=0
vapowermond.main.voltage_on_script=/usr/bin/powermon_voltage_on.sh
vapowermond.main.voltage_off_script=/usr/bin/powermon_voltage_off.sh
vapowermond.main.voltage_msg=powermon
vapowermond.main.log_severity=5
```

13.3.2 Package options

```
root@VA_router:~# uci export vapowermond
package vapowermond

config vapowermond ‘main’
      option enabled ‘1’
      option timeout ‘30’
      option voltage_sense_scripts_enable ‘0’
      option voltage_on_script ‘/usr/bin/powermon_voltage_on.sh’
      option voltage_off_script ‘/usr/bin/powermon_voltage_off.sh’
      option voltage_msg ‘powermon’
      option log_severity ‘5’
```

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13.4 AC power sense diagnostics

13.4.1 Monitoring Vapowermond status using the command line interface

To view status information about the current ignition sense state, enter:

```
root@VA_router:~# cat /sys/devices/platform/gpio-keys-polled/power
0
```

1 for power failure

0 for power good

14 Configuring a WiFi connection

This chapter explains how to configure WiFi on a Virtual Access router using the web interface or via UCI.

WiFi can act as an Access Point (AP) to another device in the network or it can act as a client to an existing AP.

You can configure WiFi in two different ways:

- on a new interface, or
- on an existing interface

14.1 Configuration packages used

Package	Sections
network	wlan_ap wlan_client
wireless	wifi-device wifi-iface

14.2 Configuring a WiFi interface using the web interface

To create a new WiFi interface via the web interface, in the top menu, click **Network -> Wifi**. The Wireless overview page appears.

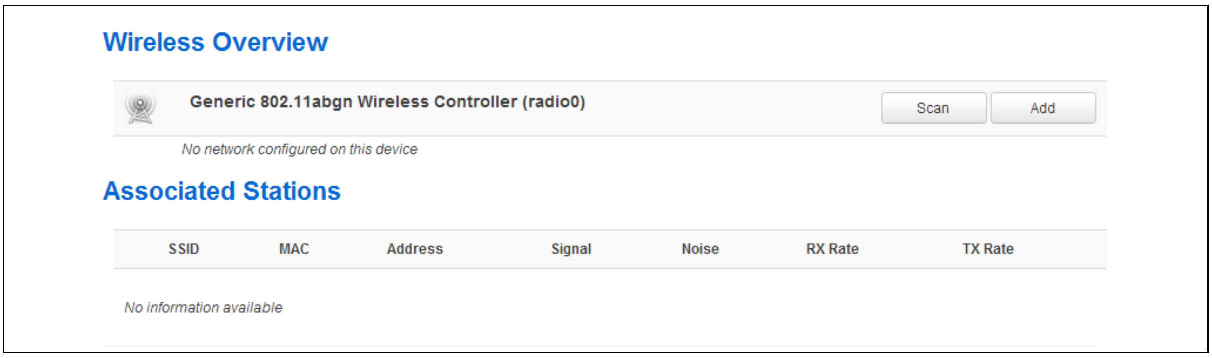

Figure 66: The wireless overview page

Click **Add** to create a new WiFi interface. The Wireless Network configuration page appears. The Wireless Network configuration page consists of two sections:

Section	Description
Device Configuration	Configure physical wireless radio settings such as channel and transmit power settings, HT mode, country code, distance optimisation, fragmentation threshold and RTS/CTS threshold. The settings are shared among all defined wireless networks.
Interface Configuration	Configure network interface settings: interface name, mode, network settings, security and filtering.

14.2.1 Wireless network: device configuration

The Device Configuration section covers physical settings of the radio hardware such as channel, transmit power or antenna selection, which is shared among all defined wireless networks if the radio hardware is multi-SSID capable. There are two sections within the Device Configuration section.

Section	Description
General Setup	Channel and transmit power settings.
Advanced Settings	HT mode, country code, distance optimisation, fragmentation threshold and RTS/CTS threshold.

14.2.1.1 Device configuration: general setup

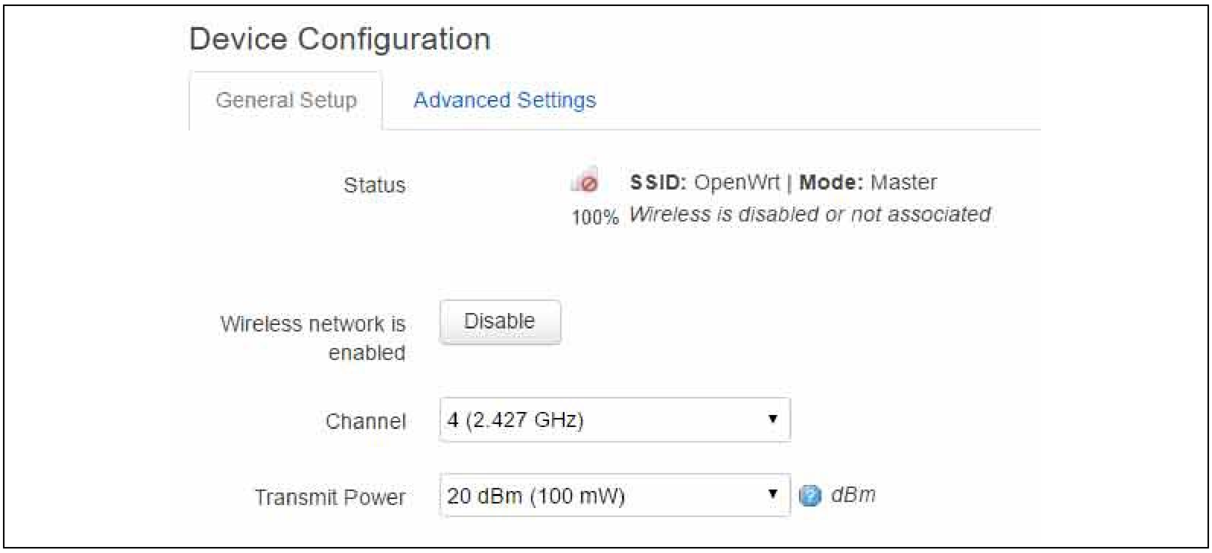

Figure 67: The device configuration general setup section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Wireless network
UCI: wireless.radio0.disabled
Opt: disanabled</td><td>Enables or disables a wireless interface.<table><tr><td>1</td><td>Disables a WiFi interface.</td></tr><tr><td>0</td><td>Enables a WiFi interface.</td></tr></table></td></tr>
<tr><td>Web: Channel
UCI: wireless.radio0.channel
Opt: channel</td><td>Select the channel you require.<table><tr><td>Range</td><td>1-11</td></tr><tr><td>11 (2.462GHz)</td><td></td></tr></table></td></tr>
<tr><td>Web: Transmit power
UCI: wireless.radio0.txpower
Opt: txpower</td><td>Select the transmit power range range you require.<table><tr><td>Range</td><td>0dBm(1mW)-17dBm(50mW)</td></tr><tr><td>17dBM(50mW)</td><td></td></tr></table></td></tr>
</table>

Table 35: Information table for the device configuration section

14.2.1.2 Device configuration: advanced settings

Figure 68: The device configuration advanced settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Mode
UCI: wireless. radio0.hwmode
Opt: hwmode</td><td>Mode options.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Auto</td><td>Wireless protocl negotiate with supplicat device.</td></tr>
<tr><td>802.11b</td><td>Select the wireless protocol to use.</td></tr>
<tr><td>802.11g</td><td>Select the wireless protocol to use.</td></tr>
<tr><td>802.11a</td><td>Select the wireless protocol to use.</td></tr>
<tr><td>802.11g+n</td><td>Select the wireless protocol to use.</td></tr>
<tr><td>802.11a+n</td><td>Select the wireless protocol to use.</td></tr>
</table></td></tr>
<tr><td>Web: HT mode
UCI: wireless.radio0.htmode
Opt: country</td><td>HT mode options.
<table>
<tr><td>20MHz</td><td>Specifies the channel width in 802.11</td></tr>
<tr><td>40MHz 2nd channel below</td><td>Specifies the channel width in 802.11</td></tr>
<tr><td>40MHz 2nd channel above</td><td>Specifies the channel width in 802.11</td></tr>
</table></td></tr>
<tr><td>Web: Country Code
UCI: wireless.radio0.country
Opt: country</td><td>Sets the country code. Use ISO/1EC 3166 alpha2 country codes.</td></tr>
<tr><td>Web: Distance Optimization
UCI: wireless.radio0.distance
Opt: distance</td><td>Defines the distance between the AP and the furthest client in meters
<table>
<tr><td>15</td><td>15 meters</td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Fragmentation Threshold
UCI: wireless.radio0.frag
Opt: frag</td><td>Defines the fragmentation threshold.
<table>
<tr><td>None</td><td>Routers defults applied.</td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: RTS/CTS Threshold
UCI: wireless.radio0.rts
Opt: rts</td><td>Defines the RTS/CTS threshold.
<table>
<tr><td>None</td><td>Router defaults applied.</td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
</table>

Table 36: Information table for device configuration advanced settings

14.2.2 Wireless network: interface configuration

The interface configuration section is used to configure the network and security settings. It has three sub-sections.

Section	Description
General Setup	Identification, network and mode settings.
Wireless Security	Encryption, cipher and key security settings.
MAC Filter	MAC address filter settings.

14.2.2.1 Interface configuration: general setup

Use this section to configure the interface name, mode and network settings. Differing web options may be presented depending on the mode selected.

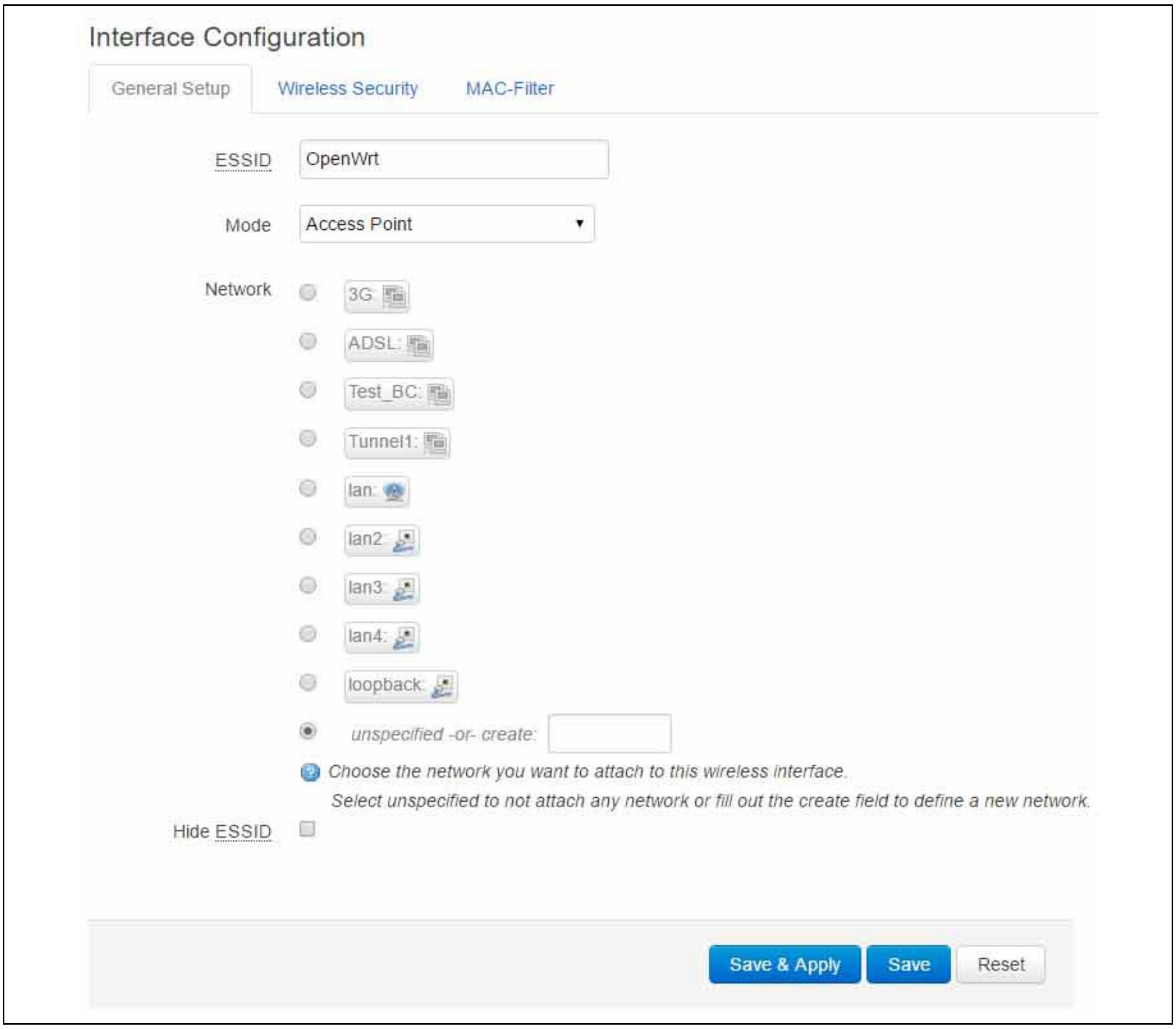

Figure 69: The interface configuration general setup section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: ESSID
UCI: wireless. @wifi-iface[0]..ssid
Opt: ssid</td><td>Extended Service Set Identification. Type the name of the wireless local area network.</td></tr>
<tr><td>Web: Mode
UCI: wireless.@wifi-iface[0].mode
Opt: mode</td><td>Mode type. For AP mode, select Access Point.
<table>
<tr><td>Web value</td><td>UCI</td></tr>
<tr><td>Access Point</td><td>ap</td></tr>
<tr><td>Client</td><td>sta</td></tr>
<tr><td>Ad-Hoc</td><td>adhoc</td></tr>
<tr><td>802.11s</td><td>mesh</td></tr>
<tr><td>Pseudo Ad-Hoc (ah demo)</td><td>ahdemo</td></tr>
<tr><td>Monitor</td><td>monitor</td></tr>
<tr><td>Access Point (WDS)</td><td>ap-wds</td></tr>
<tr><td>Client (WDS)</td><td>sta-wds</td></tr>
</table></td></tr>
<tr><td>Web: Mode
UCI: wireless.@wifi-iface[0].bssid
Opt: bssid</td><td>Defines the BSSID value. Only displayed if using client, ad-hoc or client (wds) modes.</td></tr>
<tr><td>Web: Network
UCI:wireless.@wifi-iface[0].network
Opt: network</td><td>The network the wireless interface is attached to. If using an existing interface select the appropriate network.
Select unspecified to not attach to any network or fill out the create field to define a new network.</td></tr>
<tr><td>Web: Hide ESSID
UCI: wireless.@wifi-iface[0].hidden
Opt: hidden</td><td>Hides the SSID when enabled. Only displayed if using access point or access point (wds) modes.
<table>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
</table></td></tr>
</table>

Table 37: Information table for the interface configuration general setup section

14.2.2.2 Interface configuration: wireless security

Use this section to configure encryption, ciper and create a security key. Differing options will be defined depending on the encryption selected.

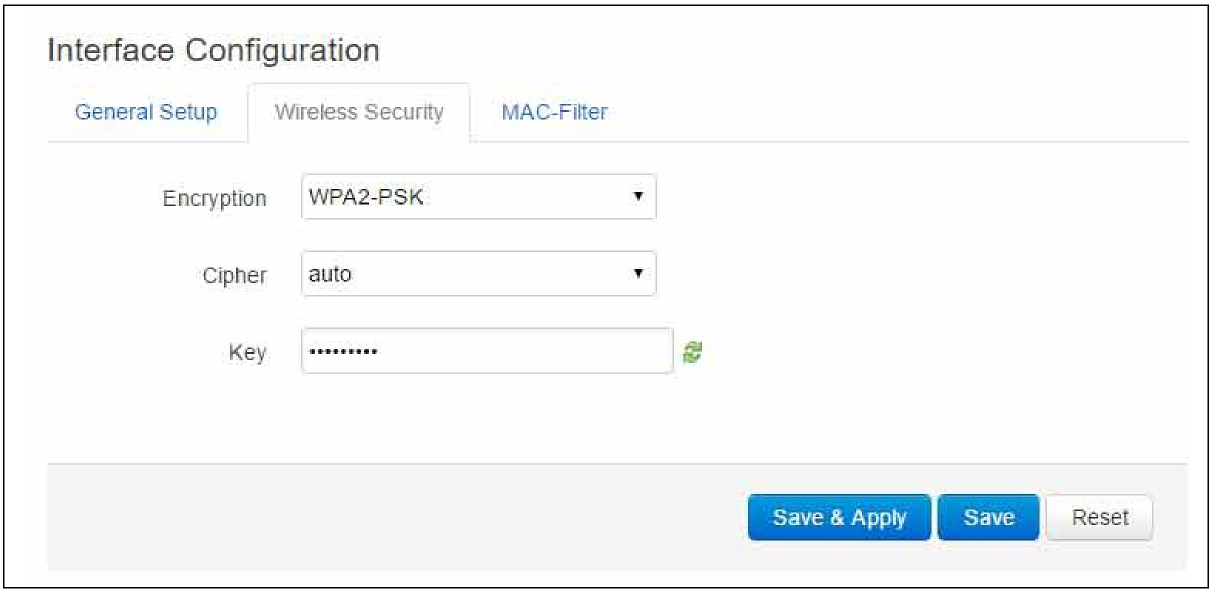

Figure 70: The wireless security section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Encryption
UCI: wireless.@wifi-iface[0].encryption
Opt: encryption</td><td>Method of encryption.
<table>
<tr><th>Web value</th><th>UCI value</th></tr>
<tr><td>No encryption</td><td>none</td></tr>
<tr><td>WEP Open System</td><td>wep-open</td></tr>
<tr><td>WEP Shared Key</td><td>wep-shared</td></tr>
<tr><td>WPA–PSK</td><td>psk</td></tr>
<tr><td>WPA2–PSK</td><td>psk2</td></tr>
<tr><td>WPA-PSK/WPA2-PSK Mixed Mode</td><td>psk-mixed</td></tr>
<tr><td>WPA-EAP</td><td>wpa</td></tr>
<tr><td>WPA2-WAP</td><td>wpa2</td></tr>
</table></td></tr>
<tr><td>Web: Cipher
UCI: wireless.@wifi-iface[0].cipher=
Opt: cipher</td><td>Cipher type. Only displayed if WPA encryption modes are selected.
<table>
<tr><th>Web value</th><th>UCI</th></tr>
<tr><td>Auto</td><td>auto</td></tr>
<tr><td>Force CCMP (AES)</td><td>ccmp</td></tr>
<tr><td>Force TKIP</td><td>tkip</td></tr>
<tr><td>Force TKIP and CCMP</td><td>tkip+ccmp</td></tr>
</table></td></tr>
<tr><td>Web: Key
UCI:wireless.@wifi-iface[0].key
Opt: key</td><td>Specifies the wireless key authentication phrase.</td></tr>
<tr><td>Web: Key #1
UCI:wireless.@wifi-iface[0].key1
Opt: key1</td><td>Specifies the first wireless key authentication phrase.</td></tr>
<tr><td>Web: Key #2
UCI:wireless.@wifi-iface[0].key2
Opt: key2</td><td>Specifies the second wireless key authentication phrase.</td></tr>
<tr><td>Web: Key #3
UCI:wireless.@wifi-iface[0].key3
Opt: key3</td><td>Specifies the third wireless key authentication phrase.</td></tr>
<tr><td>Web: Key #4
UCI:wireless.@wifi-iface[0].key4
Opt: key4</td><td>Specifies the fourth wireless key authentication phrase.</td></tr>
<tr><td>Web: Radius Authentication-Server
UCI:wireless.@wifi-iface[0].auth_serverOpt: auth server</td><td>Defines the radius server for EAP authentication.</td></tr>
<tr><td>Web: Radius Authentication-Port
UCI:wireless.@wifi-iface[0].auth_port
Opt: auth_port</td><td>Defines the radius server port for EAP authentication.</td></tr>
<tr><td>Web: Radius Authentication-Secret
UCI:wireless.@wifi-iface[0].auth_secret
Opt: auth_secret</td><td>Defines the radius server secret for EAP authentication.</td></tr>
<tr><td>Web: Radius Accounting-Server
UCI:wireless.@wifi-iface[0].acct_server
Opt: acct_server</td><td>Defines the radius server for EAP accounting.</td></tr>
<tr><td>Web: Radius Accounting -Port
UCI:wireless.@wifi-iface[0].acct_port
Opt: acc_port</td><td>Defines the radius port for EAP accounting.</td></tr>
<tr><td>Web: Radius Accounting -Secret
UCI:wireless.@wifi-iface[0].acct_secret
Opt: acct_secret</td><td>Defines the radius secret for EAP accounting.</td></tr>
</table>

Web: NAS ID UCI:wireless.@wifi-iface[0].nasid Opt: nasid	Defines the NAS ID for the wireless interface.

Table 38: Information table for the interface configuration wireless security section

14.2.2.3 Interface configuration: MAC filter

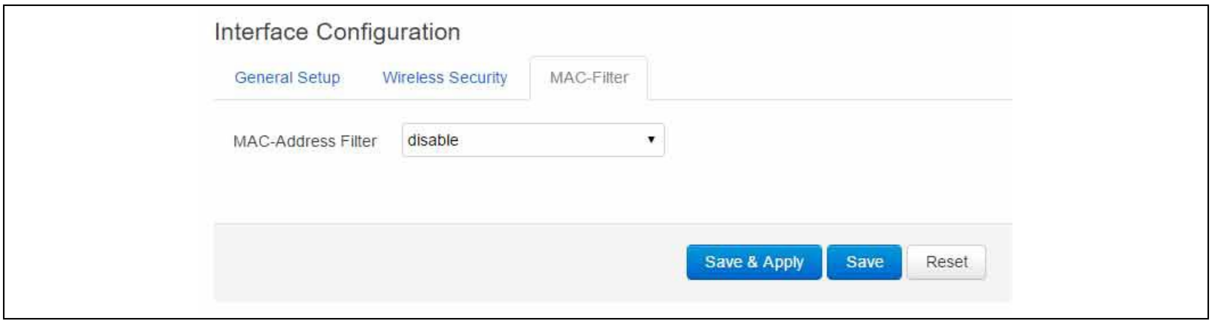

Figure 71: The MAC filter section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: MAC-Address Filter
UCI: wireless.@wifi-iface[0].macfilter
Opt: macfilter</td><td>MAC address filtering process.
<table>
<tr><th>Option</th><th>Description</th><th>UCI</th></tr>
<tr><td>Disable</td><td>Disables MAC Address filter.</td><td>disable</td></tr>
<tr><td>Allow listed only</td><td>Allows only the MAC address listed in the text field.</td><td>allow</td></tr>
<tr><td>Allow all except listed</td><td>Allows everything but the MAC address listed in the text field.</td><td>deny</td></tr>
</table></td></tr>
<tr><td>Web: MAC -List
UCI: wireless.@wifi-iface[0].maclist
Opt: list maclist</td><td>Defines the MAC addresses to use. Multiple MAC address should be separated by a space if using UCI. MAC must be in the format hh:hh:hh:hh:hh:hh</td></tr>
</table>

Table 39: Information table for interface configuration MAC filter section

14.3 Configuring WiFi in AP mode

AP mode is when the router's WiFi is used as an access point to one of the router's other interfaces. For example, if a router is connected to the internet via 3G, the WiFi on the router can be used as an access point for other devices to connect to the router and use its 3G internet connection.

14.3.1 AP mode on a new interface

Configure the WiFi network in AP mode as described in the above section 'Configuring a WiFi interface', selecting a new interface for the wireless network in the Interface Configuration section.

Next, in the top menu, select **Network -> Interfaces**. The Interface Overview page appears.

In the Interface Overview page, click **Edit** on the newly created WiFi interface. Then configure the interface by following instructions in the chapter 'Configuring an Ethernet interface'. When you have completed those steps, continue with the section below.

14.3.2 AP mode on an existing Ethernet interface

Configure the WiFi network in AP mode as described in the above section 'Configuring a WiFi interface'.

Next, in the top menu, select **Network -> Interfaces**. The Interface Overview page appears.

In the Interface Overview page, click **Edit** on the Ethernet interface that will be bridged into the router's WiFi AP. The Common Configuration page appears. It has four sections.

This configuration only uses the Physical Settings section. Click the **Physical Settings** tab.

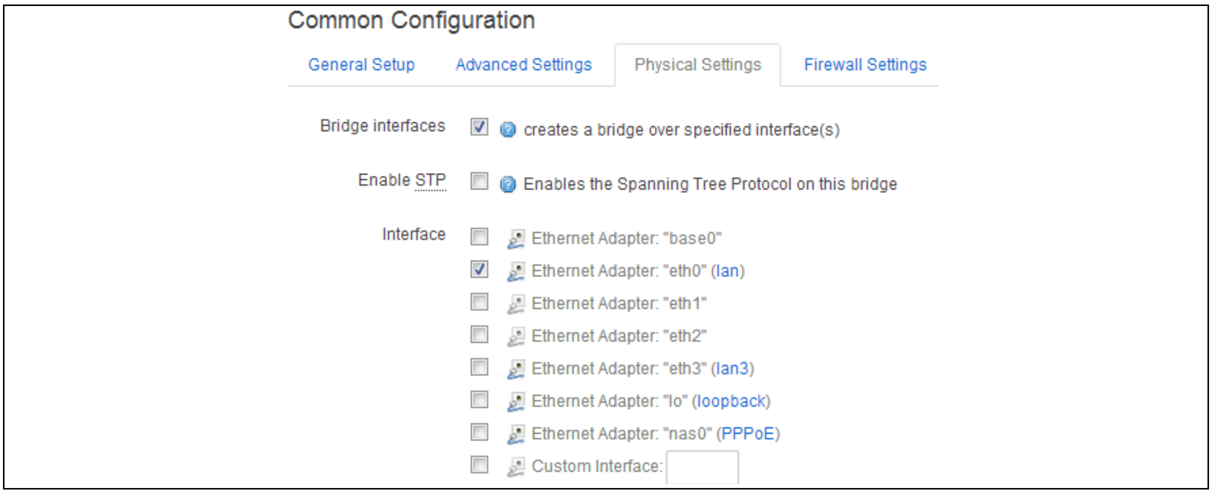

Figure 72: The physical settings section in the common configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Bridge Interfaces
UCI: network.lan.type
Opt: Type</td><td>Creates a bridge over the specified interface.<table><tr><td>Empty</td><td></td></tr><tr><td>Bridge</td><td>Configures a bridge over multiple interfaces.</td></tr></table></td></tr>
<tr><td>Web: Enable STP
UCI: network.lan.stp
Opt: stp</td><td>Enables the Spanning Tree Protocol on this bridge.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Interface
UCI: network.lan.ifname
Opt:ifname</td><td>Select the physical interfaces to bridge. If mapping multiple interfaces for bridging, the interface names are separated by a space when using UCI and package options.
Example:
<code>option ifname 'eth2 eth3' or network.<if name>.ifname=eth2 eth 3</code></td></tr>
</table>

Table 40: Information table for the physical section on the common configuration page

14.4 Configuring WiFi using UCI

The configuration files are stored on:

- Network file /etc/config/network
- Wireless file /etc/config/wireless

14.4.1 AP modem on a new Ethernet interface using package options

```
root@VA_router:~# uci export network
package network
config interface 'newwifilan'
        option proto 'static'
        option ipaddr '192.168.111.1'
        option netmask '255.255.255.0'
root@VA_router:~# uci export wireless
package wireless
config wifi-device 'radio0'
        option type 'mac80211'
        option channel '11'
        option phy 'phy0'
        option hwmode '11ng'
        option htmode 'HT20'

list ht_capab 'SHORT-GI-40'
        list ht_capab 'TX-STBC'
        list ht_capab 'RX-STBC1'
        list ht_capab 'DSSS_CCK-40'
        option txpower '17'
        option country 'US'
config wifi-iface
        option device 'radio0'
        option mode 'ap'
        option disabled '1'
        option ssid 'Test_AP'
        option network 'newwifilan'
        option encryption 'psk'
        option key 'secretkey'
```

14.4.2 AP modem on a new Ethernet interface using UCI

```
root@VA_router:~# uci show network
network.newlan=interface
network.newlan.proto=static
network.newlan.ipaddr=192.168.111.1
network.newlan.netmask=255.255.255.0
root@VA_router:~# uci show wireless
wireless.radio0=wifi-device
wireless.radio0.type=mac80211
wireless.radio0.channel=11
wireless.radio0.phy=phy0
wireless.radio0.hwmode=11ng
wireless.radio0.htmode=HT20
wireless.radio0.ht_capab=SHORT-GI-40 TX-STBC RX-STBC1 DSSS_CCK-40
wireless.radio0.txpower=17
wireless.radio0.country=US
wireless.@wifi-iface[0]=wifi-iface
wireless.@wifi-iface[0].device=radio0
wireless.@wifi-iface[0].mode=ap
wireless.@wifi-iface[0].disabled=1
wireless.@wifi-iface[0].ssid=Test_AP
wireless.@wifi-iface[0].network=newlan
wireless.@wifi-iface[0].encryption=psk
wireless.@wifi-iface[0].key=secretkey
```

14.4.3 AP mode on an existing Ethernet interface using packages options

```
root@VA_router:~# uci export network
package network
config interface 'lan'
        option ifname 'eth0'
        option proto 'static'
        option ipaddr '192.168.100.1'
        option netmask '255.255.255.0'
        option type 'bridge'
root@VA_router:~# uci export wireless
package wireless
```

```
config wifi-device 'radio0'
        option type 'mac80211'
        option channel '11'
        option phy 'phy0'
        option hwmode '11ng'
        option htmode 'HT20'
        list ht_capab 'SHORT-GI-40'
        list ht_capab 'TX-STBC'
        list ht_capab 'RX-STBC1'
        list ht_capab 'DSSS_CCK-40'
        option txpower '17'
        option country 'US'

config wifi-iface
        option device 'radio0'
        option mode 'ap'
        option disabled '1'
        option ssid 'Test_AP'
        option network 'lan'
        option encryption 'psk'
        option key 'secretkey'
```

14.4.4 AP mode on an existing Ethernet interface using UCI

```
root@VA_router:~# uci show network
network.lan=interface
network.lan.ifname=eth0
network.lan.proto=static
network.lan.ipaddr=192.168.6.1
network.lan.netmask=255.255.255.0
network.lan.type=bridge
root@VA_router:~# uci show wireless
wireless.radio0=wifi-device
wireless.radio0.type=mac80211
wireless.radio0.channel=11
wireless.radio0.phy=phy0
wireless.radio0.hwmode=11ng
```

```
wireless.radio0.htmode=HT20
wireless.radio0.ht_capab=SHORT-GI-40 TX-STBC RX-STBC1 DSSS_CCK-40
wireless.radio0.txpower=17
wireless.radio0.country=US
wireless.@wifi-iface[0]=wifi-iface
wireless.@wifi-iface[0].device=radio0
wireless.@wifi-iface[0].mode=ap
wireless.@wifi-iface[0].disabled=1
wireless.@wifi-iface[0].ssid=Test_AP
wireless.@wifi-iface[0].network=lan
wireless.@wifi-iface[0].encryption=psk
wireless.@wifi-iface[0].key=secretkey
```

14.5 Creating a WiFi interface in client mode using the web interface

A WiFi network in Client mode receives a wireless network from another WiFi AP.

Configure the Wifi network in Client mode as described in the above section 'Configuring a WiFi interface', selecting a new interface for the Wireless Network in the Interface Configuration section. For the examples below the new WiFi interface will be called 'newwifiClient'

Example:

```
wireless.@wifi-iface[0].network=newwifiClient
wireless.@wifi-iface[0].mode=sta
```

In the top menu, select **Network -> Interfaces**. The Interfaces Overview page appears. Click **Edit** in the newly created WiFi Client interface. The Common Configuration page appears.

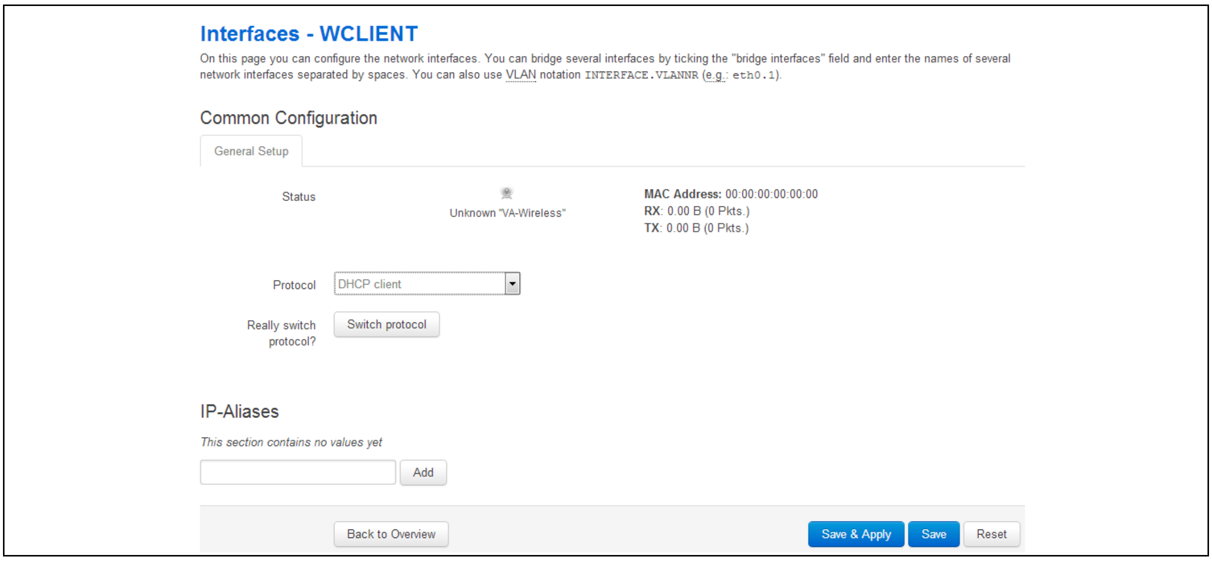

Figure 73: The client interface page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Protocol
UCI: network. newwifiClient.proto
Opt: proto</td><td>Specifies what protocol the interface will operate on. Select DHCP Client.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
</table>

Table 41: Information table for interfaces WClient page

When you have clicked **Save and Apply**, the router will restart the network package. It may take up to one minute for connectivity to the router to be restored.

14.6 Configuring WiFi in client mode using command line

The configuration files are stored on:

- Network file /etc/config/network
- Wireless file /etc/config/wireless

14.6.1 Client modem using package options

```
root@VA_router:~# uci export network
package network
config interface ' newwifiClient '
        option proto 'dhcp'
root@VA_router:~# uci export wireless
package wireless
config wifi-device 'radio0'
        option type 'mac80211'
        option channel '11'
        option phy 'phy0'
        option hwmode '11ng'
        option htmode 'HT20'
        list ht_capab 'SHORT-GI-40'
```

```
        list ht_capab 'TX-STBC'
        list ht_capab 'RX-STBC1'
        list ht_capab 'DSSS_CCK-40'
        option txpower '17'
        option country 'US'

config wifi-iface
        option device 'radio0'
        option ssid 'Remote-AP'
        option mode 'sta'
        option network ' newwifiClient '
        option encryption 'psk2'
        option key 'testtest'
```

14.6.2 Client modem using UCI

```
root@VA_router:~# uci show network
network.new=interface
network.WCLIENT.proto=dhcp
```

14.6.2.1 uci show wireless

```
root@VA_router:~# uci show wireless
wireless.radio0=wifi-device
wireless.radio0.type=mac80211
wireless.radio0.channel=11
wireless.radio0.phy=phy0
wireless.radio0.hwmode=11ng
wireless.radio0.htmode=HT20
wireless.radio0.ht_capab=SHORT-GI-40 TX-STBC RX-STBC1 DSSS_CCK-40
wireless.radio0.txpower=17
wireless.radio0.country=US
wireless.@wifi-iface[0]=wifi-iface
wireless.@wifi-iface[0].device=radio0
wireless.@wifi-iface[0].ssid=Remote-AP
wireless.@wifi-iface[0].mode=sta
wireless.@wifi-iface[0].network= newwifiClient
wireless.@wifi-iface[0].encryption=psk2
wireless.@wifi-iface[0].key=testtest
```

15 Configuring a mobile connection

15.1 Configuration package used

Package	Sections
network	interface

15.2 Configuring a mobile connection using the web interface

Note: if you are creating multiple mobile interfaces, simply repeat the steps in this chapter for each interface. Multiple interfaces are required for dual SIM or multiple radio module scenarios. Configuring static routes and/or Multi-WAN can be used to manage these interfaces.

In the top menu, select **Network -> Interfaces**. The Interfaces Overview page appears.

15.2.1 Create a new mobile interface

To create a new mobile interface, in the Interface Overview section, click **Add new interface**. The Create Interface page appears. In the examples below, 3G has been used for the interface name.

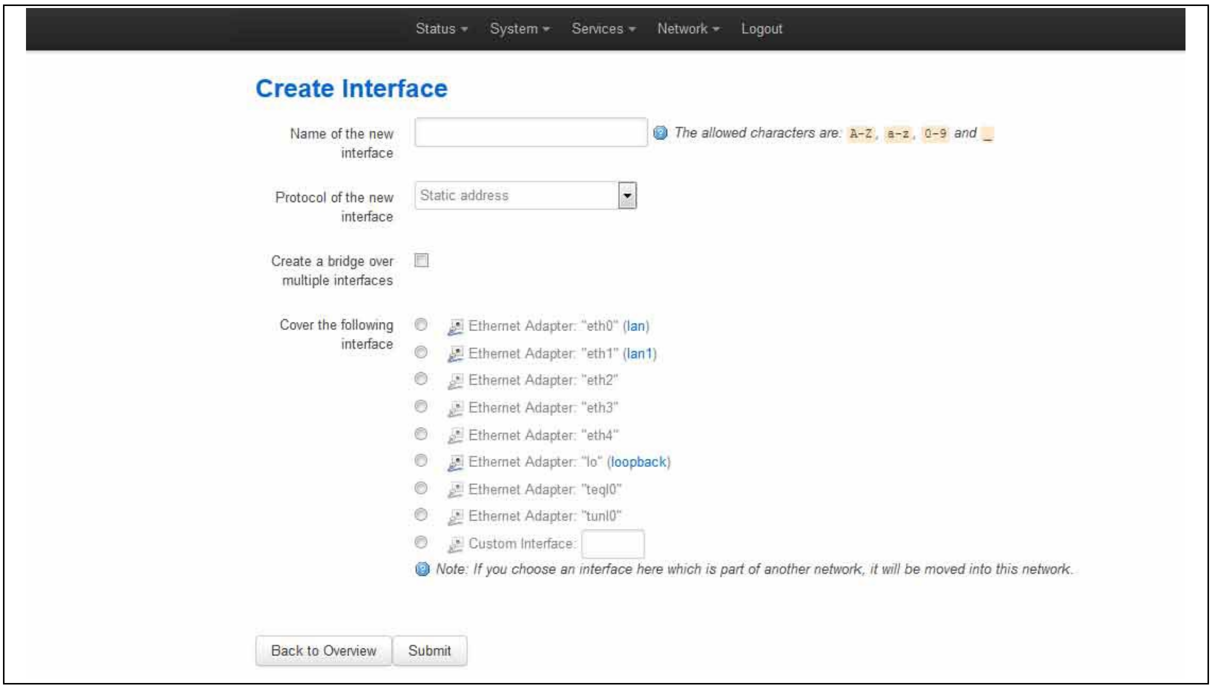

Figure 74: The create interface page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name of the new interface
UCI: network.3G=interface
Opt: interface</td><td>Allowed characters are A-Z, a-z, 0-9 and _</td></tr>
<tr><td>Web: Protocol of the new interface
UCI: network.3G.proto
Opt: proto</td><td>Protocol type. Select LTE/UMTS/GPRS/EV-DO.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4</td><td></td></tr>
<tr><td>IPv6-over-IPv4</td><td></td></tr>
<tr><td>GRE</td><td></td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol.</td></tr>
<tr><td>PPP</td><td></td></tr>
<tr><td>PPPoE</td><td></td></tr>
<tr><td>PPPoATM</td><td></td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
<tr><td>Web: Create a bridge over multiple interfaces
UCI: network.3G.type
Opt: type</td><td>Enables bridge between two interfaces.
Not relevant when configuring a mobile interface.
<table>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
</table></td></tr>
<tr><td>Web: Cover the following interface
UCI: network.3G.ifname
Opt: ifname</td><td>Select interfaces for bridge connection.
Not relevant when configuring a mobile interface.</td></tr>
</table>

Table 42: Information table for the create interface page

Click **Submit**. The Common Configuration page appears. There are three sections in the mobile interface common configurations.

Section	Description
General Setup	Configure the basic interface settings such as protocol, service type, APN information, user name and password.
Advanced Settings	Set up more in-depth features such as initialisation timeout, LCP echo failure thresholds and inactivity timeouts.
Firewall settings	Assign a firewall zone to the connection.

15.2.1.1 Mobile interface: general setup

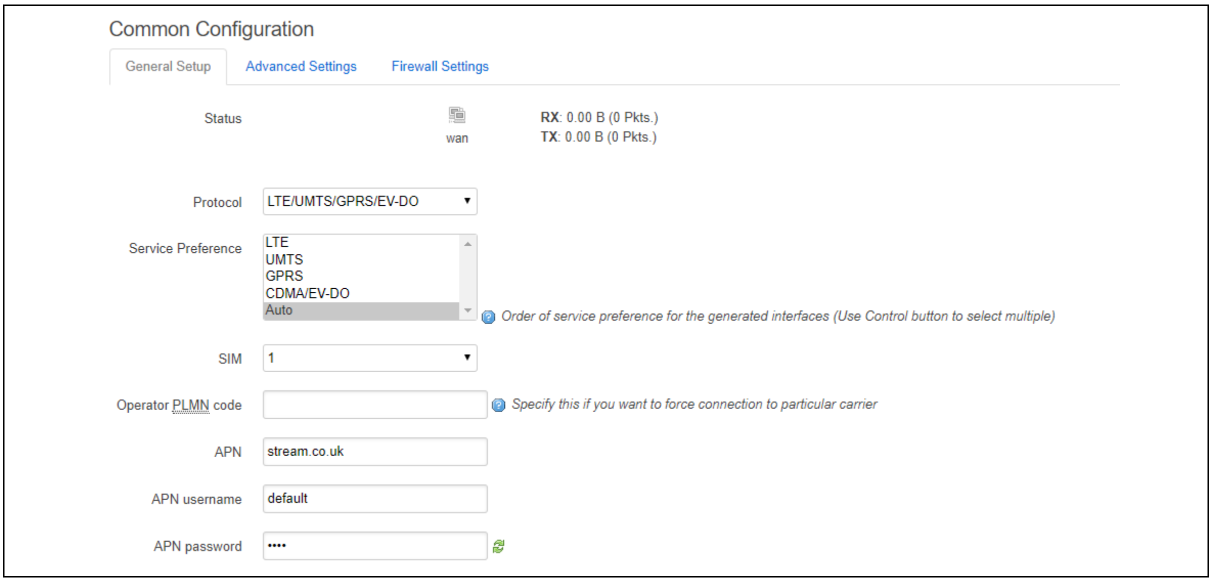

Figure 75: The common configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Status
UCI: n/a
Opt: n/a</td><td>Shows the status of the interface.</td></tr>
<tr><td>Web: Protocol
UCI: network.3G.proto
Opt: proto</td><td>Protocol type. Select LTE/UMTS/GPRS/EV-DO.
<table>
<tr><th>Web</th><th>Description</th><th>UCI</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td><td>static</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td><td>dhcp</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td><td>none</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td><td></td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td><td></td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td><td>gre</td></tr>
<tr><td>IOT</td><td>IOT</td><td>iot</td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td><td>l2tp</td></tr>
<tr><td>L2TPv3</td><td>L2TPv3 Tunnelling Protocol</td><td>l2tpv3</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol</td><td>ppp</td></tr>
<tr><td>PPtP</td><td>Point to Point Tunnelling Protocol</td><td>pptp</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td><td>pppoe</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td><td>pppoa</td></tr>
<tr><td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td><td>3g</td></tr>
<tr><td>PPP(PSTN-Modem)</td><td>PPP v90 modem</td><td>pppmodem</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Web: service Preference
UCI: network.3G.service_order
Opt: service_order</td><td>Defines a space separated list of services, in preferred order. Valid options are <code>gprs, umts, lte, auto</code>.
If no valid_service order is defined, then the configured Service Type is used. Example:
<code>network.3G.service_order=”gprs umts lte auto”</code><table><tr><td>Blank</td><td>Use configured service type.</td></tr><tr><td>Range</td><td>gprs umts lte auto</td></tr></table></td></tr>
<tr><td>Web: Operator PLMN code
UCI: network.3G.operator
Opt: operator</td><td>Specifies an operator PLMN code to force the connection to a particular network operator. The PLMN code is identified as a combination of the MCC and the MNC.
Note: the operator option is used in conjunction with the operator format option <code>option opformat</code> which is used to define how the operator string is parsed. If configuring via the web GUI, the opformat is automatically set to ‘2’ to indicate it is a PLMN code.
See below for alternative options for the operator format option.</td></tr>
<tr><td>Web: n/a
UCI: network.3G.opformat
Opt: opformat</td><td>Defines the operator format. We recommended you use a PLMN code.
The operator is case sensitive so if using long or short character format it must match the operator exactly.
To see the current operator using SSH enter the command: <code>cat /var/state/mobile</code> or using the web mobile stats page at Status -> Mobile Stats.<table><tr><td>0</td><td>Long character format</td></tr><tr><td>1</td><td>Short character format</td></tr><tr><td>2</td><td>PLMN code</td></tr></table></td></tr>
<tr><td>Web: SIM
UCI: network.3G.sim
Opt: sim</td><td>Defines which SIM is used on this interface.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Auto</td><td>automatically detect</td><td>any</td></tr><tr><td>1</td><td>SIM 1</td><td>1</td></tr><tr><td>2</td><td>SIM 2</td><td>2</td></tr></table></td></tr>
<tr><td>Web: APN
UCI: network.3G.apn
Opt: apn</td><td>APN name of Mobile Network Operator.</td></tr>
<tr><td>Web: APN username
UCI: network.3G.username
Opt: username</td><td>Username used to connect to APN.</td></tr>
<tr><td>Web: APN password
UCI: network.3G.password
Opt: password</td><td>Password used to connect to APN.</td></tr>
<tr><td>Web: n/a
UCI: network.3G.retry_interval_sec
Opt: retry_interval_sec</td><td>Specifies the interval in seconds between connection attempts.<table><tr><td>60</td><td>Retry connection after 60 seconds.</td></tr><tr><td>1-infinite</td><td>Attempt to connect again after specified interval.</td></tr><tr><td>Range</td><td>Attempt to connect within specified range. The exact interval is calculated randomly from specified range.
Example:
<code>uci set network.3G.retry_interval_sec=’60 180’</code></td></tr></table></td></tr>
</table>

Table 43: Information table for common configuration settings

The Modem Configuration link at the bottom of the page is used for SIM pin code and SMS configuration. For more information, read the chapter ‘Configuring mobile manager’.

15.2.1.2 Mobile interface: advanced settings

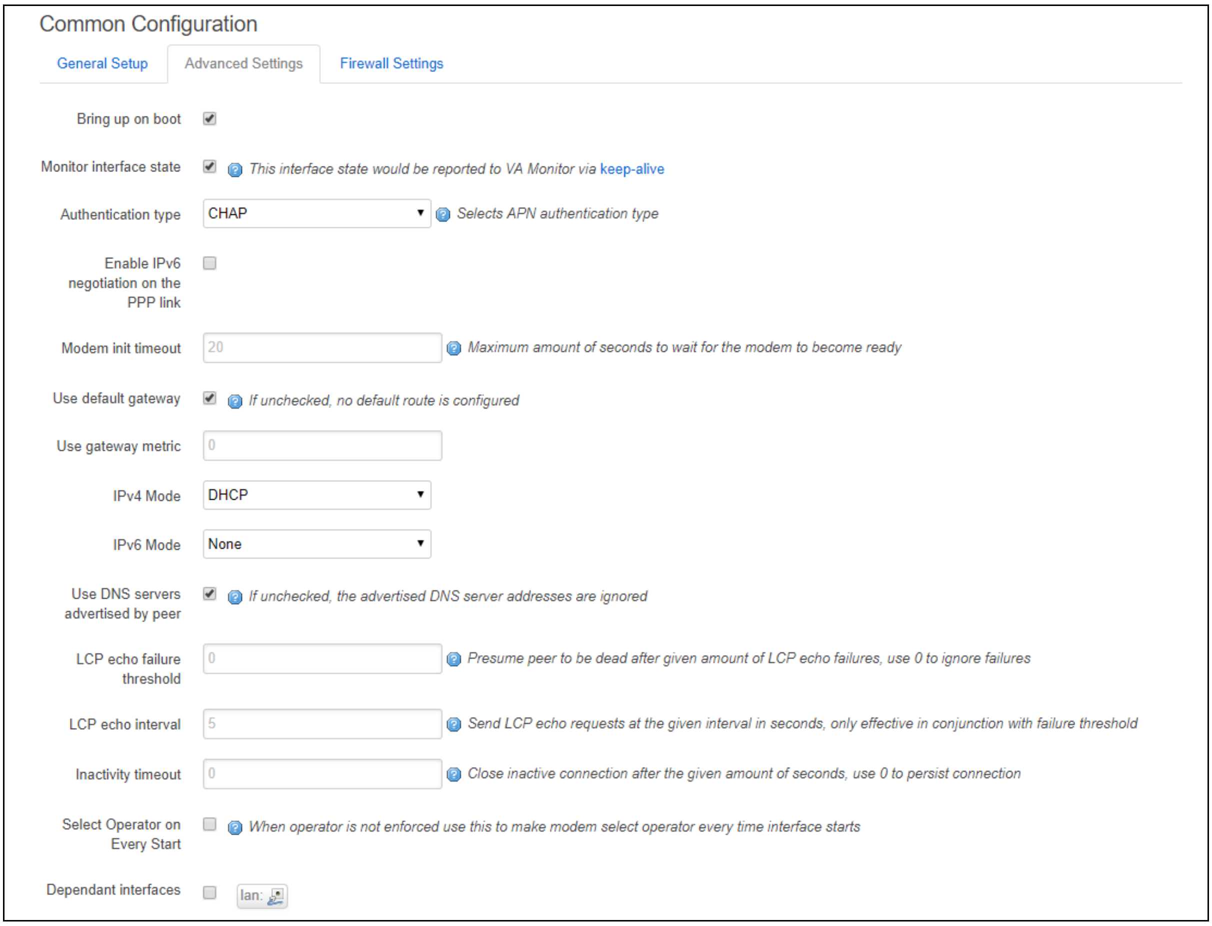

Figure 76: The advanced settings tab

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web:Bring up on boot
UCI: network.3G.auto
Opt: auto</td><td>Enables the interface to connect automatically on boot up or reconnect automatically when disconnected.</td></tr>
<tr><td>Web: Monitor interface state
UCI: network.3G.monitored
Opt: monitored</td><td>Enabled if status of interface is presented on monitoring platform.<table><tr><td>0</td><td>Does not monitor interface.</td></tr><tr><td>1</td><td>Monitor interface.</td></tr></table></td></tr>
<tr><td>Web: Authentication Type
UCI: network.3G.auth
Opt: auth</td><td>Selects the APN authentication mechanism.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>CHAP</td><td>CHAP authentication</td><td>2</td></tr><tr><td>PAP</td><td>PAP authentication</td><td>1</td></tr></table></td></tr>
<tr><td>Web: Enable IPv4 negotiation on the interface
UCI: network.3G.ipv4
Opt: ipv4</td><td>Enables IPv4 on the interface.<table><tr><td>0</td><td>IPv4 disabled.</td></tr><tr><td>1</td><td>IPv4 enabled.</td></tr></table></td></tr>
<tr><td>Web: Enable IPv6 negotiation on the interface
UCI: network.3G.ipv6
Opt: ipv6</td><td>Enables IPv6 on the interface.<table><tr><td>0</td><td>IPv6 disabled.</td></tr><tr><td>1</td><td>IPv6 enabled.</td></tr></table></td></tr>
</table>

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<table>
<tr><td>Web: Modem int timeout
UCI: network.3G.maxwait
Opt: maxwait</td><td>Maximum number of seconds to wait for the modem to become ready.<table><tr><td>20</td><td>Seconds</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Use default gateway
UCI: network.3G.defaultroute
Opt: defaultroute</td><td>Enables this interface as a default route.<table><tr><td>0</td><td>Do not use as a default route.</td></tr><tr><td>1</td><td>Use as a default route.</td></tr></table></td></tr>
<tr><td>Web: Use gateway metric
UCI: network.3G.metric
Opt: metric</td><td>Defines the metric for the default route. Lower number metrics are used first when the route is up.<table><tr><td>0</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: IPv4 Mode
UCI: network.3G.ipv4mode
Opt: ipv4mode</td><td>Defines the IPv4 address assignment approach for mobile interfaces in Ethernet Mode.
Note: by default, mobile interfaces are in Ethernet mode.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>None</td><td>No dynamic assignment.</td><td>none</td></tr><tr><td>DHCP</td><td>DHCP address assignment.</td><td>dhcp</td></tr></table></td></tr>
<tr><td>Web: IPv6 Mode
UCI: network.3G.ipv6mode
Opt: ipv6mode</td><td>Defines the IPv6 address assignment approach for mobile interfaces in Ethernet Mode.
Note: by default, mobile interfaces are in Ethernet mode.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>None</td><td>No dynamic assignment.</td><td>none</td></tr><tr><td>DHCPv6</td><td>DHCP address assignment.</td><td>dhcp</td></tr><tr><td>RA</td><td>Router Advertisement (RA) assignment.</td><td>ra</td></tr><tr><td>DHCPv6 after RA</td><td>Wait for RA then start DHCP.</td><td>ra_then_dhcp</td></tr></table></td></tr>
<tr><td>Web: Use DNS servers advertised by peer
UCI: network.3G.peerdns
Opt: peerdns</td><td>If unchecked, the advertised DNS server addresses are ignored.<table><tr><td>0</td><td>Use static DNS.</td></tr><tr><td>1</td><td>Use advertised DNS.</td></tr></table></td></tr>
<tr><td>Web: Use custom DNS servers
UCI: network.3G.dns
Opt: dns</td><td>Specifies DNS server. Only available if Use DNS servers advertised by peer is unselected. When multiple DNS servers are required separate using space for UCI or option value.
Example:
<code>uci set network.3G.dns='1.1.1.1 2.2.2.2'</code></td></tr>
<tr><td>Web: LCP echo failure threshold
UCI: network.3G.keepalive
Opt: keepalive</td><td>Presumes peer to be dead after a given amount of LCP echo failures, use 0 to ignore failures.
This command is used in conjunction with the LCP echo interval. The syntax is as follows:
<code>uci network.3G.keepalive=<echo failure threshold> <echo interval></code>
Example:
<code>uci set network.3G.keepalive='15 10'</code><table><tr><td>5</td><td>PPP peer dead after 5 failures</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: LCP echo interval
UCI: network.3G.keepalive
Opt: keepalive</td><td>Send LCP echo requests at the given interval in seconds, only effective in conjunction with failure
This command is used in conjunction with the LCP echo failure threshold. The syntax is as follows:
<code>uci network.3G.keepalive=<echo failure threshold> <echo interval></code>
Example:
<code>uci set network.3G.keepalive='15 10'</code><table><tr><td>1</td><td>LCP echo request every 1 second</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

<table>
<tr><td>Web: Inactivity timeout
UCI: network.3G.demand
Opt: demand</td><td>Closes an inactive connection after the given amount of seconds. Use 0 to persist connection.<table><tr><td>0</td><td>Do not disconnect on inactivity.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Select Operator on Every Start
UCI: network.3G.operator_reselect
Opt: operator_reselect</td><td>Defines whether to force the modem to run operator selection (with AT+COPS=0 command) on every interface restart.<table><tr><td>0</td><td>Operator selection will not happen on interface restart.</td></tr><tr><td>1</td><td>Force modem to run operator selection on every interface restart.</td></tr></table></td></tr>
<tr><td>Web: Dependant Interfaces
UCI: network.3G.dependants
Opt: dependants</td><td>Lists interfaces that are dependent on this parent interface. Dependant interfaces will go down when the parent interface is down and will start or restart when the parent interface starts.
Separate multiple interfaces by a space when using UCI. Example: <code>option dependants ‘PPPADSL MOBILE’</code>
This replaces the following previous options in child interfaces.<table><tr><td>gre</td><td>option local_interface</td></tr><tr><td>lt2p</td><td>option src_ipaddr</td></tr><tr><td>iot</td><td>option wan1 wan2</td></tr><tr><td>6in4</td><td>option ipaddr</td></tr><tr><td>6to4</td><td>option ipaddr</td></tr></table></td></tr>
<tr><td>Web: SNMP Alias ifindex
UCI: network.[..x..].snmp_alias_ifindex
Opt: snmp_alias_ifindex</td><td>Defines a static SNMP interface alias index for this interface that can be polled via the SNMP interface index. (<code>snmp_alias_ifindex+1000</code>). For more information, read the chapter ‘Configuring SNMP’.<table><tr><td>Blank</td><td>No SNMP interface alias index.</td></tr><tr><td>Range</td><td>0 - 4294966295</td></tr></table></td></tr>
<tr><td>Web: VRF
UCI: network.3G.vrf
Opt: vrf</td><td>Defines VRF for this interface.<table><tr><td>blank</td><td>No VFR.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 44: Information table for general set up page

15.2.1.3 Mobile interface: firewall settings

Use this section to select the firewall zone you want to assign to the interface.

Select **unspecified** to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.

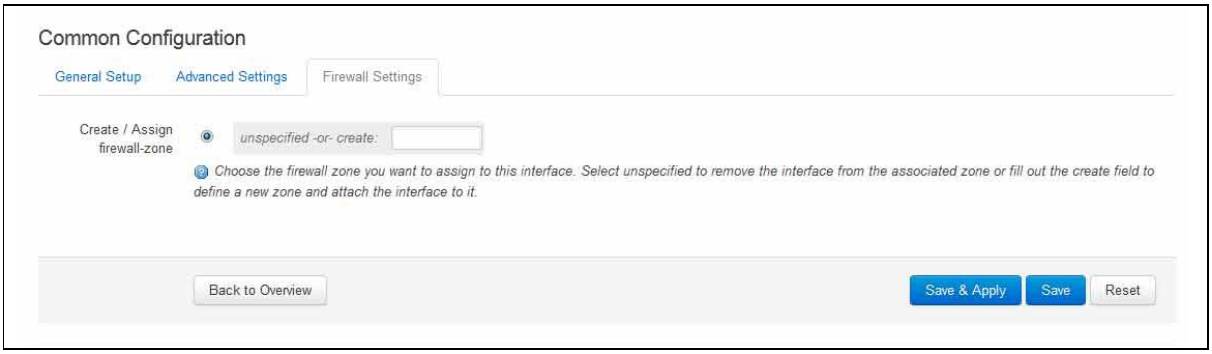

Figure 77: Firewall settings page

15.3 Configuring a mobile connection using CLI

15.3.1 UCI

To establish a basic mobile connection, enter:

```
root@VA_router:~# uci show network
network.3G=interface
network.3G.proto=3g
network.3G.monitored=0
network.3G.sim=any
network.3G.auto=1
network.3G.defaultroute=1
network.3G.metric=1
network.3G.service_order=auto lte umts gprs
network.3G.apn=test.apn
network.3G.username=username
network.3G.password=password
network.3G.ipv4mode=dhcp
network.3G.ipv6mode=none
network.3G.keepalive='5 1'
network.3G.operator_reselect=0
network.3G.auth=2
```

15.3.2 Package options

```
root@VA_router:~#
package network

config interface '3G'
	option proto '3g'
	option monitored '0'
	option auto '1'
	option sim 'any'
	option defaultroute '1'
	option metric '1'
	option service_order 'auto lte umts gprs'
	option apn 'test.apn'
	option username 'username'
```

```
option password 'password'
option ipv4mode ‘dhcp’
option ipv6mode ‘none’
option keepalive ’15 10’
option operator_reselect ‘0’
option auth ‘2’
```

15.4 Diagnositcs

Note: the information presented on screen and data output using UCI depends on the actual mobile hardware being used. Therefore, the interfaces or output you see may differ from the samples shown here.

15.4.1 Mobile status via the web

To view mobile connectivity information, in the top menu, select **Status -> Mobile Information**. The Mobile Information page appears. The information presented depends on the actual mobile hardware used; therefore, it might differ from the samples shown here.

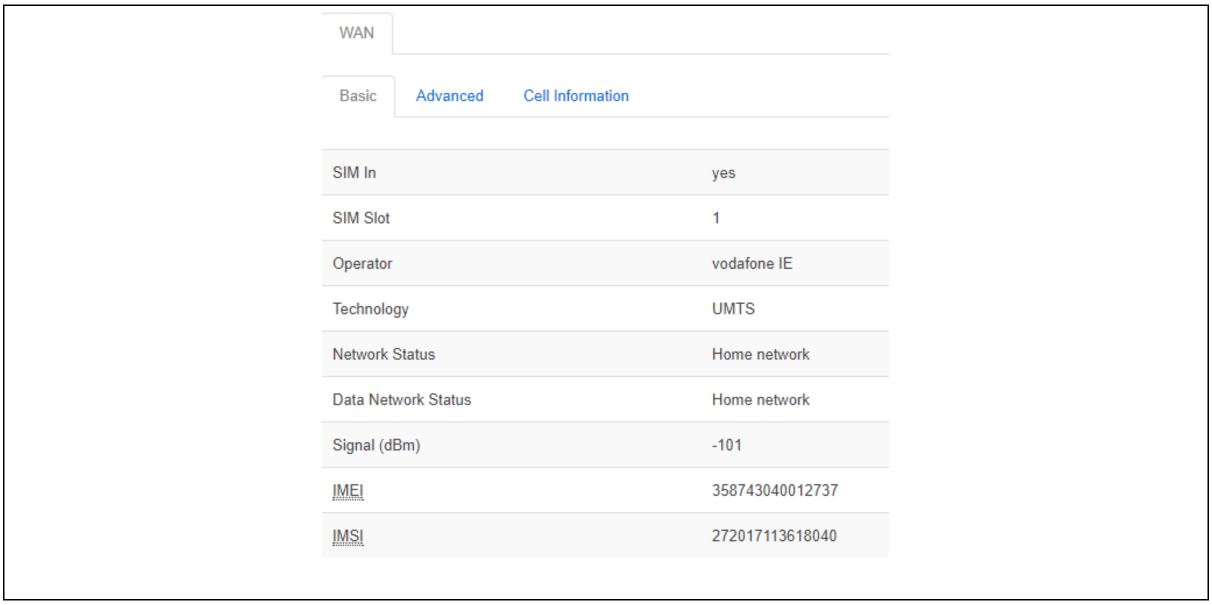

Figure 78: The mobile information page

WAN

Basic | Advanced | Cell Information

Network Status	Home network
Data Network Status	Home network
IMEI	358743040012737
IMSI	272017113618040
Operator	vodafone IE
Phone Number	+353874512040
SIM In	yes
SIM Slot	1
SIM1 ICCID	8935301140701270414
Signal (dBm)	-101
Technology	UMTS
Temperature (C)	28
Hardware Revision	R1C08

Figure 79: The advanced information page

WAN

Basic | Advanced | Cell Information

Cell ID	2007516
Location Area Code	3023
Mobile Country Code	272
Mobile Network Code	01

Figure 80: The cell information page

15.4.2 Mobile status using UCI

To display information and status of mobile interfaces such as 3G, 4G or CDMA, enter:

```
root@VA_router:~# mobile_status


Mobile Interface     : WAN
Status               : idle
SIM In               : yes
SIM Slot             : 1
Operator             : vodafone IE
Technology           : UMTS
CS Network Status    : Home network
PS Network Status    : Home network
Signal (dBm)         : -107
IMEI                 : 358743040012737
IMSI                 : 272017113618040
```

For more advanced information, enter:

```
root@ VA_router:~# mobile_status -a


Mobile Interface     : WAN
Status               : idle
CS Network Status    : Home network
PS Network Status    : Home network
IMEI                 : 358743040012737
IMSI                 : 272017113618040
Operator             : vodafone IE
Phone Number         : +353874512040
SIM In               : yes
SIM Slot             : 1
SIM1 ICCID           : 89353011407012704l4
Signal (dBm)         : -107
Technology           : UMTS
Temperature (C)      : 28
Hardware Revision    : R1C0
```

15.4.3 Mobile operator scan

To perform and display results of an operator scan, enter:

```
root@VA_router:~# mobile_operators -s
Starting operator search on phy 3-1.1 (may take some time)
Operator search finished
ICCID                   Status     MCC/MNC  Name             Service
8945020184544181234     Current    27201    SimService       LTE UMTS
8945020184544181234     Available  27203    IRL - METEOR     GSM UMTS LTE
8945020184544181234     Available  27202    3                UMTS
8945020184544181234     Available  27205    3                LTE
```

15.4.4 Restarting mobile

To restart all instances of vamobile on the system, enter:

```
root@ VA_router:~# /etc/init.d/usb_start_up restartmobile
usb_startup: Restarting va-mobile on PHY 1-1
```

16 Configuring mobile manager

The Mobile Manager feature allows you to configure SIM settings.

16.1 Configuration package used

Package	Sections
mobile	main
	callers
	roaming_template

16.2 Configuring mobile manager using the web interface

Select **Services -> Mobile Manager**. The Mobile Manager page appears.

There are four sections in the mobile manager page:

Section	Description
Basic	Enable SMS, configure SIM pin code and select roaming SIM.
Advanced	Configure advanced options such as collect ICCIDs and temperature polling interval.
LTE	LTE-specific settings
CDMA*	CDMA configuration.
Callers	Configure callers that can use SMS.
Roaming Interface Template	Configure Preferred Roaming List options.
*Option available only for CDMA modules.	

16.2.1 Mobile manager: basic settings

Figure 81: The mobile manager basic page

Web Field/UCI/Package Option	Description	
Web: SMS Enable UCI: mobile.main.sms Opt: sms	Enables or disables SMS functionality.	
	0	Disabled.
	1	Enabled.
Web: PIN code for SIM1 UCI: mobile.main.sim1pin Opt: sim1pin	Depending on the SIM card specify the pin code for SIM 1.	
	Blank	
	Range	Depends on the SIM provider.
Web: PIN code for SIM2 UCI: mobile.main.sim2pin Opt: sim2pin	Depending on the SIM card specify the pin code for SIM 2.	
	Blank	
	Range	Depends on the SIM provider.

Table 45: Information table for mobile manager basic settings

16.2.2 Mobile manager: advanced settings

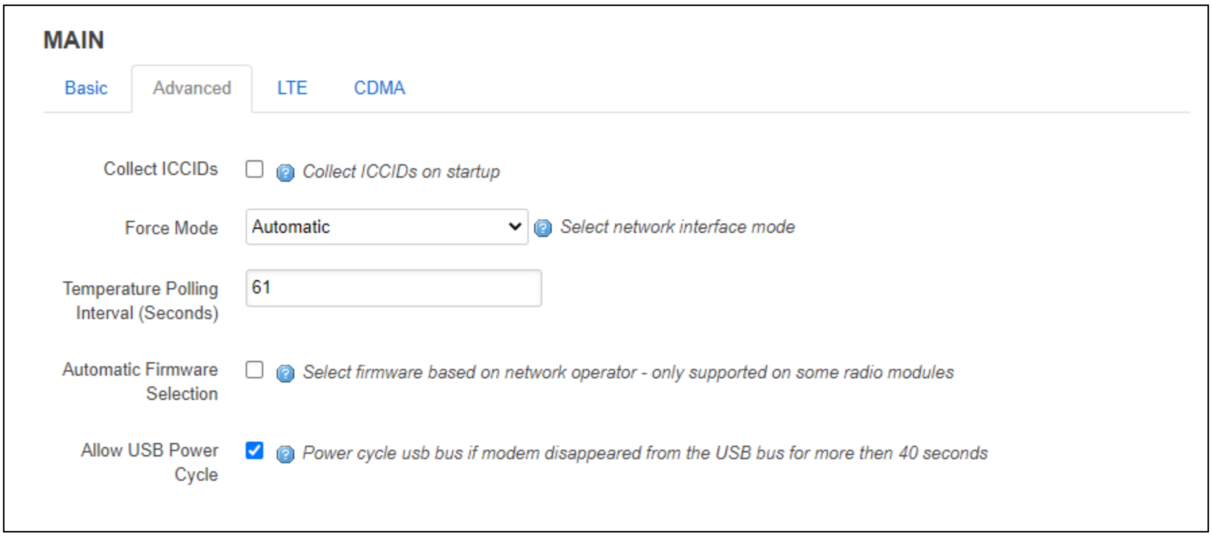

Figure 82: The mobile manager advanced page

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<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Collect ICCIDs
UCI: mobile.main.init_get_iccids
Opt: init_get_iccids</td><td>Enables or disables integrated circuit card identifier ICCIDs collection functionality. If enabled, then both SIM 1 and SIM 2 ICCIDs will be collected; otherwise it will default to SIM 1. This will be displayed under mobile stats.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Force Mode
UCI: mobile.main.force_mode
Opt: force_mode</td><td>Defines whether to operate mobile modem in PPP or Ethernet mode. The mode will be dependent on the service provided by the mobile provider. In general, this is Ethernet mode (default).
Note: It should not be necessary to force PPP mode – contact Virtual Access support for advice.<table><tr><th>Web</th><th>UCI</th><th>Description</th></tr><tr><td>Automatic</td><td></td><td>Ethernet mode (option not present).</td></tr><tr><td>PPP</td><td>tty</td><td>Enable PPP mode.</td></tr></table></td></tr>
<tr><td>Web: Temperature Polling Interval
UCI: mobile.main.temp_poll_interval_sec
Opt: temp_poll_interval_sec</td><td>Defines the time in seconds to poll the mobile module for temperature. Set to 0 to disable.<table><tr><td>61</td><td>61 seconds.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Automatic Firmware Selection
UCI: mobile.main.enable_firmware_autoselect
Opt: enable_firmware_autoselect</td><td>Enables the selection of an operator-specific firmware in the radio module. The selection is based on the ICCID of the used SIM. At module initialisation the IMSI is checked and if necessary, the correct firmware image in the module will be activated.
Note: activation of the firmware will lead to a delayed startup of the network interface associated with the radio module.
Note: this feature is currently only supported for the Telit LE910NA V2 module. Here Verizon-specific firmware will be selected if the ICCID starts with “891480”.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Allow USB Power Cycle
UCI: mobile.main.allow_usb_powercycle
Opt: allow_usb_powercycle</td><td>Defines whether to automatically power cycle the USB modem if a mobile module is not detected for 40 seconds.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

Table 46: Information table for mobile manager advanced settings

16.2.3 Mobile manager: LTE settings

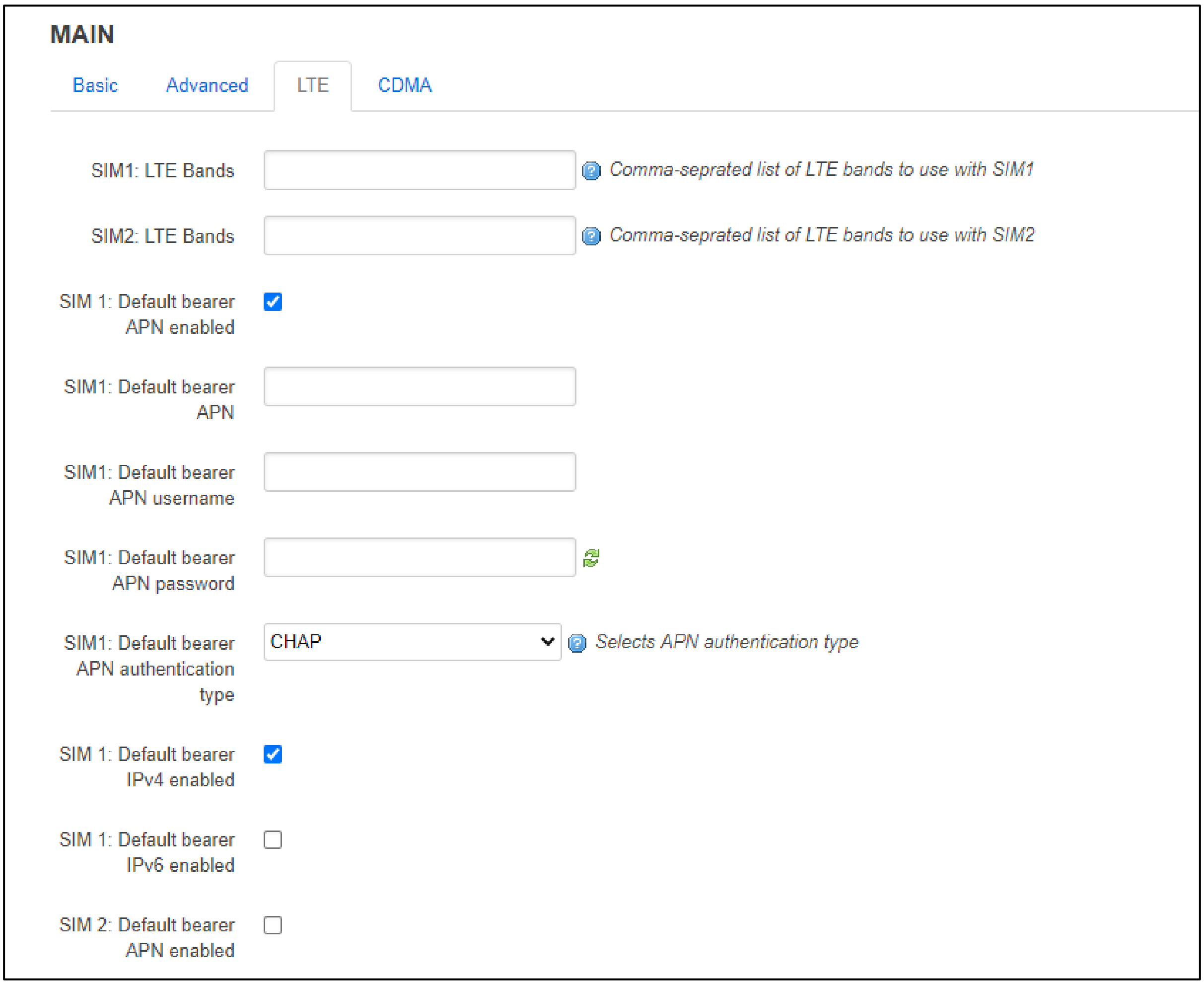

Figure 83: Mobile manager: LTE settings page

Web Field/UCI/Package Option	Description
Web: SIM1: LTE bands UCI: mobile.main.sim1_lte_bands Opt: sim1_lte_bands	Depending on the SIM card, specify the LTE bands for SIM 1. Comma delimiter. Example: `option sim1_lte_bands '3,20'` Limits LTE bands to 3 and 20. **Note**: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200, Asiatel and Quectel radio modules Blank: Range: LTE bands range from 1 to 70.
Web: SIM2: LTE bands UCI: mobile.main.sim2_lte_bands Opt:sim2_lte_bands	Depending on the SIM card, specify the LTE bands for SIM 2. Comma delimiter. Example: `option sim2_lte_bands '3,20'` Limits LTE bands to 3 and 20. **Note**: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200, Asiatel and Quectel radio modules Blank: Range: LTE bands range from 1 to 70.
Web: SIM1: Default bearer APN enabled UCI: mobile.main.sim1_lte_default_apn_enabled Opt: sim1_lte_default_apn_enabled	Enables the use of a specific LTE attach bearer. 0: Disabled. 1: Enabled.
Web: SIM1: Default bearer APN UCI: mobile.main.sim1_lte_default_apn Opt: sim1_lte_default_apn	Specifies the LTE attach bearer APN.
Web: SIM1: Default bearer APN username UCI: mobile.main.sim1_lte_default_apn_username Opt: sim1_lte_default_apn_username	Username for authentication with attach bearer APN.
Web: SIM1: Default bearer APN password UCI: mobile.main.sim1_lte_default_apn_password Opt: sim1_lte_default_apn_password	Password for authentication with attach bearer APN.
Web: SIM1: Default bearer APN authentication type UCI: mobile.main.sim1_lte_default_apn_password Opt: sim1_lte_default_apn_password	Selects the APN authentication mechanism. **Web** / **Description** / **UCI** CHAP / CHAP authentication / 2 PAP / PAP authentication / 1
Web: SIM1: Default bearer IPv4 enabled UCI: mobile.main.sim1_lte_default_apn_ipv4 Opt: sim1_lte_default_apn_ipv4	Enables IPv4 for the attach bearer. 0: IPv4 disabled 1: IPv4 enabled.
Web: SIM1: Default bearer IPv6 enabled UCI: mobile.main.sim1_lte_default_apn_ipv6 Opt: sim1_lte_default_apn_ipv6	Enables IPv6 for the attach bearer. 0: IPv6 disabled 1: IPv6 enabled.
Web: SIM2: Default bearer APN enabled UCI: mobile.main.sim2_lte_default_apn_enabled Opt: sim2_lte_default_apn_enabled	Enables the use of a specific LTE attach bearer. 0: Disabled. 1: Enabled.

<table>
<tr><td>Web: SIM2: Default bearer APN
UCI: mobile.main.sim2_lte_default_apn
Opt: sim2_lte_default_apn</td><td>Specifies the LTE attach bearer APN.</td></tr>
<tr><td>Web: SIM2: Default bearer APN username
UCI: mobile.main.sim2_lte_default_apn_username
Opt: sim2_lte_default_apn_username</td><td>Username for authentication with attach bearer APN.</td></tr>
<tr><td>Web: SIM2: Default bearer APN password
UCI: mobile.main.sim2_lte_default_apn_password
Opt: sim2_lte_default_apn_password</td><td>Password for authentication with attach bearer APN.</td></tr>
<tr><td>Web: SIM2: Default bearer APN authentication type
UCI: mobile.main.sim2_lte_default_apn_password
Opt: sim2_lte_default_apn_password</td><td>Selects the APN authentication mechanism.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>CHAP</td><td>CHAP authentication</td><td>2</td></tr><tr><td>PAP</td><td>PAP authentication</td><td>1</td></tr></table></td></tr>
<tr><td>Web: SIM2: Default bearer IPv4 enabled
UCI: mobile.main.sim2_lte_default_apn_ipv4
Opt: sim2_lte_default_apn_ipv4</td><td>Enables IPv4 for the attach bearer.<table><tr><td>0</td><td>IPv4 disabled</td></tr><tr><td>1</td><td>IPv4 enabled.</td></tr></table></td></tr>
<tr><td>Web: SIM2: Default bearer IPv6 enabled
UCI: mobile.main.sim2_lte_default_apn_ipv6
Opt: sim2_lte_default_apn_ipv6</td><td>Enables IPv6 for the attach bearer.<table><tr><td>0</td><td>IPv6 disabled</td></tr><tr><td>1</td><td>IPv6 enabled.</td></tr></table></td></tr>
</table>

Table 47: LTE-specific settings

16.2.4 Mobile manager: CDMA settings

This configuration page is only supported for CDMA modules.

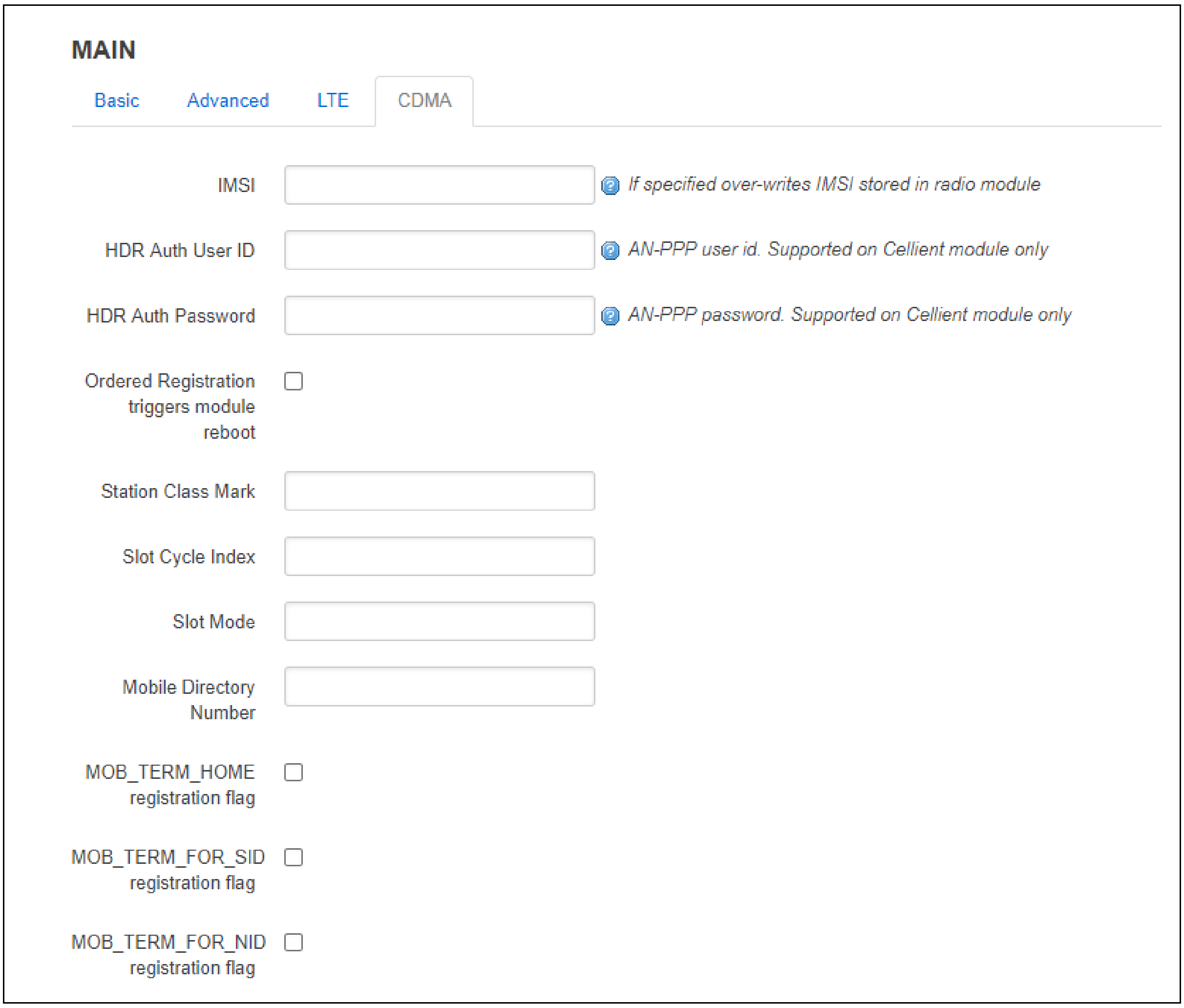

Figure 84: The mobile manager CDMA page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: IMSI
UCI: mobile.main.imsi
Opt: imsi</td><td>Allows the IMSI (International Mobile Subscriber Identity) to be changed.<table><tr><td>Default</td><td>Programmed in module.</td></tr><tr><td>Digits</td><td>Up to 15 digits.</td></tr></table></td></tr>
<tr><td>Web: HDR Auth User ID
UCI: mobile.main.hdr_userid
Opt: hdr_userid</td><td>AN-PPP user ID. Supported on Cellient CDMA modem only.<table><tr><td>Blank</td><td></td></tr><tr><td>Range</td><td>Depends on the CDMA provider.</td></tr></table></td></tr>
<tr><td>Web: HDR Auth User Password
UCI: mobile.main.hdr_password
Opt: hdr_password</td><td>AN-PPP password. Supported on Cellient CDMA modem only.<table><tr><td>Blank</td><td></td></tr><tr><td>Range</td><td>Depends on the CDMA provider.</td></tr></table></td></tr>
<tr><td>Web: Ordered Registration triggers module reboot
UCI: mobile.main. mobile.main.cdma_ordered_registration_reboot_ enabled
Opt: cdma_ordered_registration_reboot_enabled</td><td>Enables or disables rebooting the module after the order registration command is received from a network.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

Web: Station Class Mark UCI: mobile.main.cdma_station_class_mark Opt: cdma_station_class_mark	Allows the station class mark for the MS to be changed. 58 0-255
Web: Slot Cycle Index UCI: mobile.main.cdma_slot_cycle_index Opt: cdma_slot_cycle_index	Defines the desired slot cycle index if different from the default. 2 0-7
Web: Slot Mode UCI: mobile.main.cdma_slot_mode Opt: cdma_slot_mode	Specifies the slot mode. 0
Web: Mobile Directory Number UCI: mobile.main.cdma_mobile_directory_number Opt: cdma_mobile_directory_number	Allows the mobile directory number (MDN) to be changed. Default: Programmed in module. Digits: Up to 15 digits.
Web: MOB_TERM_HOME registration flag UCI: mobile.main. cdma_mob_term_home_registration_flag Opt: cdma_mob_term_home_registration_flag	The MOB_TERM_HOME registration flag. 0: Disabled. 1: Enabled.
Web: MOB_TERM_FOR_SID registration flag UCI: mobile.main. cdma_mob_term_for_sid_registration_flag Opt: cdma_mob_term_for_sid_registration_flag	The MOB_TERM_FOR_SID registration flag. 0: Disabled. 1: Enabled.
Web: MOB_TERM_FOR_NID registration flag UCI: mobile.main. cdma_mob_term_for_nid_registration_flag Opt: cdma_mob_term_for_nid_registration_flag	The MOB_TERM_FOR_NID registration flag. 0: Disabled. 1: Enabled.
Web: Access Overload Control UCI: mobile.main.cdma_access_overload_control Opt: cdma_access_overload_control	Allows the access overload class to be changed. Default: Programmed into module as part of IMSI. Range: 0-7
Web: Preferred Serving System UCI: mobile.main.cdma_preferred_serving_system Opt: cdma_preferred_serving_system	The CDMA Preferred Serving System(A/B). 5
Web: Digital Analog Mode Preference UCI: cdma_digital_analog_mode_preference Opt: cdma_digital_analog_mode_preference	Digital/analog mode preference. 4
Web: Primary Channel A UCI: mobile.main.cdma_primary_channel_a Opt: cdma_primary_channel_a.	Allows the primary channel (A) to be changed. 283 1-2016: Any band class 5 channel number.
Web: Primary Channel B UCI: mobile.main.cdma_primary_channel_b Opt: cdma_primary_channel_b	Allows the primary channel (B) to be changed. 384 1-2016: Any band class 5 channel number.
Web: Secondary Channel A UCI: mobile.main.cdma_secondary_channel_a Opt: cdma_secondary_channel_a	Allows the secondary channel (A) to be changed. 691 1-2016: Any band class 5 channel number.
Web: Secondary Channel B UCI: mobile.main.cdma_secondary_channel_b Opt: cdma_secondary_channel_b	Allows the secondary channel (B) to be changed. 777 1-2016: Any band class 5 channel number.
Web: Preferred Forward & Reverse RC UCI: mobile.main.cdma_preferred_forward_and_reverse_rc Opt: cdma_preferred_forward_and_reverse_rc	The preferred forward & reverse RC value, this takes the form "forward_rc,reverse_rc" 0,0 Format: forward radio channel, reverse radio channel

<table>
<tr><td>Web: SID-NID pairs
UCI: mobile.main.cdma_sid_nid_pairs
Opt:cdma_sid_nid_pairs</td><td>Allows specification of SID:NID pairs, this takes the form "SID1,NID1,SID2,NID2,<table><tr><td>0,0</td><td></td></tr><tr><td>Format</td><td></td></tr></table></td></tr>
</table>

Table 48: Information table for mobile manager CDMA settings

16.2.5 Mobile manager: callers

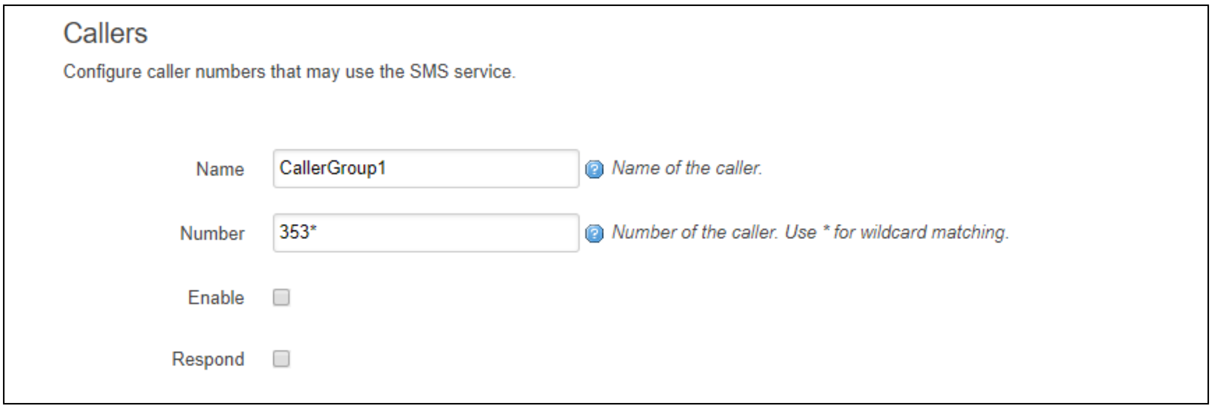

Figure 85: The mobile manager CDMA page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name
UCI: mobile.@caller[0].name
Opt:name</td><td>Name assigned to the caller.<table><tr><td>Blank</td><td></td></tr><tr><td>Range</td><td>No limit.</td></tr></table></td></tr>
<tr><td>Web: Number
UCI: mobile.@caller[0].number
Opt:number</td><td>Number of the caller allowed to SMS the router. Add in specific caller numbers, or use the * wildcard symbol.<table><tr><td>Blank</td><td></td></tr><tr><td>Range</td><td>No limit.</td></tr><tr><td>Characters</td><td>Global value (*) is accepted.
International value (+) is accepted.</td></tr></table></td></tr>
<tr><td>Web: Enable
UCI: mobile.@caller[0].enabled
Opt:enabled</td><td>Enables or disables incoming caller ID.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Respond
UCI: mobile.@caller[0].respond
Opt: respond</td><td>If checked, the router will return an SMS. Select Respond if you want the router to reply.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

Table 49: Information table for mobile manager callers settings

16.2.6 Mobile manager: roaming interface template

For more information on Roaming Interface Template configuration, read the chapter, ‘Automatic Operator Selection’.

16.3 Configuring mobile manager using command line

16.3.1 Mobile manager using UCI

The configuration files for mobile manager are stored on **/etc/config/mobile**

The following example shows how to enable the SMS functionality to receive and respond from certain caller ID numbers.

```
root@VA_router:~# uci show mobile
uci set mobile.main=mobile
uci set mobile.main.sim1pin=0000
uci set mobile.main.sim2pin=0000
uci set mobile.main.sim1_lte_bands='3,20'
uci set mobile.main.sim2_lte_bands='4,5'
uci set mobile.main.temp_poll_interval_sec=61
uci set mobile.main.enable_firmware_autoselect=0
uci set mobile.main.allow_usb_powercycle=1
uci set mobile.main.roaming_sim=none
uci set mobile.main.sms=1
uci set mobile.main.hdr_password=5678
uci set mobile.main.hdr_userid=1234
uci set mobile.main.init_get_iccids=1
uci set mobile.@caller[0]=caller
uci set mobile.@caller[0].name=user1
uci set mobile.@caller[0].number=3538712345678
uci set mobile.@caller[0].enabled=1
uci set mobile.@caller[0].respond=1
uci set mobile.@caller[1]=caller
uci set mobile.@caller[1].name=user2
uci set mobile.@caller[1].number=3538723456789
uci set mobile.@caller[1].enabled=1
uci set mobile.@caller[1].respond=1
```

16.3.2 Mobile manager using package options

```
root@VA_router:~# uci export mobile
package mobile
config mobile 'main'
        option sim1pin '0000'
```

```
        option sim2pin '0000'
        option roaming_sim 'none'
        option sms '1'
        option hdr_password '5678'
        option hdr_userid '1234'
        option init_get_iccids '1'
        option sim1_lte_bands '3,20'
        option sim2_lte_bands '4,5'
        option temp_poll_interval_sec '61'
        option enable_firmware_autoselect '0'
        option allow_usb_powercycle '1'

config caller
        option name 'vasupport'
        option number '353871234567'
        option enabled '1'
        option respond '1'

config caller
        option name 'vasupport1'
        option number '353872345678'
        option enabled '1'
        option respond '1'
```

16.4 Monitoring SMS

You can monitor inbound SMS messages using the router's web browser or via an SSH session.

To monitor SMS using the web browser, login and select **Status > system log**.

Scroll to the bottom of the log to view the SMS message.

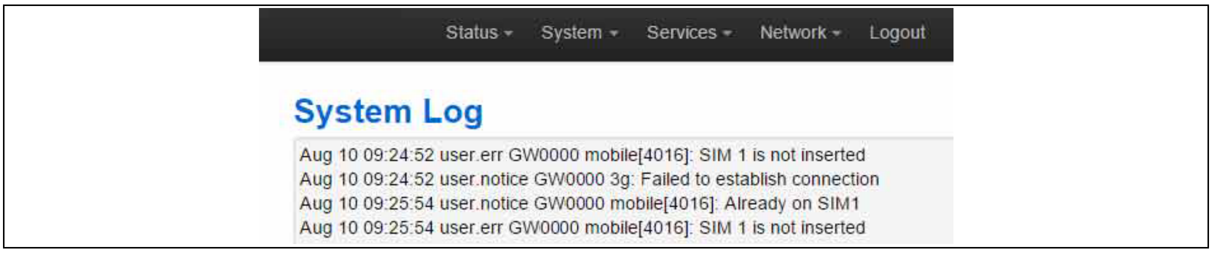

Figure 86: Example of output from system log

To monitor using SSH, login and enter:

```
logread –f &
```

Or, when logging system messages to a flash file at `/root/syslog.messages`

```
tail –f /root/syslog.messages &
```

16.5 Sending SMS from the router

You can send an outgoing message via the command line using the following syntax:

```
sendsms 353879876543 ‘hello’
root@VirtualAccess:~# Aug 10 16:29:1 user.notice VirtualAccess
mobile[1737]: Queue sms to 353879876543 "hello"
```

16.6 Sending SMS to the router

The router can accept UCI show and set commands via SMS if the caller is enabled.

Note: commands are case sensitive.

An example would be to SMS the SIM card number by typing the following command on the phone and checking the SMS received from the router.

```
uci show mobile.@caller[0].number
```

Multiple commands can be sent in a single SMS using a semicolon (;) separator; for example, to set the router to factory config and then reboot.

```
vacmd set next config factconf;reboot
```

17 Configuring multi-APNs for mobile interfaces

The GW1000M, GW1150, GW1400, GW2300 and GW6650 Series routers support simultaneous multiple APN connections to be connected using a single SIM card. Up to two APNs per SIM are currently supported.

Support for this feature is limited to specific mobile modules.

17.1 Supported mobile modules

Vendor	Module
Quectel	Quectel EC25
SIMCOM	SIMCOM7600E-H

17.2 Multi-APN overview

A PDP (Packet Data Protocol) context is a data structure that exists within the mobile service provider's network that contains a subscriber's session information when the subscriber has an active session. The PDP context data structure contains:

- the subscriber's IP address,
- IMSI (International Mobile Subscriber Identity), and
- APN (Access Point Name).

It is sometimes required to connect to two different APNs at the same time. This can be achieved with a single SIM card using separate PDP contexts.

Note: the SIM card must allow connection to each of the APNs. Also, two PDP contexts from the same SIM card cannot use the same APN.

You can use routing and VRF support for each PDP context by referring to the unique interface name that the APN is configured under. Routing and VRF support can be utilised for each PDP context. For more information on these features, read chapters 'Configuring Static Routes' and 'VRF: Virtual Router Forwarding'.

Multi-WAN can control routing to each PDP context in the same way it can control routing to other interfaces. However, in package multiwan `option manage_state`, set to **no** for both multiwan interface configurations. Multiwan will then control routing through each PDP context by altering the interface metric to '-1' when it determines the interface has failed its health check.

17.3 Configuration package used

Package	Sections
network	interface

17.4 Configuring multi-APN

17.4.1 Configuring multi-APN using the web interface

To configure multi-APN, select **Network -> Interface.** A unique PDP context needs to be configured on each mobile interface. For more information on how to configure a mobile interface, read the chapter 'Configuring a mobile connection'.

Note: on each mobile interface set **option sim** to the same number and not to **any**.

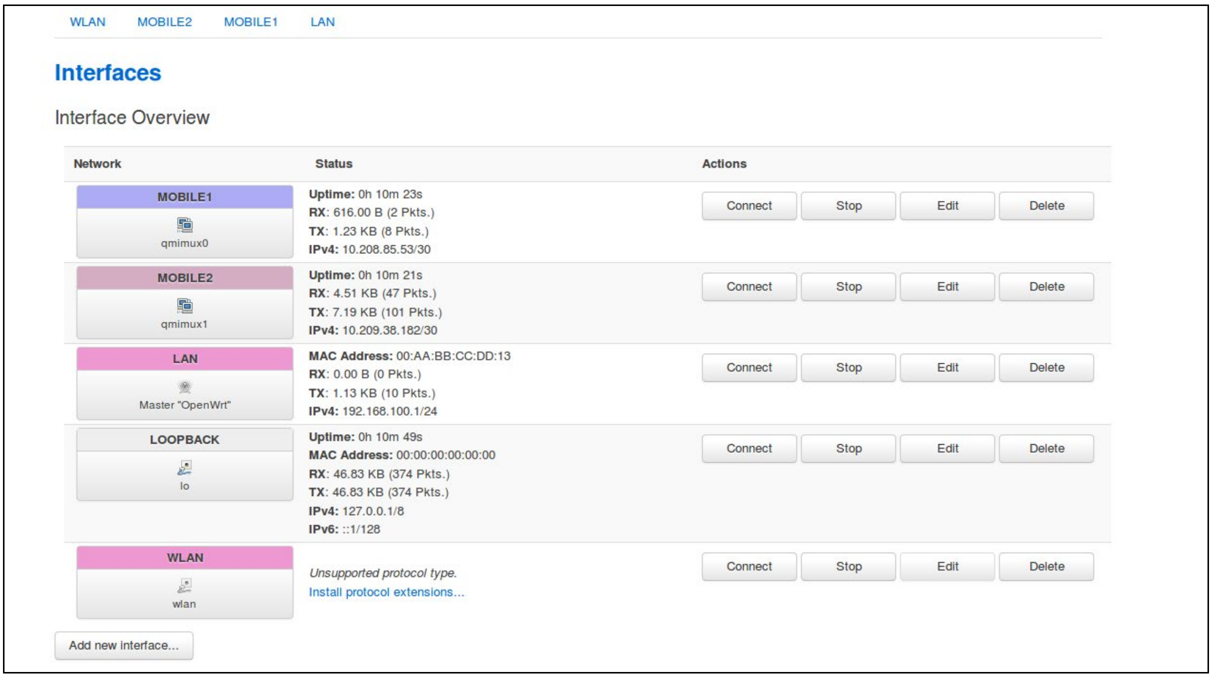

Figure 87: The network interface page

On the the desired mobile interface, select **Edit** and then select **Advanced Settings**.

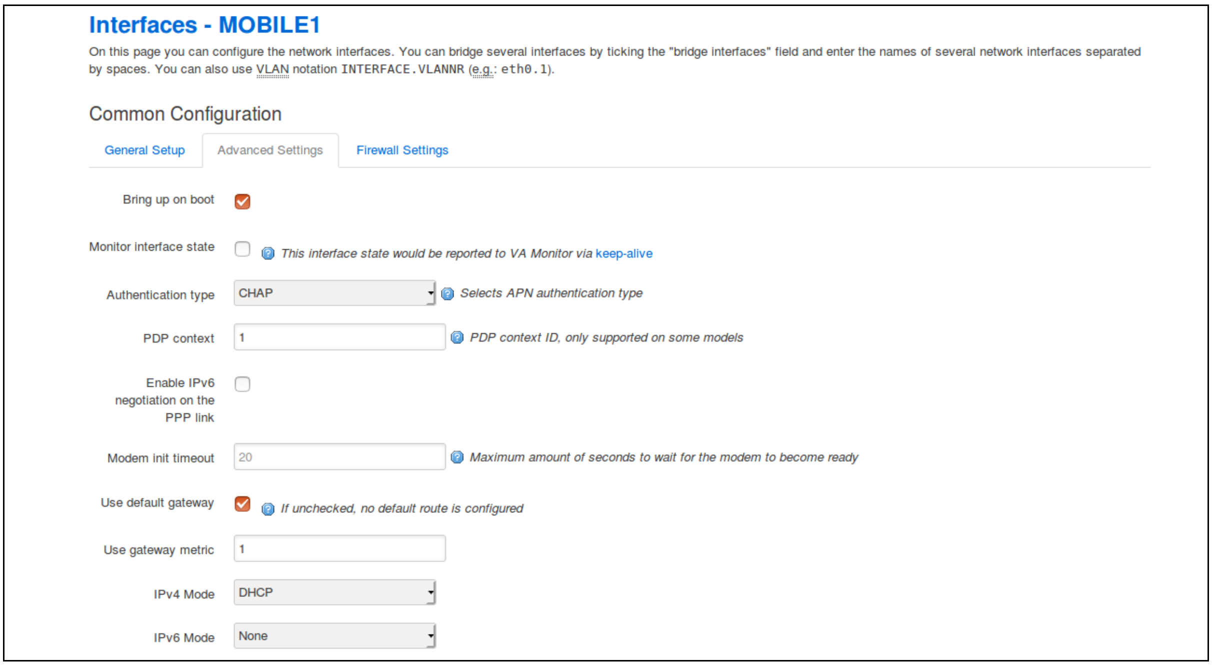

Figure 88: Mobile interface advanced settings page

Web Field/UCI/Package Option	Description
Web: PDP context UCI: network.[interface].pdp_context Opt:pdp_context	Defines the PDP context ID. Should multiple active PDP contexts be supported, you must configure interfaces with different PDP context IDs. 1 Range: 1 – 4

Table 50: Information table for Multi-APN

17.4.2 Configuring multi-APN using the command line

You can configure multi-APN using the interface configuration section in the network package /etc/config/network using the option `pdp_context`. The option value should be an integer that is unique to each APN configuration.

17.4.2.1 Multi-APN using UCI

```
root@VA_router:~# uci show network
package network
......
network.Mobile1=interface
network.Mobile1.proto=3g
network.Mobile1.apn=open.internet
network.Mobile1.username=gprs
network.Mobile1.password=gprs
network.Mobile1.sim=1
network.Mobile1.service=auto
network.Mobile1.metric=1
```

```
network.Mobile1.pdp_context=1
network.Mobile2=interface
network.Mobile2.proto=3g
network.Mobile2.apn=3ireland.ie
network.Mobile2.sim=1
network.Mobile2.service=auto
network.Mobile2.metric=1
network.Mobile2.pdp_context=2
```

17.4.2.2 Configuring multi-APN using package options

```
root@VA_router:~# uci export network
package network
……
config interface 'Mobile1'
        option proto '3g'
        option apn 'open.internet'
        option username 'gprs'
        option password 'gprs'
        option sim '1'
        option service 'auto'
        option metric '1'
        option pdp_context '1'

config interface 'Mobile2'
        option proto '3g'
        option apn '3ireland.ie'
        option sim '1'
        option service 'auto'
        option metric '1'
        option pdp_context '2'
```

17.4.2.3 Example of simple routing over multi-APN using UCI

```
root@VA_router:~# uci show network
package network
……
network.Mobile1=interface
```

```
network.Mobile1.proto=3g
network.Mobile1.apn=open.internet
network.Mobile1.username=gprs
network.Mobile1.password=gprs
network.Mobile1.sim=1
network.Mobile1.service=auto
network.Mobile1.metric=1
network.Mobile1.pdp_context=1
network.Mobile1.defaultroute=0
network.Mobile2=interface
network.Mobile2.proto=3g
network.Mobile2.apn=3ireland.ie
network.Mobile2.sim=1
network.Mobile2.service=auto
network.Mobile2.metric=1
network.Mobile2.pdp_context=2
network.Mobile1.defaultroute=0
……
network.8888=route
network.8888.interface=Mobile1
network.8888.target=8.8.8.8
network.8888.netmask=255.255.255.255
network.8844=route
network.8844.interface=Mobile1
network.8844.target=8.8.4.4
network.8844.netmask=255.255.255.255
```

17.5 Multi-APN diagnostics

17.5.1 Interface status

When active, to see the status of interfaces with multiple APNs, enter:

```
root@VA_router:~# ifconfig
……

qmimux0   Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00
          inet addr:10.205.77.223  P-t-P:10.205.77.223 Mask:255.255.255.192
          inet6 addr: fe80::9bb3:25f7:278c:a8f1/64 Scope:Link
```

```
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:5 errors:0 dropped:0 overruns:0 frame:0
          TX packets:23 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:1540 (1.5 KiB)  TX bytes:3976 (3.8 KiB)

qmimux1   Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00
          inet addr:10.209.38.182  P-t-P:10.209.38.182 Mask:255.255.255.252
          inet6 addr: fe80::89f2:b5d5:f017:ae91/64 Scope:Link
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:94 errors:0 dropped:0 overruns:0 frame:0
          TX packets:293 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:9032 (8.8 KiB)  TX bytes:20860 (20.3 KiB)
```

To check which mobile interface corresponds to the output from the `ifconfig` command shown above, enter:

```
root@VA_router:~# network_status -a

Interface:      Mobile1
Status:         Up
Uptime:         00h 05m 30s
IPv4 addresses: 10.202.187.228/29
MAC address:    00:00:00:00:00:00
Device name:    "qmimux0"

Interface:      Mobile2
Status:         Up
Uptime:         00h 05m 27s
IPv4 addresses: 10.201.206.252/29
MAC address:    00:00:00:00:00:00
Device name:    "qmimux1"
```

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17.5.2 Routing table

To check the routing table, enter:

```
root@VA_router:~# ip route
8.8.4.4 via 10.204.5.101 dev qmimux0
8.8.8.8 via 10.204.5.101 dev qmimux0
10.204.5.100/30 dev qmimux0 proto kernel scope link src 10.204.5.102
10.209.38.180/30 dev qmimux1 proto kernel scope link src 10.209.38.182
192.168.100.0/24 dev eth0 proto kernel scope link src 192.168.100.1
192.168.101.0/24 dev wlan0 proto kernel scope link src 192.168.101.1
192.168.101.0/24 dev wlan1 proto kernel scope link src 192.168.101.1
```

17.5.3 Mobile status

17.5.3.1 Mobile status via the web

To view mobile connectivity information, in the top menu, select **Status -> Mobile Information**. The Mobile Information page appears. The information presented depends on the actual mobile hardware used; it might therefore differ from the samples shown in this document.

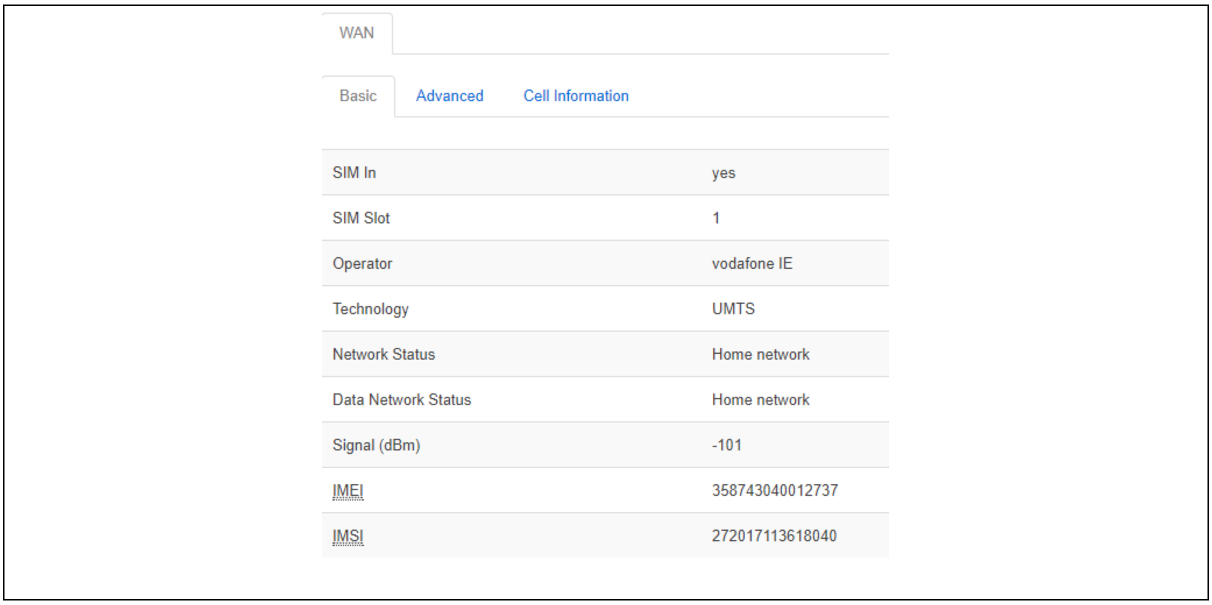

Figure 89: The mobile information page

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WAN

Basic | Advanced | Cell Information

Network Status	Home network
Data Network Status	Home network
IMEI	358743040012737
IMSI	272017113618040
Operator	vodafone IE
Phone Number	+353874512040
SIM In	yes
SIM Slot	1
SIM1 ICCID	8935301140701270414
Signal (dBm)	-101
Technology	UMTS
Temperature (C)	28
Hardware Revision	R1C08

Figure 90: The advanced information page

WAN

Basic | Advanced | Cell Information

Cell ID	2007516
Location Area Code	3023
Mobile Country Code	272
Mobile Network Code	01

Figure 91: The cell information page

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17.5.3.2 Mobile status using UCI

To display information and status of mobile interfaces such as 3G, 4G or CDMA, enter:

```
root@VA_router:~# mobile_status


Mobile Interface    : WAN
Status              : idle
SIM In              : yes
SIM Slot            : 1
Operator            : vodafone IE
Technology          : UMTS
CS Network Status   : Home network
PS Network Status   : Home network
Signal (dBm)        : -107
IMEI                : 358743040012737
IMSI                : 272017113618040
```

For more advanced information, enter `mobile_status -a`:

```
root@ VA_router:~# mobile_status -a


Mobile Interface    : WAN
Status              : idle
CS Network Status   : Home network
PS Network Status   : Home network
IMEI                : 358743040012737
IMSI                : 272017113618040
Operator            : vodafone IE
Phone Number        : +353874512040
SIM In              : yes
SIM Slot            : 1
SIM1 ICCID          : 8935301140701270414
Signal (dBm)        : -107
Technology          : UMTS
Temperature (C)     : 28
Hardware Revision   : R1C0
```

18 Configuring a GRE interface

General Routing Encapsulation (GRE) is a tunnelling protocol used for encapsulation of other communication protocols inside point-to-point links over IP.

18.1 Configuration packages used

Package	Sections
network	interface

18.2 Creating a GRE connection using the web interface

To create GRE interfaces through the web interface, in the top menu, select **Network ->Interfaces**.

There are three sections in the Interfaces page.

Section	Description
Interface Overview	Shows existing interfaces and their status. You can create new, and edit existing interfaces here.
Port Map	In this section you can map device ports to Ethernet interfaces. Ports are marked with capital letters starting with 'A'. Type in space separated port numbers in the port map fields.
ATM Bridges	ATM bridges expose encapsulated Ethernet in AAL5 connections as virtual Linux network interfaces, which can be used in conjunction with DHCP or PPP to dial into the provider network.

In the Interface Overview section, click **Add new interface**. The Create Interface page appears.

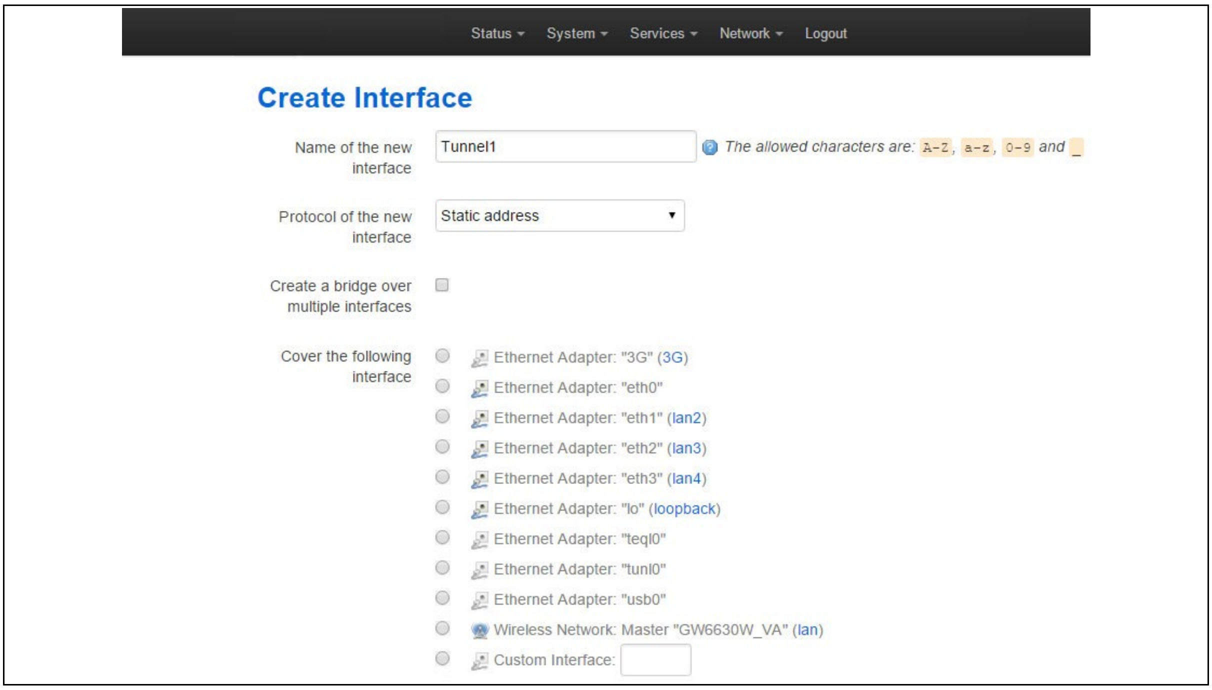

Figure 92: The create interface page

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<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name of the new interface
UCI: network. .<if name>
Opt: config interface</td><td>Assigns a logical name to the GRE tunnel. The network interface section will be assigned this name <if name>.
Type the name of the new interface.
Allowed characters are A-Z, a-z, 0-9 and _.
Must be less than 11 characters.</td></tr>
<tr><td>Web: Protocol of the new interface
UCI: network.<if name>.proto
Opt: proto</td><td>Specifies what protocol the interface will operate on. Select GRE.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr>
<tr><td>PPP</td><td>Point-to-Point protocol</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
<tr><td>Proto</td><td>Not applicable for GRE.</td></tr>
<tr><td>Web: Cover the following interface
UCI: network.<if name>
Opt:n/a</td><td>Not applicable for GRE.</td></tr>
</table>

Table 51: Information table for the create new interface page

Click **Submit**. The Common Configuration page appears. There are three sections in the Common Configurations page.

Section	Description
General Setup	Configure the basic interface settings such as protocol, IP address, mask length, local interface, remote IP address, TTL, tunnel key and MTU.
Advanced Settings	'Bring up on boot' and 'monitor interface state' settings.
Firewall settings	Assign a firewall zone to the connection.

18.2.1 GRE connection: common configuration: general setup

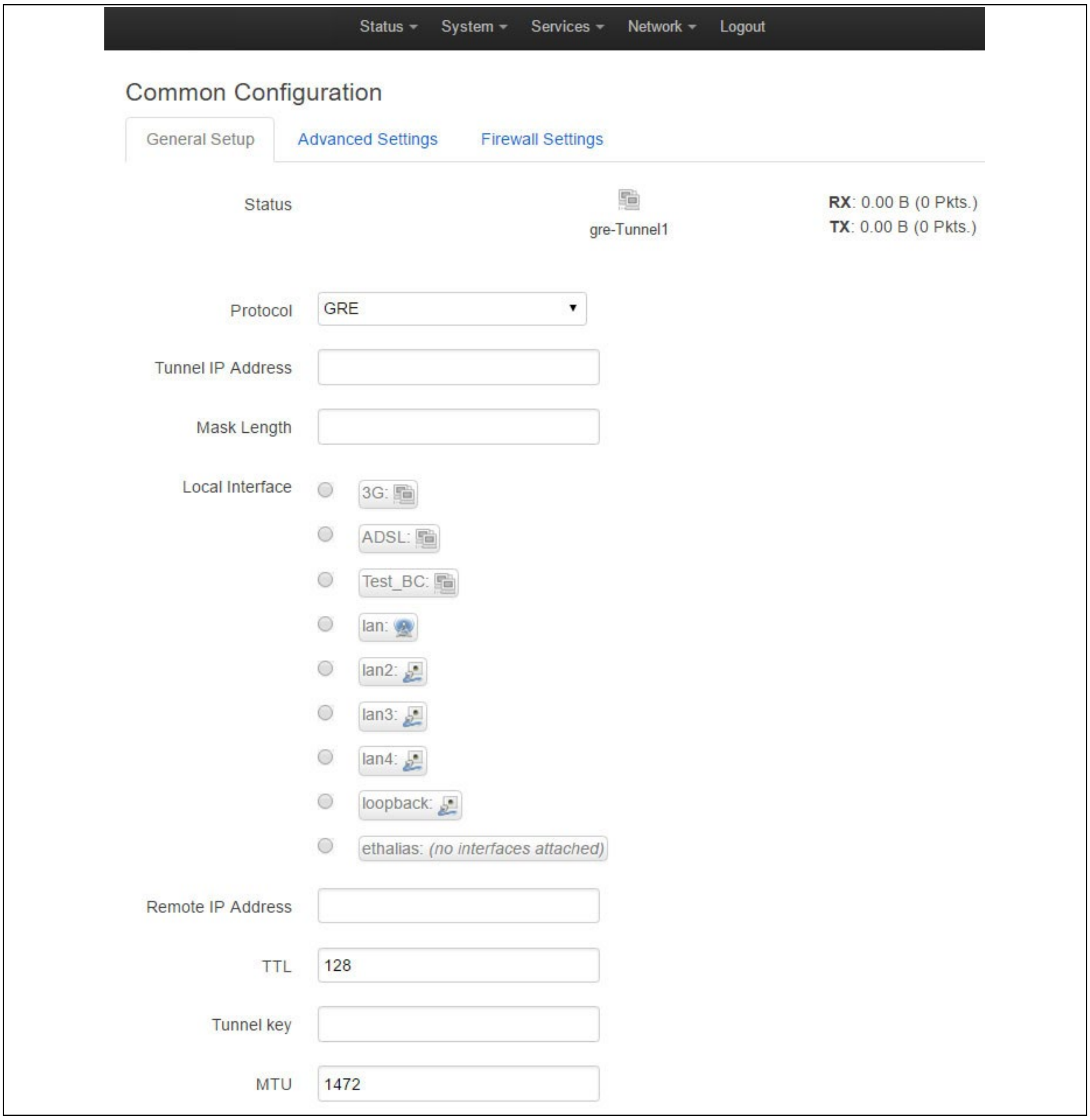

Figure 93: The GRE common configuration page

Web Field/UCI/Package Option	Description
Web: Protocol of the new interface UCI: network.<if name>.proto Opt: proto	Shows the protocol the interface will operate on. GRE should be currently selected.
Web: Tunnel IP Address UCI: network.<if name>.ipaddr Opt: ipaddr	Configures local IP address of the GRE interface.
Web: Mask Length UCI: network.<if name>.mask_length Opt: mask_length	Subnet mask, in CIDR notation, to be applied to the tunnel. Typically '30' for point-to-point tunnels. 24 Range: 0 - 30

Web: Local Interface UCI: network.<if name>.local_interface Opt: local_interface	Specifies which interface is going to be linked with the GRE tunnel interface (optional).
Web: Remote IP address UCI: network.<if name>.remote_ip Opt: remote_ip	For point to point tunnels; specifies remote IP address.
Web: TTL UCI: network.<if name>.ttl Opt: ttl	Sets Time-To-Live value on the interface. 128 | Range |
Web: Tunnel key UCI: network.<if name>.key Opt: key	Sets GRE tunnel ID key (optional). Usually an integer.
Web: MTU UCI: network.<if name>.mtu Opt: mtu	Configures MTU (maximum transmission unit) size of PDUs using this interface. 1472 | Range |

Table 52: Information table for GRE

18.2.2 GRE connection: common configuration-advanced settings

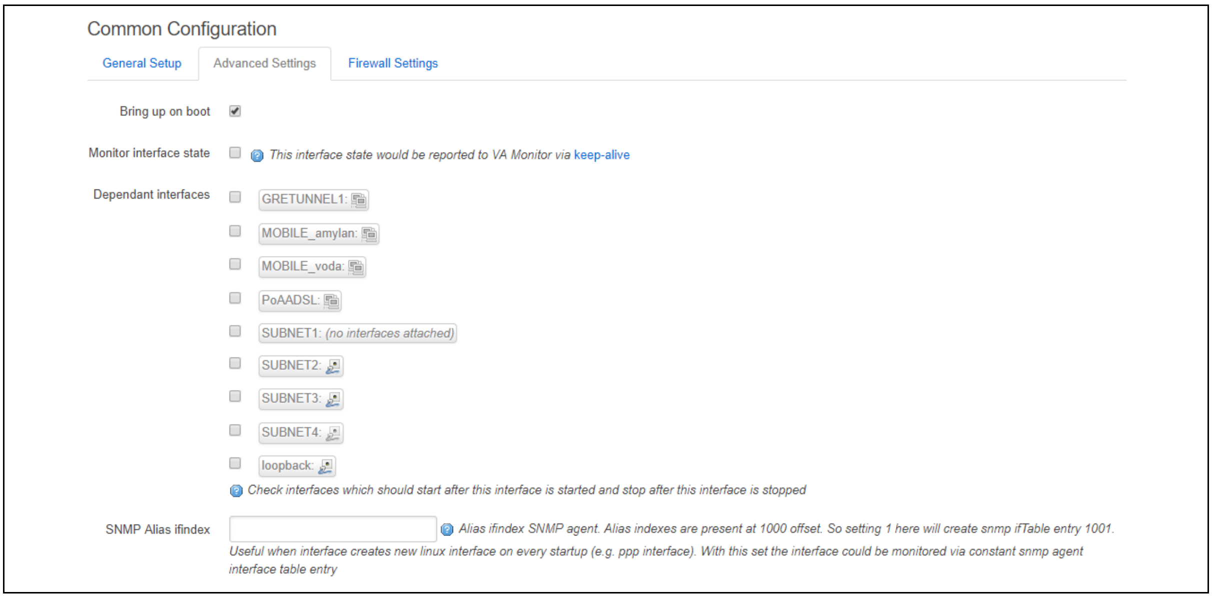

Figure 94: GRE advanced settings page

Web Field/UCI/Package Option	Description
Web: Bring up on boot UCI: network.<if name>.auto Opt: auto	Enables the interface to connect automatically on boot up. 0 — Disabled. 1 — Enabled.
Web: Monitor interface state UCI: network.<if name>.monitored Opt: monitored	Enabled if status of interface is presented on Monitoring platform. 0 — Disabled. 1 — Enabled.
Web: Dependant Interfaces UCI: network.[..x..].dependants Opt: dependants	Lists interfaces that are dependant on this parent interface. Dependant interfaces will go down when parent interface is down and will start or restart when parent interface starts. Separate multiple interfaces by a space when using UCI. Example: `option dependants 'PPPADSL MOBILE'` This replaces the following previous options in child interfaces. gre — option local_interface lt2p — option src_ipaddr iot — option wan1 wan2 6in4 — option ipaddr 6to4 — option ipaddr
Web: SNMP Alias ifindex UCI: network.[..x..].snmp_alias_ifindex Opt: snmp_alias_ifindex	Defines a static SNMP interface alias index for this interface, that can be polled via the SNMP interface index (`snmp_alias_ifindex+1000`). For more information, read the chapter 'Configuring SNMP'. Blank — No SNMP interface alias index. Range — 0 - 4294966295

Table 53: Information table for GRE advanced settings

18.2.3 GRE connection: firewall settings

Use this section to select the firewall zone you want to assign to this interface.

Select **unspecified** to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.

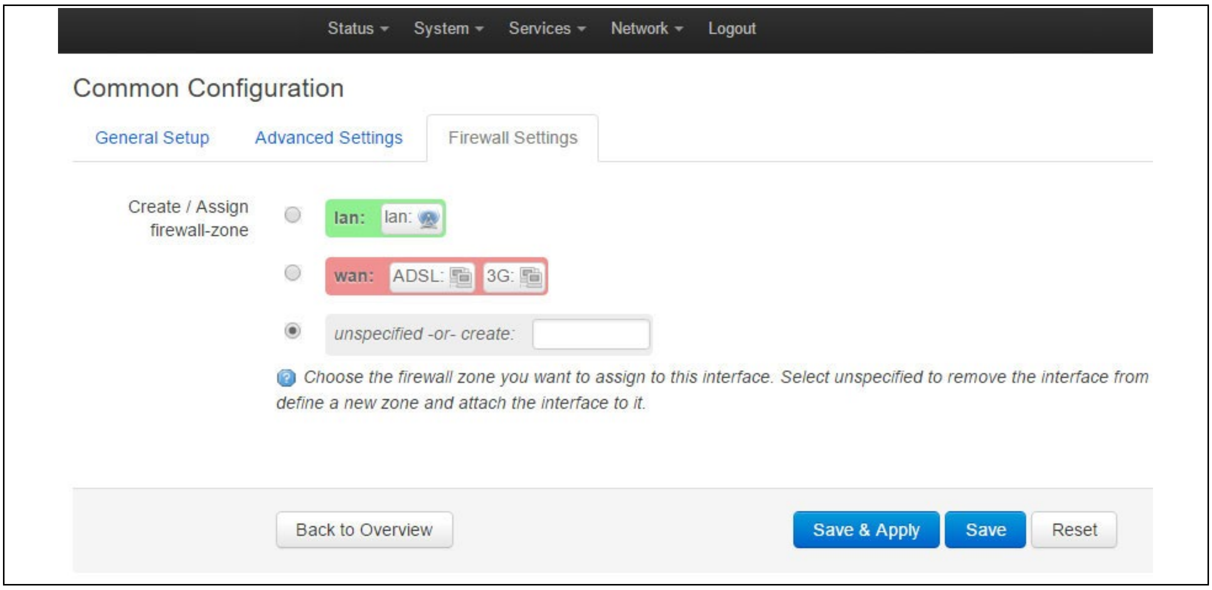

Figure 95: GRE firewall settings

Click **Save and Apply**. This will save the current settings and return you to the Interface Overview page. To configure further settings on the GRE interface select **EDIT** for the relevant GRE interface.

18.2.4 GRE connection: adding a static route

After you have configured the GRE interface, you must configure a static route, to route the desired traffic over the GRE tunnel. To do this, browse to **Network -> Static Routes**. For more information, read the chapter 'Configuring Static Routes'.

18.3 GRE configuration using command line

The configuration file is stored on **/etc/config/network**

For the examples below, tunnel1 is used as the interface logical name.

18.4 GRE configuration using UCI

```
root@VA_router:~# uci show network
network.tunnel1=interface
network.tunnel1.proto=gre
network.tunnel1.monitored=0
network.tunnel1.ipaddr=172.255.255.2
network.tunnel1.mask_length=24
network.tunnel1.local_interface=wan
network.tunnel1.remote_ip=172.255.255.100
network.tunnel1.ttl=128
network.tunnel1.key=1234
network.tunnel1.mtu=1472
network.tunnel1.auto=1
```

18.5 GRE configuration using package options

```
root@VA_router:~# uci export network
config interface 'tunnel1'
      option proto 'gre'
      option monitored '0'
      option ipaddr '172.255.255.2'
      option mask_length '24'
      option local_interface 'wan'
      option remote_ip '172.255.255.100'
      option ttl '128'
```

```
      option key '1234'
      option mtu '1472'
      option auto '1'
```

To change any of the above values use `uci set` command.

18.6 GRE diagnostics

18.6.1 GRE interface status

To show the current running interfaces, enter:

```
root@VA_router:~# ifconfig
base0       Link encap:Ethernet  HWaddr 00:00:00:00:01:01
            inet6 addr: fe80::200:ff:fe00:101/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1504  Metric:1
            RX packets:39810 errors:0 dropped:0 overruns:0 frame:0
            TX packets:365 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:10889090 (10.3 MiB)  TX bytes:68820 (67.2 KiB)
eth4        Link encap:Ethernet  HWaddr 00:1E:10:1F:00:00
            inet addr:10.68.66.54  Bcast:10.68.66.55  Mask:255.255.255.252
            inet6 addr: fe80::21e:10ff:fe1f:0/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:81 errors:0 dropped:0 overruns:0 frame:0
            TX packets:127 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:8308 (8.1 KiB)  TX bytes:12693 (12.3 KiB)
gre-Tunnel1 Link encap:UNSPEC  HWaddr 0A-44-42-36-DB-B0-00-48-00-00-00-00-
00-00-00-00
            inet addr:13.13.13.2  Mask:255.255.255.248
            inet6 addr: fe80::5efe:a44:4236/64 Scope:Link
            UP RUNNING MULTICAST  MTU:1472  Metric:1
            RX packets:7 errors:0 dropped:0 overruns:0 frame:0
            TX packets:7 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:0
            RX bytes:912 (912.0 B)  TX bytes:884 (884.0 B)
lo          Link encap:Local Loopback
            inet addr:127.0.0.1  Mask:255.0.0.0
            inet6 addr: ::1/128 Scope:Host
```

```
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:1465 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1465 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:166202 (162.3 KiB)  TX bytes:166202 (162.3 KiB)
```

To display a specific GRE interface, enter `ifconfig gre-<if name>`:

```
root@VA_router:~# ifconfig gre-Tunnel1
gre-Tunnel1   Link encap:UNSPEC  HWaddr 0A-44-42-36-00-00-7F-E2-00-00-00-
00-00-00-00-00
              inet addr:13.13.13.2  Mask:255.255.255.248
              inet6 addr: fe80::5efe:a44:4236/64 Scope:Link
              UP RUNNING MULTICAST  MTU:1472  Metric:1
              RX packets:7 errors:0 dropped:0 overruns:0 frame:0
              TX packets:7 errors:0 dropped:0 overruns:0 carrier:0
              collisions:0 txqueuelen:0
              RX bytes:912 (912.0 B)  TX bytes:8GRE route status
```

To show the current GRE route status, enter:

```
root@VA_router:~# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use
Iface
0.0.0.0         10.68.66.53     0.0.0.0         UG    0      0      0 eth4
0.0.0.0         13.13.13.1      0.0.0.0         UG    1      0      0 gre-
Tunnel1
10.68.66.52     0.0.0.0         255.255.255.252 U     0      0      0 eth4
13.13.13.0      0.0.0.0         255.255.255.248 U     0      0      0 gre-
Tunnel1
172.19.101.3    13.13.13.1      255.255.255.255 UGH   0      0     0 gre-
Tunnel1
```

Note: a GRE route will only be displayed in the routing table when the interface is up.

19 Configuring VRF (Virtual Routing and Forwarding)

Virtual Routing and Forwarding (VRF) is a technology that allows multiple instances of a routing table to exist in a router and work simultaneously. Traffic between routing tables is segregated and so increases security.

19.1 VRF overview

An interface is configured to belong to a VRF. Interfaces included in the VRF form an independent routing domain, so routing of incoming and outgoing packets only happens within a VRF. It is also possible to add individual routes to a VRF using static routes.

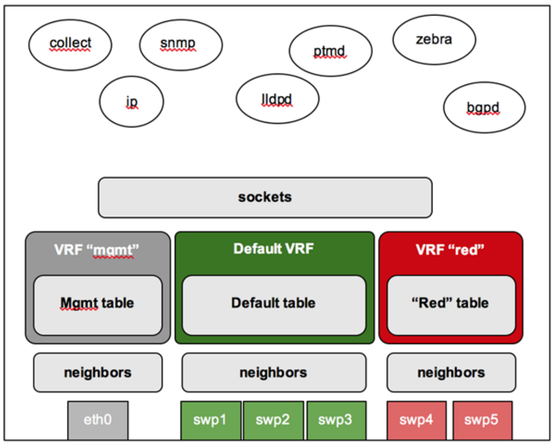

Figure 96: VRF architecture

19.2 Configuration package used

Package	Sections
network	interface route

19.3 Configuring VRF

19.3.1 Configuring VRF using the web UI

19.3.1.1 Setting the VRF for an interface

To create VRFs, you must add interfaces. To add an interface to a VRF instance, select **Network - > Interfaces,** select the desired interface to edit then select **Common Configuration - > Advanced Settings**.

Enter in the relevant VRF name in the VRF field.

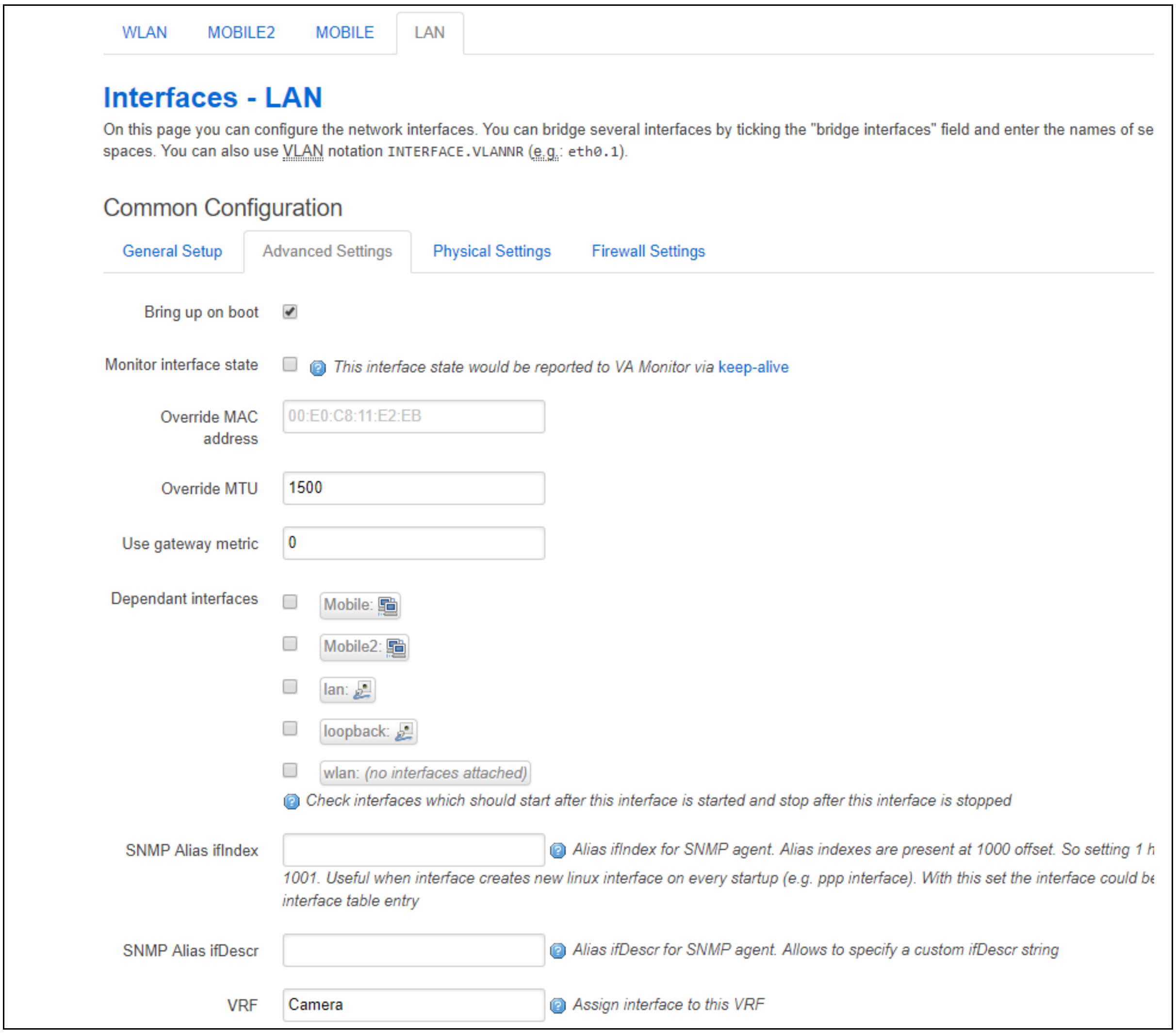

Figure 97: The interfaces configuration page

Web Field/UCI/Package Option	Description
Web: VRF UCI: network.<if name>.vrf Opt: vrf	Defines the VRF name to which this interface belongs. **Note**: the name must be consistent across all interfaces that want to reside on that VRF. (Empty): Interface is not attached to a VRF. Range: 0 – 15 characters

Table 54: Information table for VRF interface configuration

To add additional interfaces to a VRF, repeat the above for the relevant interface(s).

For example, the above configuration creates a VRF on a LAN interface. To configure this VRF to be used by traffic from a camera on a LAN interface to a VRF on a mobile interface, repeat the above instructions for a mobile interface so the camera VRF will now contain a local network and mobile interface to route traffic.

Note: the default VRF is created automatically and is not assigned any VRF name. It is recommended to use this default VRF to access router services and applications; for example, HTTP, SSH, SNMP etc.

19.3.1.2 Configuring a VRF on a static route

Each VRF has its own routing table and static routes can be added to a VRF routing table. To define a static route on a VRF, select **Network - >Static Routes**.

Figure 98: The static routes configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: VRF
UCI: network.route.vrf
Opt: vrf</td><td>Defines the VRF name.
Note: ‘none’ is a special name to move a route out of a VRF.
Example: <code>network.route.vrf=none</code><table><tr><td>(Empty)</td><td>Interface is not attached to a VRF</td></tr><tr><td>Range</td><td>0 – 15 characters</td></tr></table></td></tr>
</table>

Table 55: Information table for VRF static route configuration

19.3.2 Configuring the VRFs using the command line

You configure a VRF using the interface configuration section in the network etc/config/network.

The VRF name must be consistent across all interfaces that want to reside on that VRF.

For the command line examples below, two VRFs called Camera and Management are configured.

19.3.2.1 VRF using UCI

```
root@VA_router:~# uci show network | grep vrf
network.lan.vrf=Camera
network.Mobile1.vrf=Camera
network.Mobile2.vrf=Management
```

19.3.2.2 VRF using package options

```
root@VA_router:~# uci export network
package network

config interface lan
        option vrf 'Camera'

config interface Mobile1
```

```
        option vrf 'Camera'

config interface Mobile2
        option vrf 'Management'
```

19.4 VRF diagnostics

19.4.1 VRF table

To display a list of running VRFs, enter:

```
root@VA_router:~# ip vrf
Name              Table
-----------------------
Management           10
Camera               10
```

19.4.2 VRF routes

To display the routing table for a VRF, enter the command:

`ip route list vrf <vrf name>`.

```
root@VA_router:~# ip route list vrf Camera
default via 10.92.163.130 dev qmimux0
10.92.163.128/30 dev qmimux0 proto kernel scope link src 10.92.163.129
172.16.100.0/24 dev eth1 proto kernel scope link src 172.16.100.1

root@VA_router:~# ip route list vrf Management
default via 10.176.120.94 dev qmimux1
10.176.120.92/30 dev qmimux1 proto kernel scope link src 10.176.120.93
```

20 Configuring static routes

It is possible to define arbitrary IPv4 routes on specific interfaces using route sections. As for aliases, multiple sections can be attached to an interface. These types of routes are most commonly known as static routes.

You can add static routes to the routing table to forward traffic to specific subnets when dynamic routing protocols are not used or they are not configured for such subnets. They can be created based on an outgoing interface or next hop IP address.

20.1 Configuration package used

Package	Sections
network	route

20.2 Configuring static routes using the web interface

In the top menu, select **Network -> Static Routes**. The Routes page appears.

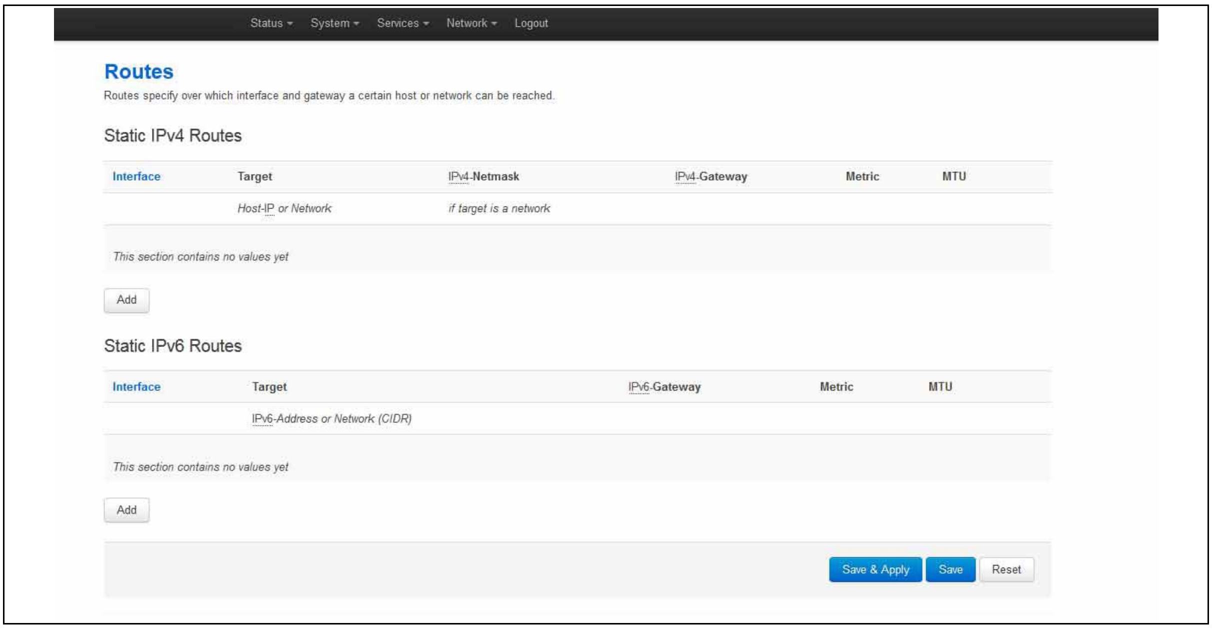

Figure 99: The routes page

In the IPv4 Routes section, click **Add**.

Web Field/UCI/Package Option	Description
Web: Interface UCI: network.@route[0].interface Opt: Interface	Specifies the logical interface name of the parent or master interface this route belongs to. It must refer to one of the defined interface sections.
Web: target UCI: network.@route[0].target Opt: target	Specifies the route network IP address.
Web: netmask UCI: network.@route[0].netmask Opt: netmask	Defines the route netmask. If omitted, 255.255.255.255 is assumed, which makes the target a host address.

Web: Gateway UCI: network.@route[0].gateway Opt: Gateway	Network gateway. If omitted, the gateway from the parent interface is taken. If set to 0.0.0.0 no gateway will be specified for the route.
Web: Metric UCI: network.@route[0].metric Opt: metric	Specifies the route metric to use. 0 Range
Web: MTU UCI: network.@route[0].mtu Opt:mtu	Defines a specific MTU for this route. If omitted, the MTU from the parent interface will be taken. Blank Range

Table 56: Information table for IPv4 static routes section

20.3 Configuring IPv6 routes using the web interface

You can also specify IPv6 routes by defining one or more IPv6 routes. In the IPv6 routes section, click **Add**.

Web Field/UCI/Package Option	Description
Web: Interface UCI: network.@route[1].interface Opt: interface	Specifies the logical interface name of the parent or master interface this route belongs to. It must refer to one of the defined interface sections.
Web: target UCI: network.@route[1].target Opt: target	Specifies the route network IP address, or subnet in CIDR notation: Eample: 2001:0DB8:100:F00:BA3::1/64
Web: Gateway UCI: network.@route[1].gateway Opt: Gateway	Network gateway. If omitted, the gateway from the parent interface is taken. If set to 0.0.0.0 no gateway will be specified for the route.
Web: Metric UCI: network.@route[1].metric Opt: metric	Specifies the route metric to use. 0 Range
Web: MTU UCI: network.@route[1].mtu Opt:mtu	Defines a specific MTU for this route. If omitted the MTU from the parent interface will be taken. Empty Range

Table 57: Information table for IPv6 routes

When you have made your changes, click **Save & Apply**.

20.4 Configuring routes using command line

By default, all routes are named 'route', it is identified by `@route` then the route's position in the package as a number. For example, for the first route in the package using UCI:

```
network.@route[0]=route

network.@route[0].interface=lan
```

Or using package options:

```
config route
        option 'interface' 'lan'
```

However, you can give a route a name if desired. For example, a route named 'myroute' will be `network.myroute`.

To define a named route using UCI, enter:

```
network.name_your_route=route
network.name_your_route.interface=lan
```

To define a named route using package options, enter:

```
config route 'name_your_route'
        option 'interface' 'lan'
```

20.5 IPv4 routes using UCI

The command line example routes in the subsections below do not have a configured name.

```
root@VA_router:~# uci show network
network.@route[0]=route
network.@route[0].interface=lan
network.@route[0].target=3.3.3.10
network.@route[0].netmask=255.255.255.255
network.@route[0].gateway=10.1.1.2
network.@route[0].metric=3
network.@route[0].mtu=1400
```

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20.6 IPv4 routes using package options

```
root@VA_router:~# uci export network
package network
      ….
config route
        option interface 'lan'
        option target '2.2.2.2'
        option netmask '255.255.255.255'
        option gateway '192.168.100.1'
        option metric '1'
        option mtu '1500'
```

20.7 IPv6 routes using UCI

```
root@VA_router:~# uci show network
network.@route[1]=route
network.@route[1].interface=lan
network.@route[1].target=2001:0DB8:100:F00:BA3::1/64
network.@route[1].gateway=2001:0DB8:99::1
network.@route[1].metric=1
network.@route[1].mtu=1500
```

20.8 IPv6 routes using package options

```
root@VA_router:~# uci export network
package network
      ….
config route
        option interface 'lan'
        option target '2001:0DB8:100:F00:BA3::1/64'
        option gateway '2001:0DB8:99::1'
      option metric ‘1’
        option mtu '1500'
```

20.9 Static routes diagnostics

20.9.1 Route status

To show the current routing status, enter:

```
root@VA_router:~# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.100.0   *               255.255.255.0   U     0      0        0 eth0
```

Note: a route will only be displayed in the routing table when the interface is up.

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21 Configuring BGP (Border Gateway Protocol)

BGP is a protocol for exchanging routing information between gateway hosts, each with its own router, in a network of autonomous systems. BGP is often the protocol used between gateway hosts on the internet. The routing table contains a list of known routers, the addresses they can reach, and a cost metric associated with the path to each router so that the best available route is chosen.

21.1 Configuration package used

Package	Sections
bgpd	routing
	peer
	routemap

21.2 Configuring BGP using the web interface

In the top menu, select **Network -> BGP**. The BGP configuration page appears. The page has three sections: Global Settings, BGP Neighbours and BGP Route Map.

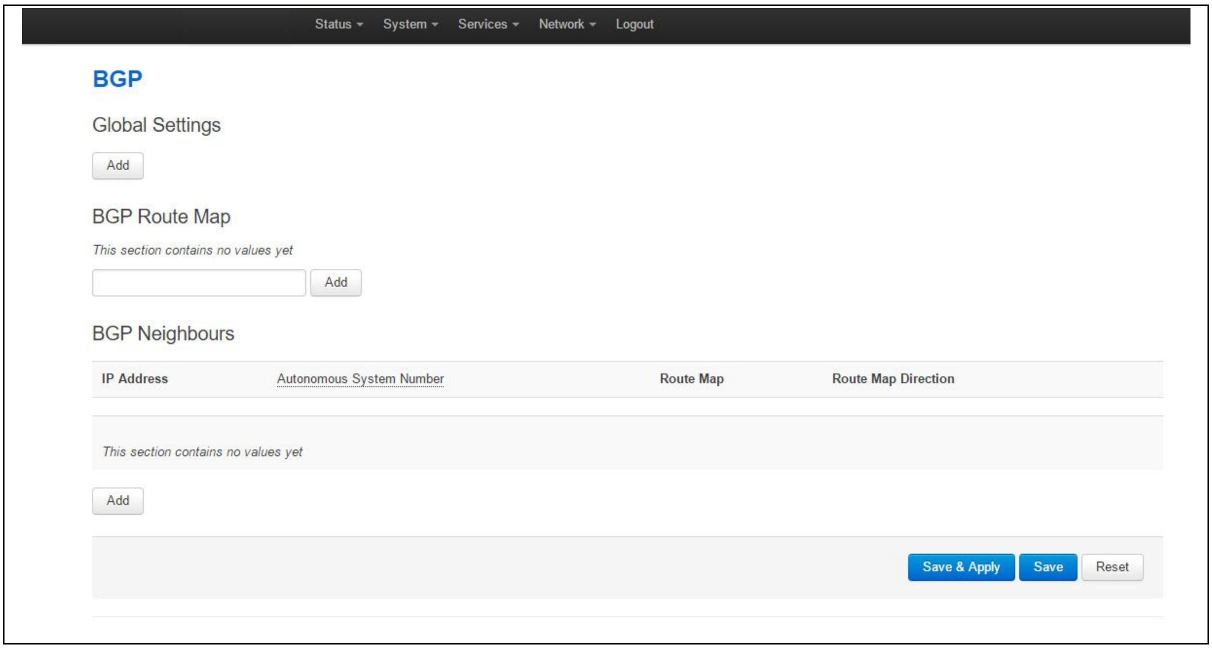

Figure 100: The BGP page

21.2.1 BGP global settings

To configure global BGP settings, click **Add**. The Global Settings page appears.

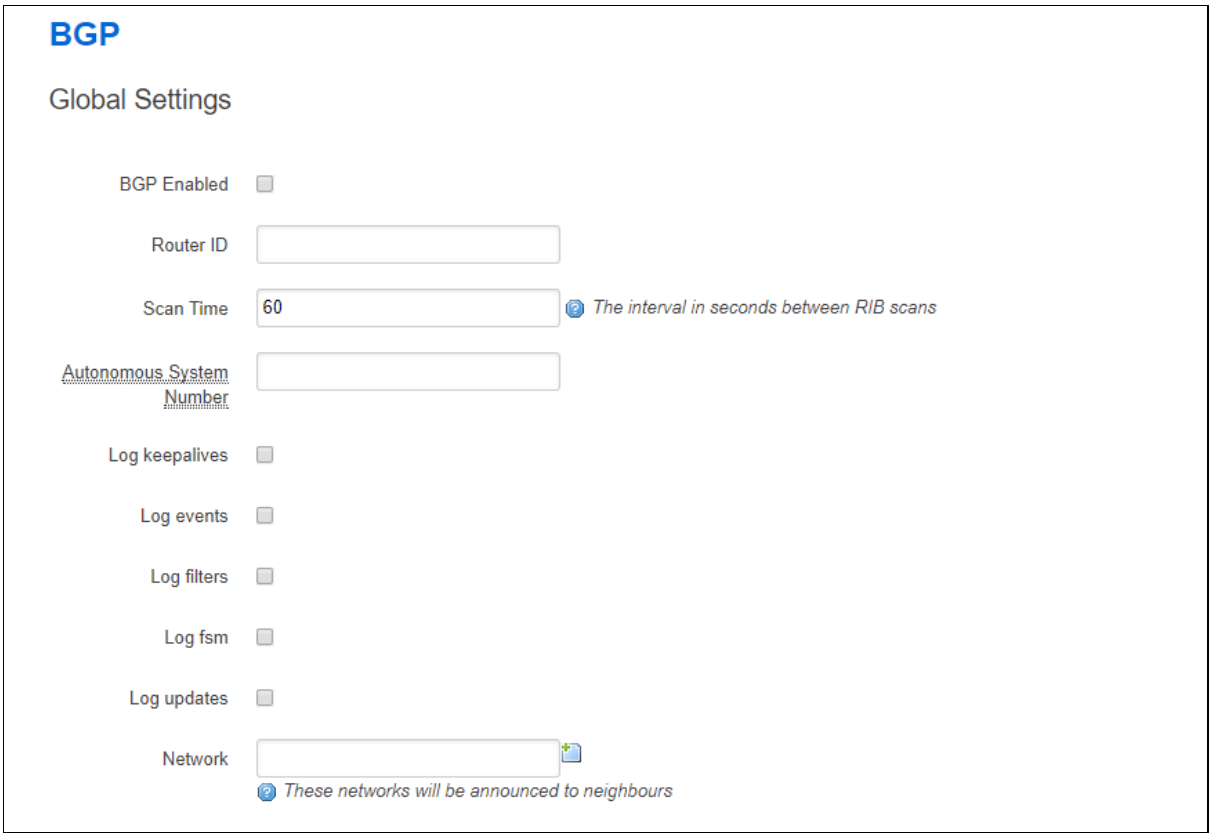

Figure 101: The BGP global settings page

Web Field/UCI/Package Option	Description
Web: BGP Enabled UCI: bgpd.bgpd.enabled Opt: enabled	Enables or disables BGP protocol. 1 | Enabled. 0 | Disabled.
Web: Router ID UCI: bgpd.bgpd.router_id Opt: router_id	Sets a unique router ID in 4 byte format 0.0.0.0.
Web: Scan Time UCI: bgpd.bgpd.scan_time Opt: scan_time	Defines the interval in seconds between RIB scans. 60 | 60 seconds Range |
Web: Autonomous System Number UCI: bgpd.bgpd.asn Opt: asn	Defines the ASN for the local router. Type in the ASN. Blank | Range | 1-4294967295
Web: Log keepalives UCI: bgpd.bgpd.debug_keepalive Opt: debug_keepalives	Defines whether to enable BGP keepalives to the system log. 1 | Enabled. 0 | Disabled.
Web: Log events UCI: bgpd.bgpd.debug_events Opt: debug_events	Defines whether to enable BGP event to the system log. 1 | Enabled. 0 | Disabled.
Web: Log filters UCI: bgpd.bgpd.debug_filters Opt: debug_filters	Defines whether to enable BGP filter events to the system log. 1 | Enabled. 0 | Disabled.

Web: Log fsm UCI: bgpd.bgpd.debug_fsm Opt: debug_fsm	Defines whether to enable BGP state changes to the system log. 1 — Enabled. 0 — Disabled.
Web: Log Updates UCI: bgpd.bgpd.debug_updates Opt: debug_updates	Defines whether to enable BGP updates to the system log. 1 — Enabled. 0 — Disabled.
Web: Network UCI: bgpd.bgpd.network Opt: list network	Sets the list of networks that will be advertised to neighbours in prefix format 0.0.0.0/0. Separate multiple networks by a space using UCI. Ensure the network prefix matches the one shown in the routing table. For more information, read the 'Routes' section below.
Web: n/a UCI: bgpd.bgpd.vrf Opt: vrf	Defines the VRF with which to associate this BGP routing instance Range — (blank) — No VRF

Table 58: Information table for BGP global settings

21.2.2 Optionally configure a BGP route map

Route maps provide a means to both filter and/or apply actions to a route. This allows a policy to be applied to routes. Route maps are an ordered list of route map entries each with a set of criteria that must be matched before specific attributes of the route are modified.

Scroll down to the BGP Route Map section.

Type in a name for the BGP route map name and then click **Add**. The BGP Route Map configuration section appears. You can configure multiple route maps. The examples below are for a route map named ROUTEMAP.

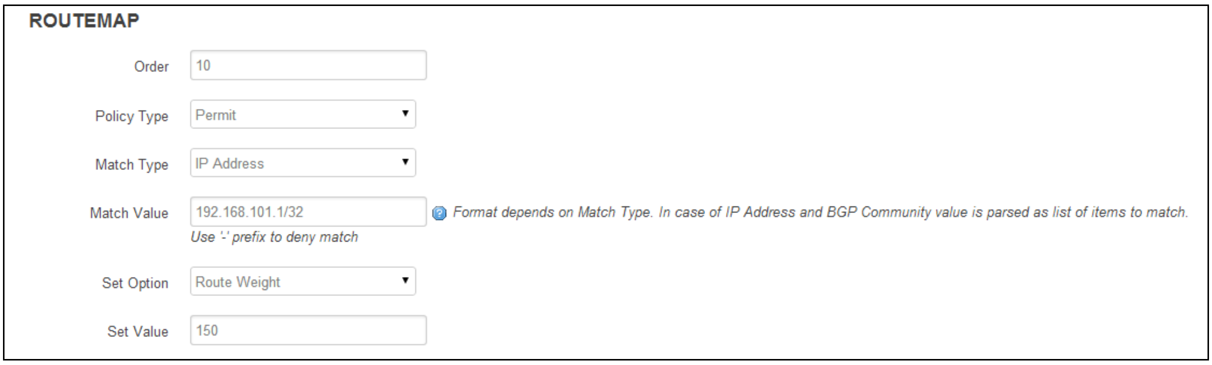

Figure 102: The routemap section

Web Field/UCI/Package Option	Description
Web: Order UCI: bgpd.ROUTEMAP.order Opt: order	Defines the route map order number. Blank — Range — 1-65535
Web: Policy Type UCI: bgpd.ROUTEMAP.permit Opt: permit	Defines the actions taken if the entry is matched. Deny — Denies the route. Permit — Permits the route to process the set actions for this entry.

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<table>
<tr><td>Web: Match Type
UCI: bgpd.ROUTEMAP.match_type
Opt: match_type</td><td>Defines match type. Available options are as follows:
<table>
<tr><td>IP address</td><td>Matches IP address.</td></tr>
<tr><td>IP Next Hop</td><td>Matches next hop IP address.</td></tr>
<tr><td>AS-Path</td><td>Matches AS-path.</td></tr>
<tr><td>Route Metric</td><td>Matches route metric.</td></tr>
<tr><td>BGP Community</td><td>Matches BGP community.</td></tr>
</table></td></tr>
<tr><td>Web: Match value
UCI: bgpd.ROUTEMAP.match
Opt: match</td><td>Defines the value of the match type. Format depends on the match type selected. In the case of IP address and BGP Community values, the match value is parsed as a list of items to match.
Enter '-' prefix to deny match.</td></tr>
<tr><td>Web: Set Option
UCI: bgpd.ROUTEMAP.set_type
Opt: set_type</td><td>Defines the set option to be processed on a match. Available options are shown below.
<table>
<tr><td>None</td><td></td></tr>
<tr><td>IP Next Hop</td><td>Setting option for IP next hop.</td></tr>
<tr><td>Local Preference</td><td>Setting option for Local Preference.</td></tr>
<tr><td>Route Weight</td><td>Setting option for Route Weight.</td></tr>
<tr><td>BGP MED</td><td>Setting option for BGP multi-exit discriminator (BGP metric).</td></tr>
<tr><td>AS Path to Prepend</td><td>Setting option to prepend AS to AS path.</td></tr>
<tr><td>BGP Community</td><td>Setting option for BGP community.</td></tr>
<tr><td>IPv6 Next Hop Global</td><td>Setting option for IPv6 Next Hop Global.</td></tr>
<tr><td>IPv6 Next Hop Local</td><td>Setting option for IPv6 Next Hop Local.</td></tr>
</table></td></tr>
<tr><td>Web: Value
UCI: bgpd.ROUTEMAP.set
Opt: set</td><td>Defines the set value when a match occurs. Value format depends on the set option you have selected.</td></tr>
<tr><td>Web: n/a
UCI: bgpd.ROUTEMAP.routing
Opt: set</td><td>Defines the routing section this BGP route map is related to.</td></tr>
</table>

Table 59: Information table for routemap

21.2.3 Configure BGP neighbours

To configure BGP neighbours, in the BGP neighbours section, click **Add**. The BGP Neighbours page appears. You can configure multiple BGP neighbours.

Figure 103: The BGP neighbours section

Web Field/UCI/Package Option	Description
Web: IP Address UCI: bgpd.@peer[0].ipaddr Opt: ipaddr	Sets the IP address of the neighbour.

Web: Autonomous System Number UCI: bgpd.@peer[0].asn Opt: asn	Sets the ASN of the remote peer. Blank: Range: 1-4294967295
Web: Route Map UCI: bgpd.@peer[0].route_map Opt: route_map	Sets route map name to use with this neighbour.
Web: Route Map Direction UCI: bgpd.@peer[0].route_map_in Opt: route_map_in	Defines what direction to apply to the route map. 1: In 0: Out
Web: IPv6 UCI: bgpd.@peer[0].ipv6 Opt: ipv6	Defines whether the peer is connected over IPv6. 1 0
Web: Local Peer UCI: bgpd.@peer[0].next_hop_self Opt: next_hop_self	Defines an announced route's next hop as being equivalent to the address of the router if it is learned via eBGP. 1 0
Web: Holdtime UCI: bgpd.@peer[0].holdtime_sec Opt: holdtime_sec	Defines how long to wait for incoming BGP messages before assuming peer is dead. The timer is reset every time a BGP message is received. 0 Range
Web: Keepalive Interval UCI: bgpd.@peer[0].keepalive_sec Opt: keepalive_sec	Defines the interval in seconds for between two successive BGP keep alive messages. 0 Range
Web: Connect Timer UCI: bgpd.@peer[0].connect_sec Opt: connect_sec	Defines how long to wait after interface is up before retrying the connection on it. 0 Range
Web: n/a UCI: bgpd.@peer[0].routing Opt: routing	Defines the routing section this BGP peer is related to.

Table 60: Information table for BGP neighbours

21.3 Configuring BGP using command line

21.3.1 Configuring BGP using UCI

You can also configure BGP using UCI. The configuration file is stored on /etc/config/bgpd

```
root@VA_router:~# uci show bgpd
bgpd.bgpd=routing
bgpd.bgpd.enabled=yes
bgpd.bgpd.router_id=3.3.3.3
bgpd.bgpd.asn=1
bgpd.bgpd.network=11.11.11.0/29 192.168.103.1/32
bgpd.bgpd.vrf=datavrf
bgpd.@peer[0]=peer
```

```
bgpd.@peer[0].route_map_in=yes
bgpd.@peer[0].ipaddr=11.11.11.1
bgpd.@peer[0].asn=1
bgpd.@peer[0].route_map=ROUTEMAP
bgpd.@peer[0].ipv6=0
bgpd.@peer[0].next_hop_self=0
bgpd.@peer[0].holdtime_sec=0
bgpd.@peer[0].keepalive_sec=0
bgpd.@peer[0].connect_sec=0
bgpd.@peer[0].routing='bgpd'
bgpd.ROUTEMAP=routemap
bgpd.ROUTEMAP.order=10
bgpd.ROUTEMAP.permit=yes
bgpd.ROUTEMAP.match_type=ip address
bgpd.ROUTEMAP.match=192.168.101.1/32
bgpd.ROUTEMAP.set_type=ip next-hop
bgpd.ROUTEMAP.set='192.168.101.2/32'
bgpd.ROUTEMAP.vrf='bgpd'
```

To change any of the above values use UCI `set` command.

21.3.2 Configuring BGP using packages options

```
root@VA_router:~# uci export bgpd
package bgpd
config routing 'bgpd'
        option enabled 'yes'
        option router_id '3.3.3.3'
        option asn '1'
        list network '11.11.11.0/29'
        list network '192.168.103.1/32'



config peer
        option route_map_in 'yes'
        option ipaddr '11.11.11.1'
        option asn '1'
```

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```
        option route_map 'ROUTEMAP'
        option ipv6 ‘0’
        option next_hop_self ‘0’
        option holdtime_sec ‘0’
        option keepalive_sec ‘0’
        option connect_sec ‘0’
        option routing ‘bgpd’

config routemap 'ROUTEMAP'
        option order '10'
        option permit 'yes'
        option match_type 'ip address'
        option match '192.168.101.1/32'
        option set_type 'ip next-hop'
        option set '192.168.101.2/32'
        option routing ‘bgpd’
```

21.4 View routes statistics

To view routes statistics, in the top menu click **Status -> Routes**. The routing table appears.

Routes

The following rules are currently active on this system.

ARP

IPv4-Address	MAC-Address	Interface
192.168.210.100	50:b7:c3:0c:1e:4b	br-lan
10.1.1.124	d4:ae:52:cd:61:21	eth1
10.1.10.83	00:13:60:51:39:56	eth1

Active IPv4-Routes

Network	Target	IPv4-Gateway	Metric
wan	0.0.0.0/0	10.64.64.64	0
wan	0.0.0.0/0	10.64.64.64	1
LAN2	10.1.0.0/16	0.0.0.0	0
wan	10.64.64.64	0.0.0.0	0
LAN2	192.168.101.1	10.1.10.83	0
lan	192.168.210.0/24	0.0.0.0	0
wan	217.67.129.143	10.64.64.64	0

Active IPv6-Routes

Network	Target	IPv6-Gateway	Metric
loopback	0:0:0:0:0:0:0:0/0	0:0:0:0:0:0:0:0/0	FFFFFFFF
loopback	0:0:0:0:0:0:0:0/0	0:0:0:0:0:0:0:0/0	FFFFFFFF
loopback	0:0:0:0:0:0:0:1	0:0:0:0:0:0:0:0/0	00000000
LAN2	FF02:0:0:0:0:0:0:FB	0:0:0:0:0:0:0:0/0	00000000
(base0)	FF00:0:0:0:0:0:0:0/8	0:0:0:0:0:0:0:0/0	00000100
lan	FF00:0:0:0:0:0:0:0/8	0:0:0:0:0:0:0:0/0	00000100
LAN2	FF00:0:0:0:0:0:0:0/8	0:0:0:0:0:0:0:0/0	00000100
loopback	0:0:0:0:0:0:0:0/0	0:0:0:0:0:0:0:0/0	FFFFFFFF

Figure 104: The routing table

To view routes via the command line, enter:

```
root@support:~# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
10.1.0.0        0.0.0.0         255.255.0.0     U     0      0        0 br-lan2
```

22 Configuring OSPF (Open Shortest Path First)

22.1 Introduction

OSPF is a standardised link state routing protocol, designed to scale efficiently to support larger networks. Link state protocols track the status and connection type of each link and produce a calculated metric based on these and other factors, including some set by the network administrator. Link state protocols will take a path which has more hops, but that uses a faster medium over a path using a slower medium with fewer hops.

OSPF adheres to the following link state characteristics:

- OSPF employs a hierarchical network design using areas.
- OSPF will form neighbour relationships with adjacent routers in the same area.
- Instead of advertising the distance to connected networks, OSPF advertises the status of directly connected links using Link-State Advertisements (LSAs).
- OSPF sends updates (LSAs) when there is a change to one of its links, and will only send the change in the update. LSAs are additionally refreshed every 30 minutes.
- OSPF traffic is multicast either to address 224.0.0.5 for all OSPF routers or 224.0.0.6 for all designated routers.
- OSPF uses the Dijkstra shortest path first algorithm to determine the shortest path.
- OSPF is a classless protocol, and therefore supports Variable Length Subnet Masks (VLSMs).

Other characteristics of OSPF include:

- OSPF supports only IP routing.
- OSPF routes have an administrative distance is 110.
- OSPF uses cost as its metric, which is computed based on the bandwidth of the link. OSPF has no hop-count limit.

The OSPF process builds and maintains three separate tables:

- A neighbour table containing a list of all neighbouring routers.
- A topology table containing a list of all possible routes to all known networks within an area.
- A routing table containing the best route for each known network.

22.1.1 OSPF areas

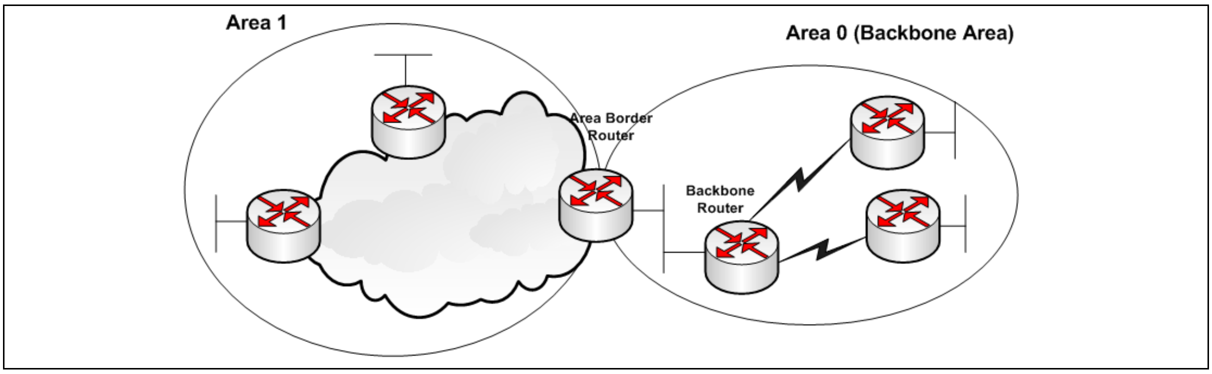

Figure 105: OSPF areas

OSPF has a number of features that allow it to scale well for larger networks. One of these features is OSPF areas. OSPF areas break up the topology so that routers in one area know less topology information about the subnets in the other area, and they do not know anything about the routers in the other area at all. With smaller topology databases, routers consume less memory and take less processing time to run SPF.

The Area Border Router (ABR) is the border between two areas. The ABR does not advertise full topology information about the part of the network in area 0 to routers in area 1. Instead, the ABR advertises summary information about the subnets in area 0. Area 1 will just see a number of subnets reachable via area 0.

22.1.2 OSPF neighbours

OSPF forms neighbour relationships, called adjacencies, with other routers in the same area by exchanging 'hello' packets to multicast address 224.0.0.5. Only after an adjacency is formed can routers share routing information.

Each OSPF router is identified by a unique router ID. The router ID can be determined in one of three ways:

- The router ID can be manually specified.
- If not manually specified, the highest IP address configured on any loopback interface on the router will become the router ID.
- If no loopback interface exists, the highest IP address configured on any physical interface will become the router ID.

By default, hello packets are sent out of OSPF-enabled interfaces every 10 seconds for broadcast and point-to-point interfaces, and 30 seconds for non-broadcast and point-to-multipoint interfaces.

OSPF also has a 'dead interval', which indicates how long a router will wait without hearing any hellos before announcing a neighbour as 'down'. The default setting for the dead interval is 40 seconds for broadcast and point-to-point interfaces; and 120 seconds for non-broadcast and point-to-multipoint interfaces. By default, the dead interval timer is four times the hello interval.

OSPF routers will only become neighbours if the following parameters within a hello packet are identical on each router:

- Area ID
- Area type (stub, NSSA, etc.)
- Prefix
- Subnet mask
- Hello interval
- Dead interval
- Network type (broadcast, point-to-point, etc.)
- Authentication

The hello packets also serve as keepalives to allow routers to quickly discover if a neighbour is down. Hello packets also contain a neighbour field that lists the router IDs of all neighbours the router is connected to. A neighbour table is constructed from the OSPF hello packets, which includes the following information:

- The router ID of each neighbouring router
- The current 'state' of each neighbouring router
- The interface directly connecting to each neighbour
- The IP address of the remote interface of each neighbour

22.1.3 OSPF designated routers

In multi-access networks such as Ethernet, there is the possibility of many neighbour relationships on the same physical segment. This leads to a considerable amount of unnecessary Link State Advertisement (LSA) traffic. If a link of a router were to fail, it would flood this information to all neighbours. Each neighbour, in turn, would then flood that same information to all other neighbours. This is a waste of bandwidth and processor load.

To prevent this, OSPF will elect a Designated Router (DR) for each multi-access network, accessed via multicast address 224.0.0.6. For redundancy purposes, a Backup Designated Router (BDR) is also elected.

OSPF routers will form adjacencies with the DR and BDR. If a change occurs to a link, the update is forwarded only to the DR, which then forwards it to all other routers. This greatly reduces the flooding of LSAs. DR and BDR elections are determined by a router's OSPF priority, which is configured on a per-interface basis as a router can have interfaces in multiple multi-access networks. The router with the highest priority becomes the DR; second highest becomes the BDR. If there is a tie in priority, whichever router has the highest router ID will become the DR.

22.1.4 OSPF neighbour states

Neighbour adjacencies will progress through several states, described in the table below.

<table>
<tr><th>State</th><th>Description</th></tr>
<tr><td>Down</td><td>Indicates that no hellos have been heard from the neighbouring router.</td></tr>
<tr><td>Init</td><td>Indicates a hello packet has been heard from the neighbour, but a two-way communication has not yet been initialised.</td></tr>
<tr><td>2-Way</td><td>Indicates that bidirectional communication has been established.
Recalls that hello packets contain a neighbour field; thus, communication is considered 2-way when a router sees its own router ID in its neighbour’s hello packet. Designated and backup designated routers are elected at this stage.</td></tr>
<tr><td>ExStart</td><td>Indicates that the routers are preparing to share link state information. Master/slave relationships are formed between routers to determine who will begin the exchange.</td></tr>
<tr><td>Exchange</td><td>Indicates that the routers are exchanging Database Descriptors (DBDs). DBDs contain a description of the router’s topology database. A router will examine a neighbour’s DBD to determine if it has information to share.</td></tr>
<tr><td>Loading</td><td>Indicates the routers are finally exchanging link state advertisements, containing information about all links connected to each router. Essentially, routers are sharing their topology tables with each other.</td></tr>
<tr><td>Full</td><td>Indicates that the routers are fully synchronised. The topology table of all routers in the area should now be identical. Depending on the role of the neighbour, the state may appear as:
<table>
<tr><td>Full/DR</td><td>Indicating that the neighbour is a Designated Router (DR).</td></tr>
<tr><td>Full/BDR</td><td>Indicating that the neighbour is a Backup Designated Router (BDR).</td></tr>
<tr><td>Full/DROther</td><td>Indicating that the neighbour is neither the DR nor BDR. On a multi-access network, OSPF routers will only form full adjacencies with DRs and BDRs. Non-DRs and non-BDRs will still form adjacencies but will remain in a 2-way state. This is normal OSPF behaviour.</td></tr>
</table></td></tr>
</table>

Table 61: Neighbour adjacency states

22.1.5 OSPF network types

OSPF’s functionality is different across several different network topology types.

State	Description
Broadcast Multi-Access	Indicates a topology where broadcast occurs. Examples include Ethernet, Token Ring and ATM. OSPF characteristics are: OSPF will elect DRs and BDRs Traffic to DRs and BDRs is multicast to 224.0.0.6. Traffic from DRs and BDRs to other routers is multicast to 224.0.0.5 Neighbours do not need to be manually specified.
Point-to-Point	Indicates a topology where two routers are directly connected. An example would be a point-to-point T1. OSPF characteristics are: OSPF will not elect DRs and BDRs All OSPF traffic is multicast to 224.0.0.5 Neighbours do not need to be manually specified
Point-to-Multipoint	Indicates a topology where one interface can connect to multiple destinations. Each connection between a source and destination is treated as a point-to-point link. For example, point to point-to-multipoint frame relay. OSPF characteristics are: OSPF will not elect DRs and BDRs. All OSPF traffic is multicast to 224.0.0.5. Neighbours do not need to be manually specified.

Non-broadcast Multi-access Network (NBMA)	Indicates a topology where one interface can connect to multiple destinations; however, broadcasts cannot be sent across a NBMA network. For example, Frame Relay. OSPF characteristics are: OSPF will elect DRs and BDRs. OSPF neighbours must be manually defined, so all OSPF traffic is unicast instead of multicast. **Note**: on non-broadcast networks, neighbours must be manually specified, as multicast hellos are not allowed.

Table 62: OSPF functionality over different topology types

22.1.6 The OSPF hierarchy

OSPF is a hierarchical system that separates an autonomous system into individual areas. OSPF traffic can either be:

- intra-area (within one area),
- inter-area (between separate areas), or
- external (from another AS).

OSPF routers build a topology database of all links within their area, and all routers within an area will have an identical topology database. Routing updates between these routers will only contain information about links local to their area. Limiting the topology database to include only the local area conserves bandwidth and reduces CPU loads.

Area 0 is required for OSPF to function and is considered the backbone area. As a rule, all other areas must have a connection into Area 0, though this rule can be bypassed using virtual links. Area 0 is often referred to as the transit area to connect all other areas.

OSPF routers can belong to multiple areas, and therefore contain separate topology databases or each area. These routers are known as Area Border Routers (ABRs).

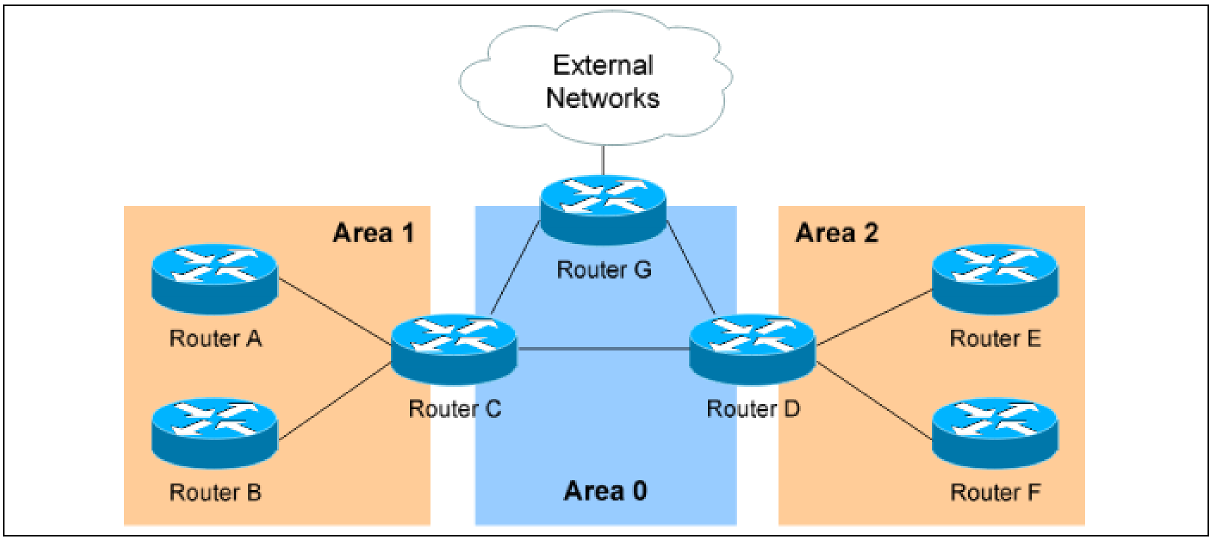

Figure 106: OSPF hierarchy

In the above example three areas exist: Area 0, Area 1, and Area 2.

Area 0 is the backbone area for this autonomous system.

Both Area 1 and Area 2 must directly connect to Area 0. Routers A and B belong fully to Area 1, while routers E and F belong fully to Area 2. These are known as internal routers.

Router C belongs to both Area 0 and Area 1; so it is an ABR. Because it has an interface in Area 0, it can also be considered a Backbone Router (BR). The same can be said for Router D, as it belongs to both Area 0 and Area 2.

Router G also belongs to Area 0 however it also has a connection to the internet, which is outside this autonomous system. This makes Router G an Autonomous System Border Router (ASBR).

A router can become an ASBR in one of two ways:

- By connecting to a separate Autonomous System, such as the internet
- By redistributing another routing protocol into the OSPF process.

ASBRs provide access to external networks. OSPF defines two types of external routes, as shown in the table below.

Type 2 (E2)	Includes only the external cost to the destination network. External cost is the metric being advertised from outside the OSPF domain. This is the default type assigned to external routes.
Type 1 (E1)	Includes both the external cost, and the internal cost to reach the ASBR, to determine the total metric to reach the destination network. Type 1 routes are always preferred over Type 2 routes to the same destination.

Table 63: Types of external routes

22.1.7 OSPF router types

The four separate OSPF router types are shown in the table below.

Route Type	**Description**
Internal Router	All router interfaces belong to only one area.
Area Border Router (ABR)	Have interfaces in at least two separate areas.
Backbone Router	Have at least one interface in area 0.
Autonomous System Border Router (ABR)	Have a connection to a separate autonomous system.

22.2 Configuration package used

Package	**Sections**
ospfd	routing network interface

22.3 Configuring OSPF using the web interface

Select **Network -> OSPF**. The OSPF page appears.

There are three sections in the OSPF page:

Section	Description
Global Settings	Enables OSPF and configures the OSPF routing section containing global configuration parameters. The web automatically names the routing section ospfd
Topology Configuration	Configures the network sections.
Interfaces Configuration	Configures the interface sections. Defines interface configuration for OSPF and interface specific parameters

22.3.1 Global settings

The Global Settings section configures the ospfd routing section. The web automatically names the routing section 'ospfd'.

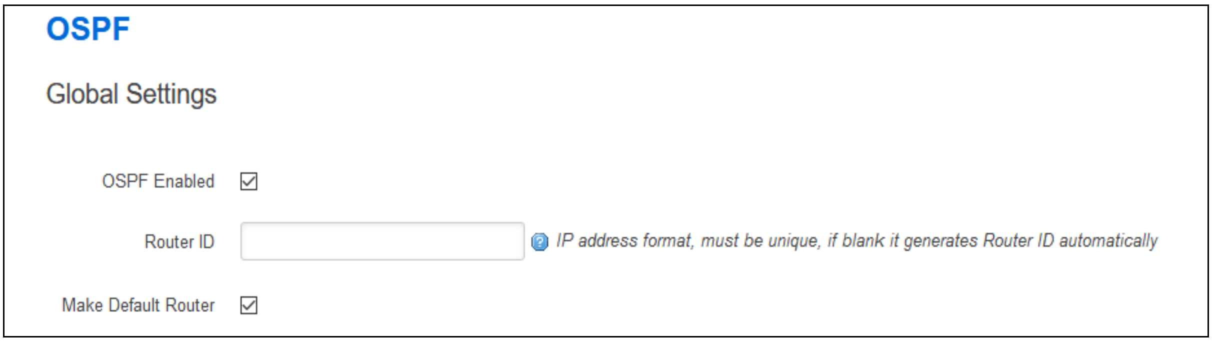

Figure 107: The OSPF global settings configuration page

Web Field/UCI/Package Option	Description
Web: OSPF Enabled UCI: ospfd.ospfd.enabled Opt: enabled	Enables OSPF advertisements on router. 0 – Disabled. 1 – Enabled.
Web: Router ID UCI: ospfd.ospfd.router_id Opt: router_id	This sets the router ID of the OSPF process. The router ID may be an IP address of the router but need not be - it can be any arbitrary 32bit number. However, it MUST be unique within the entire OSPF domain to the OSPF speaker. If one is not specified, then ospfd will obtain a router-ID automatically from the zebra daemon. Empty Range
Web: Make Default Router UCI: ospfd.ospfd.default_info_originate Opt: default_info_originate	Defines whether to originate an AS-External (type-5) LSA describing a default route into all external-routing capable areas, of the specified metric and metric type. 0 – Disabled. 1 – Enabled.
Web: n/a UCI: ospfd.ospfd.vty_enabled Opt: vty_enabled	Enable vty for OSPFd (telnet to localhost:2604)
Web: n/a UCI: ospfd.ospfd.vrf Opt: vrf	Defines the VRF for OSPF (blank) – No VRF Range

Table 64: Information table for OSPF global settings

22.3.2 Topology configuration

The Topology Configuration section configures the ospfd network section. This section specifies the OSPF enabled interface(s). The router can provide network information to the other OSPF routers via this interface.

Note: to advertise OSPF on an interface, the network mask prefix length for the topology configuration statement for the desired interface advertisement must be equal or smaller, that is, a larger network, than the network mask prefix length for the interface.

For example, the topology configuration statement in the screenshot below does not enable OSPF on an interface with address 12.1.1.1/23, but it would enable OSPF on an interface with address 12.1.1.129/25.

Figure 108: The OSPF topology configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Network
UCI: ospfd.@network[0].ip_addr
Opt: ip_addr</td><td>Specifies the IP address for OSPF enabled interface.
Format: A.B.C.D</td></tr>
<tr><td>Web: Mask Length
UCI: ospfd.@network[0].mask_length
Opt: mask_length</td><td>Specifies the mask length for OSPF enabled interface. The mask length should be entered in CIDR notation.</td></tr>
<tr><td>Web: Area
UCI: ospfd.@network[0].area
Opt: area</td><td>Specifies the area number for OSPF enabled interface.</td></tr>
<tr><td>Web: Stub Area
UCI: ospfd.@network[0].stub_area
Opt: stub_area</td><td>Only for non-backbone areas.
Configures the area to be a stub area. That is, an area where no router originates routes external to OSPF and hence an area where all external routes are via the ABR(s).
ABRs for such an area do not need to pass AS-External LSAs (type-5s) or ASBR-Summary LSAs (type-4) into the area. They need only pass network-summary (type-3) LSAs into such an area, along with a default-route summary.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

Table 65: Information table for OSPF topology configuration

22.3.3 Interfaces configuration

The Interfaces Configuration section contains settings to configure the OSPF interface. It defines interface configurations for OSPF and interface specific parameters.

OSPFv2 allows packets to be authenticated using either an insecure plain text password, included with the packet, or by a more secure MD5 based HMAC (keyed-Hashing for

Message AuthentiCation). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire OSPF routing table, to be queried remotely, potentially by anyone on the internet, via OSPFv1.

This section defines key_chains to be used for MD5 authentication.

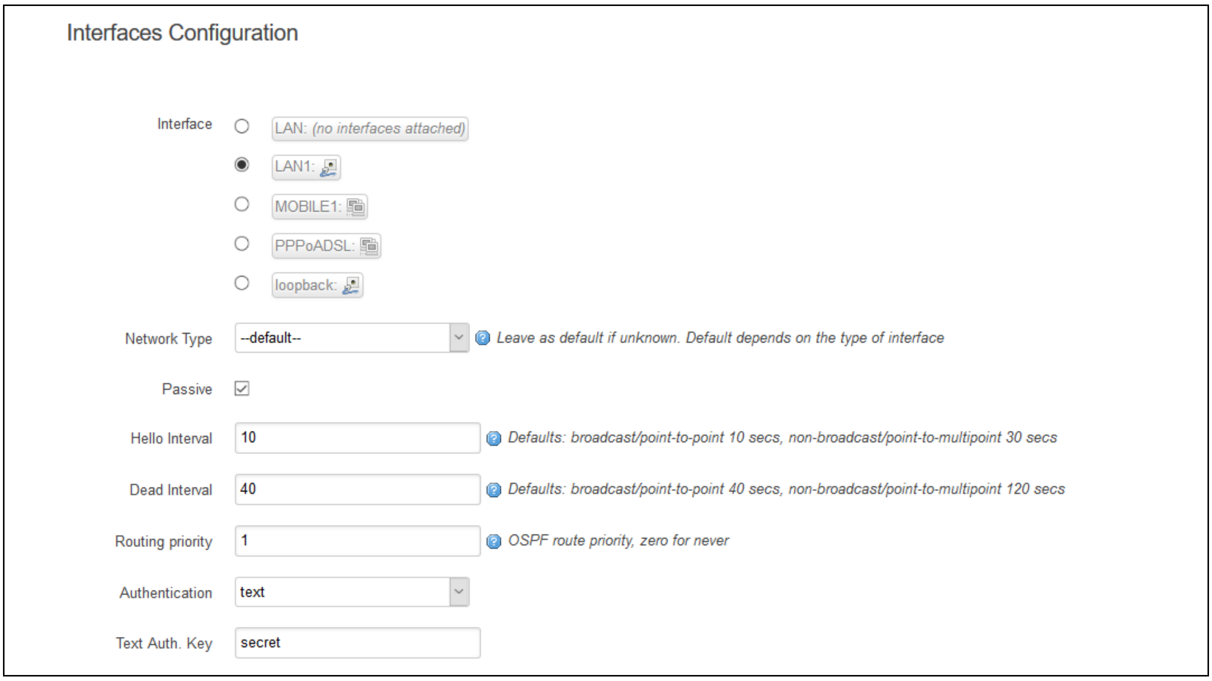

Figure 109: The OSPF interfaces configuration section

Web Field/UCI/Package Option	**Description**
Web: Interface UCI: ospfd.@interface[0].ospf_interface Opt: ospf_interface	Defines the interface name.
Web: Network Type UCI: ospfd.@interface[0].network_type Opt: network_type	Defines the network type for specified interface. Default: Autodetect: it will be broadcast. If broadcast is not supported on that interface then use point-to-point. broadcast non-broadcast point-to-point point-to-multipoint
Web: Passive UCI: ospfd.@interface[0].passive Opt: passive	Does not send hello packets on the given interface but does advertise the interface as a stub link in the router-LSA (Link State Advertisement) for this router. This allows you to advertise addresses on such connected interfaces without having to originate AS-External/Type-5 LSAs, which have global flooding scope, as would occur if connected addresses were redistributed into OSPF. This is the only way to advertise non-OSPF links into stub areas. 0: Disabled. 1: Enabled.

<table>
<tr><td>Web: Hello Interval
UCI: ospfd.@interface[0].hello_interval
Opt: hello_interval</td><td>Defines the number of seconds for the Hello Interval timer value.
A hello packet will be sent every x seconds, where x is the configured hello interval value on the specified interface. This value must be the same for all routers attached to a common network.
The default is every 10 seconds for broadcast and point-to-point interfaces, and 30 seconds for non-broadcast and point-to-multipoint interfaces.<table><tr><td>10</td><td>10 seconds</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Dead Interval
UCI: ospfd.@interface[0].dead_interval
Opt: dead_interval</td><td>Defines the number of seconds for the dead interval timer value used for wait timer and inactivity timer. This value must be the same for all routers attached to a common network.
The default is 40 seconds for broadcast and point-to-point interfaces, and 120 seconds for non-broadcast and point-to-multipoint interfaces. By default, the dead interval timer is four times the hello interval.<table><tr><td>40</td><td>40 seconds</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Routing priority
UCI: ospfd.@interface[0].priority
Opt: priority</td><td>Defines priority to become the designated router.
A value of 0 means never become a designated router; other values in the range 1-255 are allowed, with 255 being most likely to be a designated router, and 1 being least likely.<table><tr><td>1</td><td></td></tr><tr><td>Range</td><td>0 - 255</td></tr></table></td></tr>
<tr><td>Web: Authentication
UCI: ospfd.@interface[0].auth_mode
Opt: auth_mode</td><td>OSPFv2 (only) allows packets to be authenticated via either an insecure plain text password, included with the packet, or via a more secure MD5 based HMAC (keyed-Hashing for Message AuthentiCation). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire OSPF routing table to be queried remotely, potentially by anyone on the internet, via OSPFv1.<table><tr><td>no</td><td>Default value. No authentication.</td></tr><tr><td>md5</td><td>Set the interface with OSPF MD5 authentication.</td></tr><tr><td>text</td><td>Set the interface with OSPF simple password authentication.</td></tr></table></td></tr>
<tr><td>Web: Text Auth. Key
UCI: ospfd.@interface[0].text_auth_key
Opt: text_auth_key</td><td>This command sets authentication string for text authentication. text_auth_key option can have length up to 8 characters.
Displayed only when authentication is set to text.</td></tr>
<tr><td>Web: Key ID
UCI: ospfd.@interface[0].key_id
Opt: key_id</td><td>Specifies key ID. Must be unique and match at both ends.
Displayed only when authentication is set to MD5.</td></tr>
<tr><td>Web: MD5 Auth. Key
UCI: ospfd.@interface[0].md5_auth_key
Opt: md5_auth_key</td><td>Specifies keyed MD5 chain.
Displayed only when authentication is set to MD5.</td></tr>
</table>

Table 66: Information table for OSPF interface commands

22.4 Configuring OSPF using the command line

OSPF is configured under the ospfd package /etc/config/ospfd.

There are three config sections: ospfd, interface and network.

You can configure multiple interface and network sections.

By default, all OSPF interface instances are named interface, instances are identified by `@interface` then the interface position in the package as a number. For example, for the first interface in the package using UCI:

```
ospfd.@interface[0]=interface
ospfd.@interface[0].ospf_interface=lan
```

Or using package options:

```
config interface
      option ospf_interface 'lan'
```

By default, all OSPF network instances are named network, it is identified by `@network` then the interface position in the package as a number. For example, for the first network in the package using UCI:

```
ospfd.@network[0]=network
ospfd.@network[0].ip_addr=12.1.1.1
```

Or using package options:

```
config network
      option ip_addr '12.1.1.1'
```

22.5 OSPF using UCI

```
root@VA_router:~# uci show ospfd
ospfd.ospfd=routing
ospfd.ospfd.enabled=yes
ospfd.ospfd.default_info_originate=yes
ospfd.ospfd.router_id=1.2.3.4
ospfd.ospfd.vrf=datavrf
ospfd.@network[0]=network
ospfd.@network[0].ip_addr=12.1.1.1
ospfd.@network[0].mask_length=24
ospfd.@network[0].area=0
ospfd.@network[0].stub_area=yes
ospfd.@interface[0]=interface
ospfd.@interface[0].ospf_interface=lan8
ospfd.@interface[0].hello_interval=10
ospfd.@interface[0].dead_interval=40
ospfd.@interface[0].priority=1ospfd.@interface[0].network_type=broadcast
ospfd.@interface[0].passive=yes
```

```
ospfd.@interface[0].auth_mode=text
ospfd.@interface[0].text_auth_key=secret
ospfd.@interface[1]=interface
ospfd.@interface[1].ospf_interface=lan7
ospfd.@interface[1].network_type=point-to-point
ospfd.@interface[1].passive=no
ospfd.@interface[1].hello_interval=30
ospfd.@interface[1].dead_interval=120
ospfd.@interface[0].priority=2
ospfd.@interface[1].auth_mode=md5
ospfd.@interface[1].key_id=1
ospfd.@interface[1].md5_auth_key=test
```

22.6 OSPF using package options

```
root@VA_router:~# uci export ospfd
package ospfd

config routing 'ospfd'
        option enabled 'yes'
        option default_info_originate 'yes'
        option router_id '1.2.3.4'
        option vrf 'datavrf'

config network
        option ip_addr '12.1.1.1'
        option mask_length '24'
        option area '0'
        option stub_area 'yes'

config interface
        option ospf_interface 'lan8'
        option hello_interval '10'
        option dead_interval '40'
        option priority '1'
        option network_type 'broadcast'
        option passive 'yes'
```

```
        option auth_mode 'text'
        option text_auth_key 'secret'

config interface
        option ospf_interface 'lan7'
        option network_type 'point-to-point'
        option passive 'no'
        option hello_interval '30'
        option dead_interval '120'
        option priority '2'        option auth_mode 'md5'
        option key_id '1'
        option md5_auth_key 'test'
```

22.7 OSPF diagnostics

22.7.1 Route status

To show the current routing status, enter:

```
root@VA_router:~# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         10.206.4.65     0.0.0.0         UG    1      0        0 usb0
10.1.0.0        0.0.0.0         255.255.0.0     U     0      0        0 eth1
10.206.4.64     0.0.0.0         255.255.255.252 U     0      0        0 usb0
11.11.11.0      0.0.0.0         255.255.255.248 U     0      0        0 gre-
GRE
89.101.154.151  10.206.4.65     255.255.255.255 UGH   0      0        0 usb0
192.168.100.0   0.0.0.0         255.255.255.0   U     0      0        0 eth0
192.168.101.1   11.11.11.1      255.255.255.255 UGH   11     0        0 gre-
GRE
192.168.104.1   11.11.11.4      255.255.255.255 UGH   20     0        0 gre-
GRE
```

Note: a route will only be displayed in the routing table when the interface is up.

22.7.2 Tracing OSPF packets

Typically, OSPF uses IP as its transport protocol. The well-known IP protocol type for OSPF traffic is 0x59. To trace OSPF packets on any interface on the router, enter:
`tcpdump -i any -n proto ospf &`

```
root@VA_router:~# tcpdump -i any -n proto ospf &
root@VA_router:~# tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 65535 bytes
```

To stop tracing enter `fg` to bring tracing task to foreground, and then **<CTRL-C>** to stop the trace.

```
root@VA_router:~# fg
tcpdump -i any -n proto ospf
^C
33 packets captured
33 packets received by filter
0 packets dropped by kernel
```

22.8 Quagga/Zebra console

Quagga is the routing protocol suite embedded in the router firmware. Quagga is split into different daemons for implementation of each routing protocol. Zebra is a core daemon for Quagga, providing the communication layer to the underlying Linux kernel, and routing updates to the client daemons.

Quagga has a console interface to Zebra for advanced debugging of the routing protocols.

To access, enter:

```
root@VA_router:~# telnet localhost zebra


Entering character mode
Escape character is '^]'.



Hello, this is Quagga (version 0.99.21).
Copyright 1996-2005 Kunihiro Ishiguro, et al.



User Access Verification


Password:
```

To see OSPF routing from Zebra console, enter:

```
root@VA_router:~# sh ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, H - HSLS, o - OLSR,
       b - BATMAN, A - Babel,
       > - selected route, * - FIB route

K>* 0.0.0.0/0 via 10.206.4.65, usb0
O   10.1.0.0/16 [110/11] via 11.11.11.1, gre-GRE, 02:35:28
C>* 10.1.0.0/16 is directly connected, eth1
C>* 10.206.4.64/30 is directly connected, usb0
O   11.11.11.0/29 [110/10] is directly connected, gre-GRE, 02:35:29
C>* 11.11.11.0/29 is directly connected, gre-GRE
K>* 89.101.154.151/32 via 10.206.4.65, usb0
C>* 127.0.0.0/8 is directly connected, lo
C>* 192.168.100.0/24 is directly connected, eth0
O>* 192.168.101.1/32 [110/11] via 11.11.11.1, gre-GRE, 02:35:28
O>* 192.168.104.1/32 [110/20] via 11.11.11.4, gre-GRE, 02:30:45
O   192.168.105.1/32 [110/10] is directly connected, lo, 02:47:52
C>* 192.168.105.1/32 is directly connected, lo
```

22.8.1 OSPF debug console

When option `vty_enabled` is enabled in the OSPF configuration, the OSPF debug console can be accessed for advanced OSPF debugging. For more information, read the Global Settings section above.

To access OSPF debug console enter: `telnet localhost ospfd (password zebra)`

```
root@VA_router:~# telnet localhost ospfd


Entering character mode
Escape character is '^]'.


Hello, this is Quagga (version 0.99.21).
Copyright 1996-2005 Kunihiro Ishiguro, et al.


User Access Verification


Password:
```

To see OSPF routing from OSPF debug console, enter:

```
UUT> sh ip ospf route
============ OSPF network routing table ============
N    10.1.0.0/16           [11] area: 0.0.0.0
                           via 11.11.11.1, gre-GRE
N    11.11.11.0/29         [10] area: 0.0.0.0
                           directly attached to gre-GRE
N    192.168.101.1/32      [11] area: 0.0.0.0
                           via 11.11.11.1, gre-GRE
N    192.168.104.1/32      [20] area: 0.0.0.0
                           via 11.11.11.4, gre-GRE
N    192.168.105.1/32      [10] area: 0.0.0.0
                           directly attached to lo

============ OSPF router routing table =============

============ OSPF external routing table ===========
```

To see OSPF neighbours from OSPF debug console, enter:

```
root@VA_router:~# sh ip ospf neighbor


    Neighbor ID Pri State    Dead Time Address    Interface  RXmtL RqstL
DBsmL
1.1.1.1         255 Full/DR  33.961s 11.11.11.1   gre-GRE:11.11.11.5
0     0     0
```

To see OSPF interface details from OSPF debug console, enter:

```

root@VA_router:~# sh ip ospf interface
base0 is up
  ifindex 8, MTU 1518 bytes, BW 0 Kbit <UP,BROADCAST,RUNNING,MULTICAST>
  OSPF not enabled on this interface
eth0 is up
  ifindex 9, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,RUNNING,MULTICAST>
  OSPF not enabled on this interface
eth1 is up
```

```
  ifindex 10, MTU 1500 bytes, BW 0 Kbit
<UP,BROADCAST,RUNNING,PROMISC,MULTICAST>
  OSPF not enabled on this interface
eth2 is down
  ifindex 11, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth3 is down
  ifindex 12, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth4 is down
  ifindex 13, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth5 is down
  ifindex 14, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth6 is down
  ifindex 15, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth7 is down
  ifindex 16, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
gre-GRE is up
  ifindex 19, MTU 1472 bytes, BW 0 Kbit <UP,RUNNING,MULTICAST>
  Internet Address 11.11.11.5/29, Area 0.0.0.0
  MTU mismatch detection:enabled
  Router ID 192.168.105.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State Backup, Priority 1
  Designated Router (ID) 1.1.1.1, Interface Address 11.11.11.1
  Backup Designated Router (ID) 192.168.105.1, Interface Address 11.11.11.5
  Multicast group memberships: OSPFAllRouters OSPFDesignatedRouters
  Timer intervals configured, Hello 10s, Dead 40s, Wait 40s, Retransmit 5
    Hello due in 3.334s
  Neighbor Count is 1, Adjacent neighbor count is 1
gre0 is down
  ifindex 6, MTU 1476 bytes, BW 0 Kbit <NOARP>
  OSPF not enabled on this interface
ifb0 is down
```

```
  ifindex 2, MTU 1500 bytes, BW 0 Kbit <BROADCAST,NOARP>
  OSPF not enabled on this interface
ifb1 is down
  ifindex 3, MTU 1500 bytes, BW 0 Kbit <BROADCAST,NOARP>
  OSPF not enabled on this interface
lo is up
  ifindex 1, MTU 16436 bytes, BW 0 Kbit <UP,LOOPBACK,RUNNING>
  Internet Address 192.168.105.1/32, Broadcast 192.168.105.1, Area 0.0.0.0
  MTU mismatch detection:enabled
  Router ID 192.168.105.1, Network Type LOOPBACK, Cost: 10
  Transmit Delay is 1 sec, State Loopback, Priority 1
  No designated router on this network
  No backup designated router on this network
  Multicast group memberships: <None>
  Timer intervals configured, Hello 10s, Dead 40s, Wait 40s, Retransmit 5
    Hello due in inactive
  Neighbor Count is 0, Adjacent neighbor count is 0
sit0 is down
  ifindex 7, MTU 1480 bytes, BW 0 Kbit <NOARP>
  OSPF not enabled on this interface
teql0 is down
  ifindex 4, MTU 1500 bytes, BW 0 Kbit <NOARP>
  OSPF not enabled on this interface
tunl0 is down
  ifindex 5, MTU 1480 bytes, BW 0 Kbit <NOARP>
  OSPF not enabled on this interface
usb0 is up
  ifindex 17, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,RUNNING,MULTICAST>
  OSPF not enabled on this interface
```

To see OSPF database details from OSPF debug console, enter:

```
root@VA_router:~# sh ip ospf database

       OSPF Router with ID (192.168.105.1)

                Router Link States (Area 0.0.0.0)

```

```
Link ID         ADV Router      Age  Seq#       CkSum  Link count
1.1.1.1         1.1.1.1          873 0x80006236 0xd591 3
192.168.104.1   192.168.104.1    596 0x8000000a 0x3a2d 2
192.168.105.1   192.168.105.1    879 0x8000000b 0x4919 2

                Net Link States (Area 0.0.0.0)

Link ID         ADV Router      Age  Seq#       CkSum
11.11.11.1      1.1.1.1          595 0x80000004 0x5712
```

23 Configuring VRRP

23.1 Overview

Virtual Router Redundancy Protocol (VRRP) is a networking protocol designed to eliminate the single point of failure inherent in the static default routed environment.

VRRP specifies an election protocol that dynamically assigns responsibility for a virtual router to one of the VRRP routers on a LAN. The VRRP router controlling the IP address(es) associated with a virtual router is called the Master, and forwards packets sent to these IP addresses. The election process provides dynamic failover in the forwarding responsibility from the Master to a backup router should the Master become unavailable. This process allows the virtual router IP address(es) on the LAN to be used as the default first hop router by end hosts. The advantage gained from using VRRP is a higher availability default path without requiring configuration of dynamic routing or router discovery protocols on every end host.

Two or more routers forming the redundancy cluster are configured with the same router ID and virtual IP address. A VRRP router group operates within the scope of the single LAN. Additionally, the VRRP routers are configured with its initial role (Master or Backup) and the router priority, which is a factor in the master router election process. You can also configure a password authentication to protect VRRP protocol messages against spoofing.

The VRRP protocol is implemented according to internet standard RFC2338.

23.2 Configuration package used

Package	Sections
vrrp	main vrrp_group

23.3 Configuring VRRP using the web interface

To configure VRRP through the web interface, in the top menu, select **Network -> VRRP**. The VRRP page appears.

There are two sections in the VRRP page:

Section	Description
Global Settings	Enables VRRP
VRRP Group Configuration	Configures the VRRP group settings.

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23.3.1 Global settings

The Global Settings section configures the vrrp package main section.

To access configuration settings, click **ADD**.

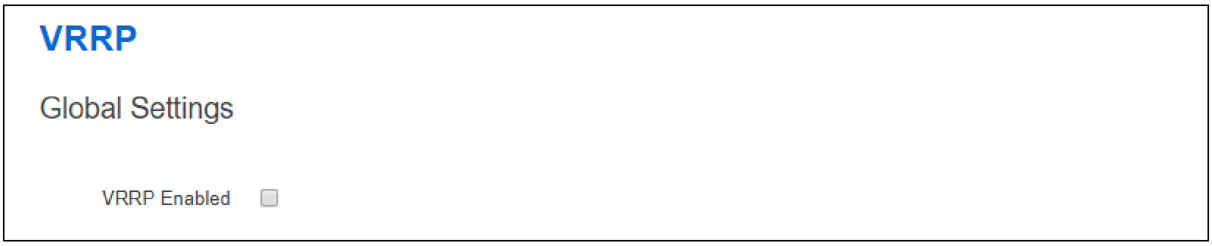

Figure 110: The VRRP global settings configuration page

Web Field/UCI/Package Option	Description	
Web: VRRP Enabled UCI: vrrp.main.enabled Opt: Enabled	Globally enables VRRP on the router.	
	0	Disabled.
	1	Enabled.

23.3.2 VRRP group configuration settings

The VRRP Group Configuration section configures vrrp package vrrp_group section.

To access configuration settings, enter a VRRP group name and click **ADD**.

Figure 111: The VRRP group name configuration page

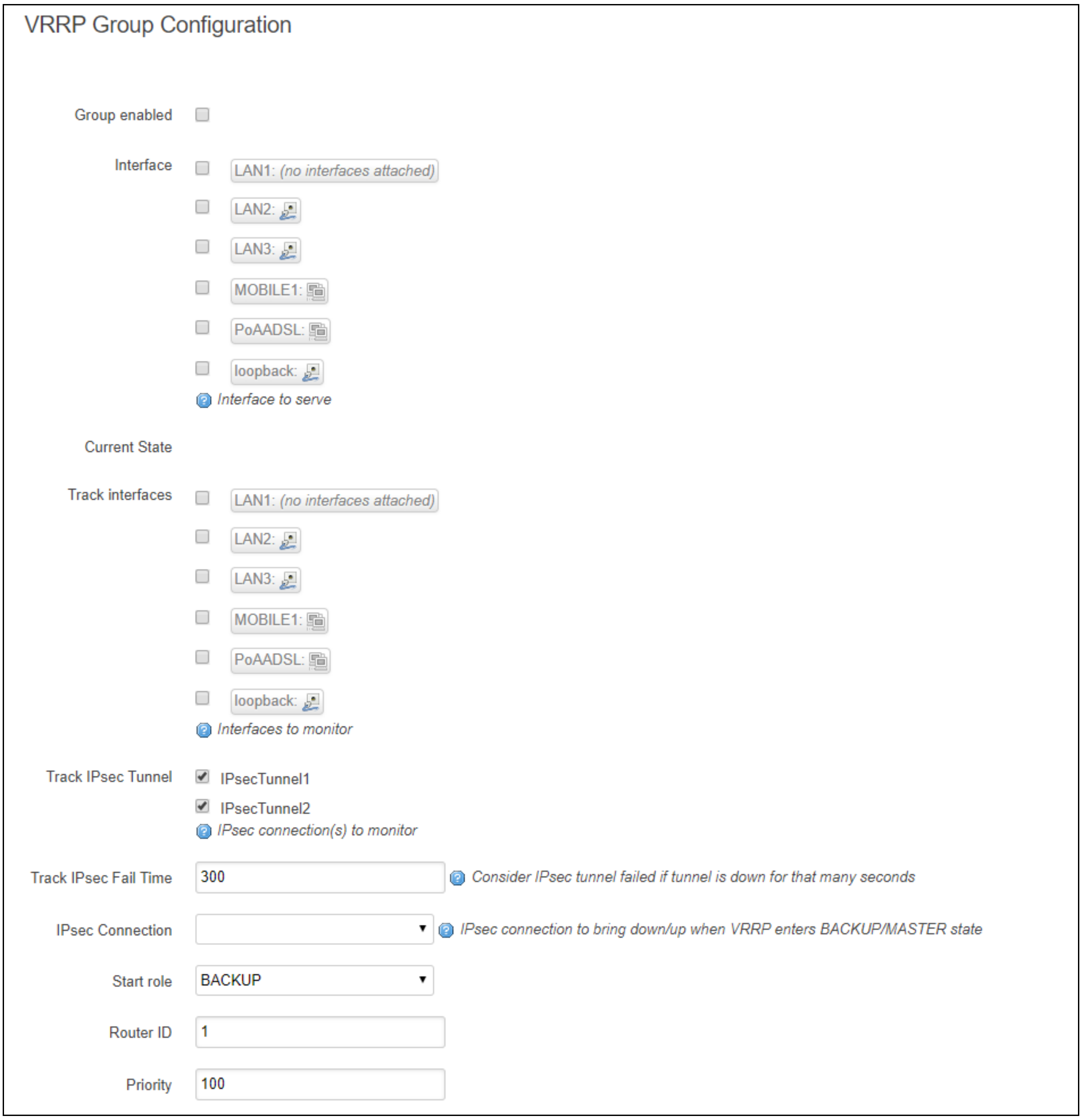

Figure 112: The VRRP group configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Group Enabled
UCI: vrrp.@vrrp_group[X].enabled
Opt: Enabled</td><td>Enables a VRRP group on the router.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Interface
UCI: vrrp.@vrrp_group[X].interface
Opt: interface</td><td>Sets the local LAN interface name in which the VRRP cluster is to operate. For example, ‘lan’. The interface name is taken from the network package and all configured interfaces will be displayed.<table><tr><td>lan</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Web: Track Interfaces
UCI: vrrp.@vrrp_group[X].track_iface
Opt: list track_iface
	Defines one or more WAN interfaces that VRRP should monitor. If a monitored interface goes down on the master VRRP router, it goes into 'Fault' state and the backup VRRP router becomes the master.
	Multiple interfaces are entered using `uci set` and `uci add_list` commands. Example:
	`uci set vrrp.@vrrp_group[0].track_iface=wan1`
	`uci add_list vrrp.@vrrp_group[0].track_iface=wan2`
	or using a list of options via package options
	`list track_iface 'wan1'`
	`list track_iface 'wan2'`
	<table><tr><td>wan</td><td></td></tr><tr><td>Range</td><td></td></tr></table>

Web: Track IPsec Tunnel
UCI: vrrp.@vrrp_group[X].track_ipsec
Opt: list track_ipsec
	Defines one or more IPSec tunnels that VRRP should monitor. If a monitored tunnel goes down on the master VRRP router for the configured Track IPSec Fail Time, it goes into 'Fault' state and the backup VRRP router becomes the master.
	Multiple IPSec connections are entered using `uci set` and `uci add_list` commands. Example:
	`uci set vrrp.@vrrp_group[0].track_ipsec=Tunnel1`
	`uci add_list vrrp.@vrrp_group[0].track_ipsec=Tunnel2`
	or using a list of options via package options
	`list track_ipsec 'Tunnel1'`
	`list track_ipsec 'Tunnel2'`
	<table><tr><td>Blank</td><td>No IPSec connection to track.</td></tr><tr><td>Range</td><td></td></tr></table>

Web: Track IPsec Fail Time UCI: vrrp.@vrrp_group[X]. track_ipsec_fail_sec Opt: track_ipsec_fail_sec	Defines duration in seconds to determine IPSec tunnel failure. <table><tr><td>300</td><td>300 seconds</td></tr><tr><td>Range</td><td></td></tr></table>
Web: IPSec connection UCI: vrrp.@vrrp_group[X].ipsec_connection Opt: ipsec_connection	Sets which IPSec connection to bring up or down when VRRP enters 'backup/master' state. Multiple IPSec connections are entered via the package option using a space separator. Example: `option ipsec_connection 'IPSecTunnel1 IPSecTunnel2'` <table><tr><td>Blank</td><td>No IPSec connection to toggle.</td></tr><tr><td>Range</td><td></td></tr></table>
Web: Start role UCI: vrrp.@vrrp_group[X].init_state Opt: init_state	Sets the initial role in which a VRRP router starts up. In a cluster of VRRP routes, set one as a master and the others as backup. <table><tr><td>BACKUP</td><td></td></tr><tr><td>MASTER</td><td></td></tr></table>
Web: Router ID UCI: vrrp.@vrrp_group[X].router_id Opt: router_id	Sets the VRRP router ID (1 to 255). All co-operating VRRP routers serving the same LAN must be configured with the same router ID. <table><tr><td>1</td><td></td></tr><tr><td>Range</td><td>1-255</td></tr></table>
Web: Priority UCI: vrrp.@vrrp_group[X].priority Opt: priority	Sets the VRRP router's priority. Higher values equal higher priority. The VRRP routers must use priority values between 1-254. The master router uses a higher priority. <table><tr><td>100</td><td></td></tr><tr><td>Range</td><td>0-255</td></tr></table>
Web: Advert intvl UCI: vrrp.@vrrp_group[X].advert_int_sec Opt: advert_int_sec	Sets the VRRP hello value in seconds. This value must match the value set on a peer. <table><tr><td>120</td><td>120 seconds</td></tr><tr><td>Range</td><td></td></tr></table>

Web: Password UCI: vrrp.@vrrp_group[X].password Opt: password	Sets the password to use in the VRRP authentication (simple password authentication method). This field may be left blank if no authentication is required.
Web: Virtual IP UCI: vrrp.@vrrp_group[X].virtual_ipaddr Opt: virtual_ipaddr	Sets the virtual IP address and mask in prefix format. For example, '11.1.1.99/24'. All co-operating VRRP routers serving the same LAN must be configured with the same virtual IP address.
Web: GARP delay UCI: vrrp.@vrrp_group[X].garp_delay_sec Opt: garp_delay_sec	Sets the gratuitous ARP message sending delay in seconds. 5 — 5 seconds Range —

Table 67: Information table for VRRP group settings

23.4 Configuring VRRP using command line

The configuration file is stored on /etc/config/vrrp.

There are two config sections: main and vrrp_group.

You can configure multiple VRRP groups. By default, all VRRP group instances are named 'vrrp_group'. Instances are identified by `@vrrp_group` then the vrrp_group position in the package as a number. For example, for the first vrrp_group in the package using UCI:

```
vrrp.@vrrp_group[0]=vrrp_group
vrrp.@vrrp_group[0].enabled=1
```

Or using package options:

```
config vrrp_group
        option enabled '1'
```

However, to better identify, it is recommended to give the vrrp_group instance a name. For example, to define a vrrp_group instance named 'g1' using UCI, enter:

```
vrrp.g1.vrrp_group
vrrp.g1.enabled=1
```

To define a named keepalive instance using package options, enter:

```
config vrrp_group 'g1'
        option enabled '1'
```

23.4.1 VRRP using UCI

To view the configuration in UCI format, enter:

```
root@VA_router:~# uci show vrrp
vrrp.main=vrrp
vrrp.main.enabled=yes
vrrp.g1=vrrp_group
vrrp.g1.enabled=yes
vrrp.g1.interface=lan
vrrp.g1.track_iface=WAN MOBILE
vrrp.g1.init_state=BACKUP
vrrp.g1.router_id=1
vrrp.g1.priority=100
vrrp.g1.advert_int_sec=120
vrrp.g1.password=secret
vrrp.g1.virtual_ipaddr=10.1.10.150/16
vrrp.g1.garp_delay_sec=5
vrrp.g1.ipsec_connection=Test
vrrp.g1.track_ipsec=conn1 conn2
```

23.4.2 VRRP using package options

To view the configuration in package option format, enter:

```
root@VA_router:~# uci export vrrp
package vrrp

config vrrp 'main'
        option enabled 'yes'

config vrrp_group 'g1'
        option enabled 'yes'
        option interface 'lan'
        list track_iface 'WAN'
        list track_iface 'MOBILE'
        option init_state 'BACKUP'
        option router_id '1'
        option priority '100'
        option advert_int_sec '120'
```

```
        option password 'secret'
        option virtual_ipaddr '10.1.10.150/16'
        option garp_delay_sec '5'
       option ipsec_connection 'Test'
        list track_ipsec 'conn1'
        list track_ipsec 'conn2'
```

23.5 VRRP diagnostics

23.5.1 VRRP process using UCI

The VRRP process has its own subset of commands.

```
root@VA_router:~# /etc/init.d/vrrp
Syntax: /etc/init.d/vrrp [command]
```

Available commands:

```
        start   Start the service
        stop    Stop the service
        restart Restart the service
        reload  Reload configuration files (or restart if that fails)
        enable  Enable service autostart
        disable Disable service autostart
```

To restart VRRP, enter:

```
root@VA_router:~# /etc/init.d/vrrp restart
```

24 Configuring Routing Information Protocol (RIP)

24.1 Introduction

RIP is a dynamic routing algorithm used on IP-based internet networks.

A distance vector routing algorithm is used by RIP to assist in maintaining network convergence. It uses a metric or 'hop' count as the only routing criteria. Each route is advertised with the number of hops a datagram would take to reach the destination network. The maximum metric for RIP is 15. This limits the size of the network that RIP can support. Smaller metrics are more efficient based on the cost associated with each metric.

RIP protocol is most useful as an Interior Gateway Protocol (IGP). An IGP refers to the routing protocol used within a single autonomous system. There may be a number of autonomous systems, using different routing protocols, combined together to form a large network.

In most networking environments, RIP is not the preferred choice for routing as its time to converge and scalability are poor compared to EIGRP or OSPF.

24.1.1 RIP characteristics

RIP is a standardised distance vector protocol, designed for use on smaller networks. RIP was one of the first true distance vector routing protocols and is supported on a wide variety of systems.

RIP adheres to the following distance vector characteristics:

- RIP sends out periodic routing updates, every 30 seconds
- RIP sends out the full routing table every periodic update
- RIP uses a form of distance as its metric, in this case, hopcount
- RIP uses the Bellman-Ford distance vector algorithm to determine the best path to a particular destination

Other characteristics of RIP include:

- RIP supports IP and IPX routing
- RIP utilises UDP port 520
- RIP routes have an administrative distance of 120
- RIP has a maximum hopcount of 15 hops. Any network that is 16 hops away or more is considered unreachable to RIP, thus the maximum diameter of the network is 15 hops. A metric of 16 hops in RIP is considered a poison route or infinity metric.

If multiple paths exist to a particular destination, RIP will load balance between those paths, by default, up to 4, only if the metric (hopcount) is equal. RIP uses a round-robin system of load balancing between equal metric routes, which can lead to pinhole congestion.

For example, two paths might exist to a particular destination, one going through a 9600 baud link, the other via a T1. If the metric (hopcount) is equal, RIP will load balance, sending an equal amount of traffic down the 9600 baud link and the T1. This will cause the slower link to become congested.

24.1.2 RIP versions

RIP has two versions, Version 1 (RIPv1) and Version2 (RIPv2).

RIPv1 (RFC 1058) is classful, and therefore does not include the subnet mask with its routing table updates. Because of this, RIPv1 does not support Variable Length Subnet Masks (VLSMs). When using RIPv1, networks must be contiguous, and subnets of a major network must be configured with identical subnet masks. Otherwise, route table inconsistencies or worse will occur.

RIPv1 sends updates as broadcasts to address 255.255.255.255.

RIPv2 (RFC 2453) is classless, and therefore does include the subnet mask with its routing table updates. RIPv2 fully supports VLSMs, allowing discontinuous networks and varying subnet masks to exist.

Other enhancements offered by RIPv2 include:

- Routing updates are sent via multicast, using address 224.0.0.9
- Encrypted authentication can be configured between RIPv2 routers
- Route tagging is supported

RIPv2 can interoperate with RIPv1. By default:

- RIPv1 routers will sent only Version 1 packets
- RIPv1 routers will receive both Version 1 and 2 updates
- RIPv2 routers will both send and receive only Version 2 updates

Virtual Access **ripd** package supports RIP version 2 as described in RFC2453 and RIP version 1 as described in RFC1058. It is part of Quagga suite of applications for routing.

24.2 Configuration package used

Package	Sections
ripd	routing interface key_chain offset

24.3 Configuring RIP using the web interface

To configure RIP using the web interface, select **Network -> RIP**. The RIP page appears.

There are four sections in the RIP page.

Section	Description
Global Settings	Enables RIP and configures the RIP routing section containing global configuration parameters. The web automatically names the routing section `ripd`
Interfaces Configuration	Configures the `interface` sections. Defines interface configuration for RIP and interface specific parameters.
Offset Configuration	Configures the `offset` sections for metric manipulation.
MD5 Authentication Key Chains	Configures the `key_chain` sections. Defines MD5 authentication settings.

24.3.1 Global settings

The web browser automatically names the routing section 'ripd'.

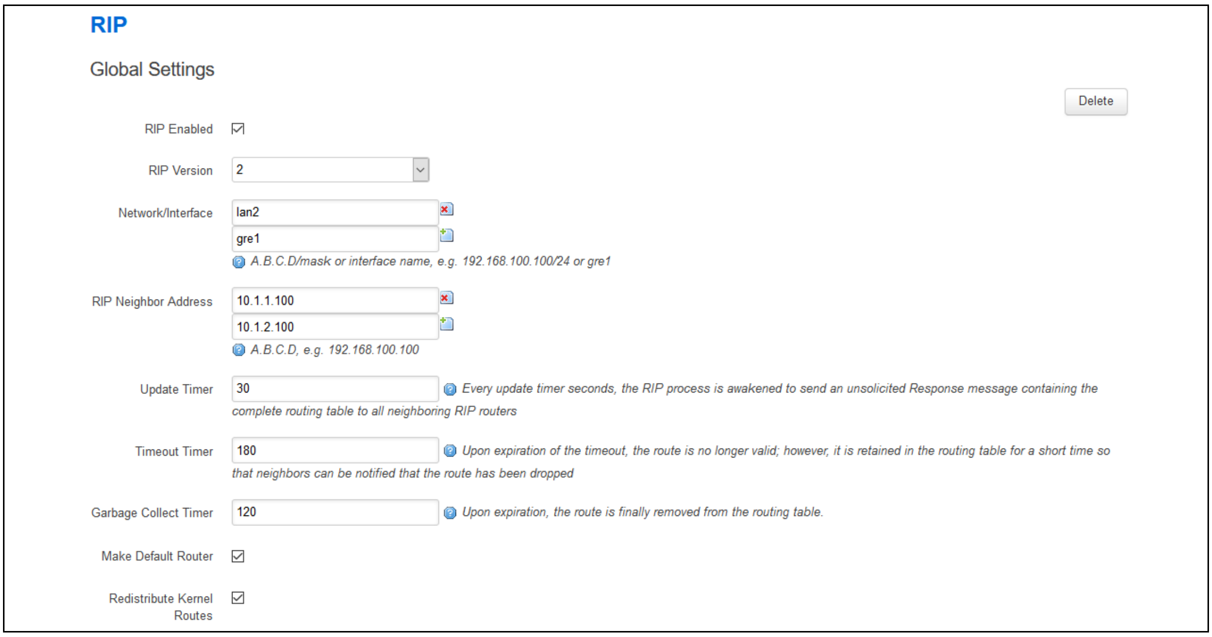

Figure 113: The RIP global settings configuration page

Web Field/UCI/Package Option	**Description**
Web: RIP Enabled UCI: ripd.ripd.enabled Opt: enabled	Enables RIP advertisements on router. 0 — Disabled. 1 — Enabled.
Web: RIP Version UCI: ripd.ripd.version Opt: version	Specifies the RIP version that will be used. Version 2 is recommended. 1 — RIP version 1 2 — RIP version 2

Web: Network/Interface
UCI: ripd.ripd.network
Opt: list network
	Defines the list of the interfaces that will be used to advertise RIP packets.
	Format: A.B.C.D/mask or interface name
	Multiple RIP interfaces are entered using `uci set` and `uci add_list` commands. Example:
	`uci set ripd.ripd.network=lan1`
	`uci add_list ripd.ripd.network=lan2`
	or using a list of options via package options
	`list network 'lan1'`
	`list network 'lan2'`

Web: RIP Neighbor Address
UCI: ripd.ripd.neighbor
Opt: list neighbor
	Specifies the list of RIP neighbours. When a neighbour does not understand multicast, this command is used to specify neighbours. In some cases, not all routers will be able to understand multicasting, where packets are sent to a network or a group of addresses. In a situation where a neighbour cannot process multicast packets, it is necessary to establish a direct link between routers. The neighbour command allows the network administrator to specify a router as a RIP neighbour.
	Multiple RIP neighbours are entered using `uci set` and `uci add_list` commands. Example:
	`uci set ripd.ripd.neighbor=1.1.1.1`
	`uci add_list ripd.ripd.neighbor=2.2.2.2`
	or using a list of options via package options
	`list neighbor '1.1.1.1'`
	`list neighbor '2.2.2.2'`

Web: Update Timer UCI: ripd.ripd.tb_update_sec Opt: tb_update_sec	Every update timer seconds, the RIP process is awakened to send an unsolicited response message containing the complete routing table to all neighbouring RIP routers. 30 Range
Web: Timeout Timer UCI: ripd.ripd.tb_timeout_sec Opt:tb_timeout_sec	Defines timeout in seconds. Upon expiration of the timeout, the route is no longer valid; however, it is retained in the routing table for a short time so that neighbours can be notified that the route has been dropped. 180 Range
Web: Garbage Collect Timer UCI: ripd.ripd.tb_garbage_sec Opt: tb_garbage_sec	Upon expiration of the garbage-collection timer, the route is finally removed from the routing table. This timer starts when Timeout timer expires or when route is advertised as "unreachable". The reason for using this two-stage marking and deleting removal method is to give the router that declared the route no longer reachable a chance to propagate this information to other routers. When the timer expires the route is deleted. If during the garbage collection period a new RIP response for the route is received, then the deletion process is aborted: the garbage-collection timer is cleared, the route is marked as valid again, and a new Timeout timer starts. 120 Range

Web: Make Default Router UCI: ripd.ripd.default_info_originate Opt: default_info_originate	Advertising a default route via RIP. 0 — Disable. 1 — Enable.
Web: Redistribute Kernel Routes UCI: ripd.ripd.redistribute_kernel_routes Opt: redistribute_kernel_routes	Redistributes routing information from kernel route entries into the RIP tables. 0 — Disable. 1 — Enable.
Web: n/a UCI: ripd.ripd.vty_enabled Opt: vty_enabled	Enable vty for RIPd (telnet to localhost:2602).

Table 68: Information table for RIP global settings

24.3.2 Offset configuration

This section is used for RIP metric manipulation. RIP metric is a value for distance in the network. Usually, ripd package increments the metric when the network information is received. Redistributed routes' metric is set to 1.

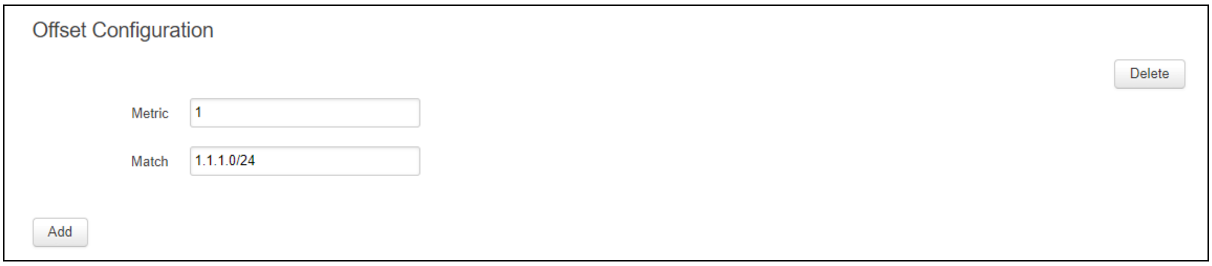

Figure 114: The RIP global settings configuration page

Web Field/UCI/Package Option	Description
Web: Metric UCI: ripd.@offset[0].metric Opt: metric	Defines the metric offset value. This modifies the default metric value for redistributed and connected routes. 1 Range
Web: Match UCI: ripd.@offset[0].match_network Opt: match_network	Defines the prefixes to match. Format: A.B.C.D/mask

Table 69: Information table for RIP offset commands

24.3.3 Interfaces configuration

Figure 115: The RIP interfaces configuration page

Web Field/UCI/Package Option	Description
Web: Interface UCI: ripd.@interface[0].rip_interface Opt: rip_interface	Specifies the interface name.
Web: Split Horizon UCI: ripd.@interface[0].split_horizon Opt: split_horizon	Prohibits the router from advertising a route back onto the interface from which it was learned. 0: Disable. 1: Enable.
Web: Poison Reverse UCI: ripd.@interface[0].poison_reverse Opt: poison_reverse	Router tells its neighbour gateways that one of the gateways is no longer connected. Notifies the gateway, setting the hop count to the unconnected gateway to 16 which would mean "infinite". 0: Disable. 1: Enable.
Web: Passive UCI: ripd.@interface[0].passive Opt: passive	Sets the specified interface to passive mode. On passive mode interface, all receiving packets are processed as normal and ripd does not send either multicast or unicast RIP packets except to RIP neighbour specified with a neighbour command. 0: Disable 1: Enable
Web: Authentication UCI: ripd.@interface[0].auth_mode Opt: auth_mode	RIPv2 (only) allows packets to be authenticated via either an insecure plain text password, included with the packet, or via a more secure MD5 based HMAC (keyed-Hashing for Message AuthentiCation). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire RIP routing table, to be queried remotely, potentially by anyone on the internet, via RIPv1. no: Default value. No authentication. md5: Sets the interface with RIPv2 MD5 authentication. text: Sets the interface with RIPv2 simple password authentication.
Web: Text Auth. Key UCI: ripd.@interface[0].auth_key Opt: auth_key	This command sets the authentication string for text authentication. The string must be shorter than 16 characters.
Web: MD5 Key Chain Name UCI: ripd.@interface[0].key_chain Opt: key_chain	Specifiy Keyed MD5 chain.

Table 70: Information table for RIP interface configuration

24.3.4 MD5 authentication key chains

RIPv2 (only) allows packets to be authenticated using either an insecure plain text password, included with the packet, or by a more secure MD5 based HMAC (keyed-Hashing for Message AuthentiCation). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire RIP routing table, to be queried remotely, potentially by anyone on the internet, using RIPv1.

This section defines key_chains to be used for MD5 authentication.

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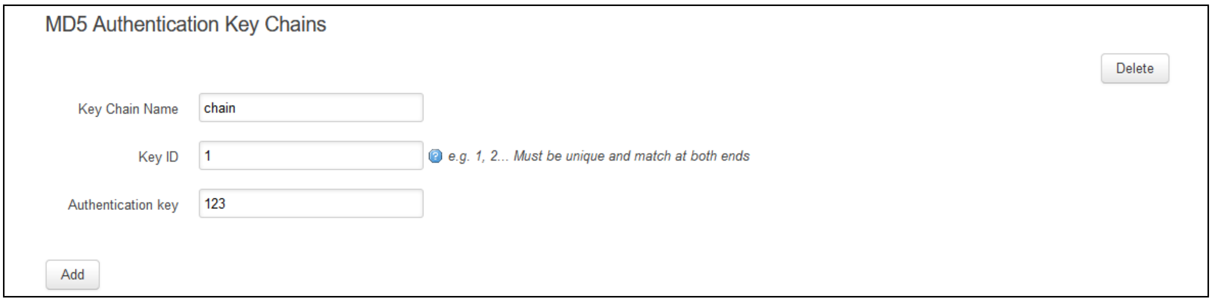

Figure 116: The MD5 authentication key chains configuration section

Web Field/UCI/Package Option	Description
Web: Key Chain Name UCI: ripd.@key_chain[0].key_chain_name Opt: key_chain_name	Specifies the chain name.
Web: Key ID UCI: ripd.@key_chain[0].key_id Opt: key_id	Specifies the key ID. Must be unique and match at both ends.
Web: Authentication key UCI: ripd.@key_chain[0].auth_key Opt: auth_key	Specifies the keyed MD5 chain.

Table 71: Information table for MD5 authentication key chains commands

24.4 Configuring RIP using command line

RIP is configured under the ripd package **/etc/config/ripd.**

There are four config sections ripd, interface, key_chain and offset.

You can configure multiple interface, key_chain and offset sections.

By default, all RIP interface instances are named interface, it is identified by `@interface` then the interface position in the package as a number. For example, for the first interface in the package using UCI:

```
ripd.@interface[0]=interface

ripd.@interface[0].rip_interface=lan
```

Or using package options:

```
config interface

      option rip_interface 'lan'
```

By default, all RIP key_chain instances are named key_chain, it is identified by `@key_chain` then the key_chain position in the package as a number. For example, for the first key_chain in the package using UCI:

```
ripd.@key_chain[0]=key_chain

ripd.@key_chain[0].key_chain_name=Keychain1
```

Or using package options:

```
config key_chain
      option key_chain_name 'Keychain1'
```

By default, all RIP offset instances are named offset, it is identified by `@offset` then the offset position in the package as a number. For example, for the first offset in the package using UCI:

```
ripd.@offset[0]=offset
ripd.@offset[0].metric=1
```

Or using package options:

```
config offset
      option metric '1'
```

24.4.1 RIP using UCI

```
root@VA_router:~# uci show ripd
ripd.ripd=routing
ripd.ripd.version=2
ripd.ripd.enabled=yes
ripd.ripd.network=lan2 gre1
ripd.ripd.neighbor=10.1.1.100 10.1.2.100
ripd.ripd.tb_update_sec=30
ripd.ripd.tb_timeout_sec=180
ripd.ripd.tb_garbage_sec=120
ripd.ripd.default_info_originate=yes
ripd.ripd.redistribute_kernel_routes=yes
ripd.@interface[0]=interface
ripd.@interface[0].rip_interface=lan
ripd.@interface[0].auth_mode=no
ripd.@interface[0].split_horizon=1
ripd.@interface[0].poison_reverse=0
ripd.@interface[0].passive=0
ripd.@interface[1]=interface
ripd.@interface[1].rip_interface=lan2
ripd.@interface[1].split_horizon=1
ripd.@interface[1].poison_reverse=0
```

```
ripd.@interface[1].passive=0
ripd.@interface[1].auth_mode=text
ripd.@interface[1].auth_key=secret
ripd.@interface[2]=interface
ripd.@interface[2].rip_interface=lan3
ripd.@interface[2].split_horizon=1
ripd.@interface[2].poison_reverse=0
ripd.@interface[2].passive=0
ripd.@interface[2].auth_mode=md5
ripd.@interface[2].key_chain=Keychain1
ripd.@key_chain[0]=key_chain
ripd.@key_chain[0].key_chain_name=Keychain1
ripd.@key_chain[0].key_id=1
ripd.@key_chain[0].auth_key=123
ripd.@offset[0]=offset
ripd.@offset[0].metric=1
ripd.@offset[0].match_network=10.1.1.1/24
```

24.4.2 RIP using package options

```
root@VA_router:~# uci export ripd
package ripd

config routing 'ripd'
        option version '2'
        option enabled 'yes'
        list network 'lan2'
        list network 'gre1'
        list neighbor '10.1.1.100'
        list neighbor '10.1.2.100'
        option tb_update_sec '30'
        option tb_timeout_sec '180'
        option tb_garbage_sec '120'
        option default_info_originate 'yes'
        option redistribute_kernel_routes 'yes'

config interface
```

```
        option rip_interface 'lan'
        option auth_mode 'no'
        option split_horizon '1'
        option poison_reverse '0'
        option passive '0'

config interface
        option rip_interface 'lan2'
        option split_horizon '1'
        option poison_reverse '0'
        option passive '0'
        option auth_mode 'text'
        option auth_key 'textsecret'

config interface
        option rip_interface 'lan3'
        option split_horizon '1'
        option poison_reverse '0'
        option passive '0'
        option auth_mode 'md5'
        option key_chain 'keychain1'

config key_chain
        option key_chain_name 'Keychain1'
        option key_id '1'
        option auth_key '123'

config offset
      option metric '1'
      option match_network '10.1.1.1/24'
```

24.5 RIP diagnostics

24.5.1 Route status

To show the current routing status, enter:

```
root@VA_router:~#
route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use
Iface
0.0.0.0         10.205.154.65   0.0.0.0         UG    1      0      0 usb0
10.1.0.0        0.0.0.0         255.255.0.0     U     0      0      0 eth1
10.205.154.64   0.0.0.0         255.255.255.252 U     0      0      0 usb0
11.11.11.0      0.0.0.0         255.255.255.248 U     0      0      0 gre-
GRE
89.101.154.151  10.205.154.65   255.255.255.255 UGH   0      0      0 usb0
192.168.100.0   0.0.0.0         255.255.255.0   U     0      0      0 eth0
192.168.104.1   11.11.11.4      255.255.255.255 UGH   3      0      0 gre-
GRE
192.168.154.154 11.11.11.1      255.255.255.255 UGH   2      0      0 gre-
GRE
```

Note: a route will only be displayed in the routing table when the interface is up.

24.5.2 Tracing RIP packets

RIP uses UDP port 520. To trace RIP packets on any interface on the router, enter:
`tcpdump -i any -n -p port 520 &`

```
root@VA_router:~# tcpdump -i any -n -p port 520 &
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 65535
bytes
```

To stop tracing enter `fg` to bring tracing task to foreground, and then **<CTRL-C>** to stop the trace.

```
root@VA_router:~# fg
tcpdump -i any -n -p port 67
^C
33 packets captured
33 packets received by filter
0 packets dropped by kernel
```

24.5.3 Quagga/Zebra console

Quagga is the routing protocol suite embedded in the router firmware. Quagga is split into different daemons for implementation of each routing protocol. Zebra is a core daemon for Quagga, providing the communication layer to the underlying Linux kernel, and routing updates to the client daemons.

Quagga has a console interface to Zebra for advanced debugging of the routing protocols.

To access, enter: `telnet localhost zebra` (password: zebra)

```
root@VA_router:~# telnet localhost zebra


Entering character mode

Escape character is '^]'.



Hello, this is Quagga (version 0.99.21).

Copyright 1996-2005 Kunihiro Ishiguro, et al.



User Access Verification


Password:
```

To see RIP routing information from Zebra console, enter:

```
root@VA_router:~# sh ip route

Codes: K - kernel route, C - connected, S - static, R - RIP,

       O - OSPF, I - IS-IS, B - BGP, P - PIM, H - HSLS, o - OLSR,

       b - BATMAN, A - Babel,

       > - selected route, * - FIB route


K>* 0.0.0.0/0 via 10.205.154.65, usb0

C>* 10.1.0.0/16 is directly connected, eth1

C>* 10.205.154.64/30 is directly connected, usb0

C>* 11.11.11.0/29 is directly connected, gre-GRE

K>* 89.101.154.151/32 via 10.205.154.65, usb0

C>* 127.0.0.0/8 is directly connected, lo

C>* 192.168.100.0/24 is directly connected, eth0

R>* 192.168.104.1/32 [120/3] via 11.11.11.4, gre-GRE, 15:54:47
```

```
C>* 192.168.105.1/32 is directly connected, lo
R>* 192.168.154.154/32 [120/2] via 11.11.11.1, gre-GRE, 16:09:51
```

24.5.4 RIP debug console

When option `vty_enabled` (see Global settings section above) is enabled in the RIP configuration, RIP debug console can be accessed for advanced RIP debugging.

To access RIP debug console enter: `telnet localhost ripd` (password zebra)

```
root@VA_router:~# telnet localhost ripd

Entering character mode
Escape character is '^]'.


Hello, this is Quagga (version 0.99.21).
Copyright 1996-2005 Kunihiro Ishiguro, et al.


User Access Verification

Password:
```

To see RIP status from RIP debug console, enter:

```
root@VA_router:~# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface

     Network            Next Hop         Metric From            Tag Time
C(i) 11.11.11.0/29      0.0.0.0               1 self              0
R(n) 192.168.104.1/32   11.11.11.4            3 11.11.11.1        0 02:48
C(i) 192.168.105.1/32   0.0.0.0               1 self              0
R(n) 192.168.154.154/32 11.11.11.1            2 11.11.11.1        0 02:48
```

To see RIP status from RIP debug console, enter:

```
root@VA_router:~# sh ip rip status
Routing Protocol is "rip"
  Sending updates every 30 seconds with +/-50%, next due in 17 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Default redistribution metric is 1
  Redistributing:
  Default version control: send version 2, receive version 2
    Interface        Send  Recv   Key-chain
    gre-GRE          2     2
    lo               2     2
  Routing for Networks:
    11.0.0.0/8
    192.168.105.1/32
  Routing Information Sources:
    Gateway          BadPackets BadRoutes  Distance Last Update
    11.11.11.1               0         0       120   00:00:20
  Distance: (default is 120)
```

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25 Configuring Multi-WAN

Multi-WAN is used for managing WAN interfaces on the router, for example, 3G interfaces to ensure high availability. You can customise Multi-WAN for various needs, but its main use is to ensure WAN connectivity and provide a failover system in the event of failure or poor coverage.

Multi-WAN periodically does a health check on the interface. A health check comprises of a configurable combination of the following:

- interface state
- pings to an ICMP target
- signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks, results in a fail. After a configurable number of health check failures, Multi-WAN will move to the next highest priority interface. Multi-WAN will optionally stop the failed interface and start the new interface, if required.

In some circumstances, particularly in mobile environments, it is desirable for a primary interface to be used whenever possible. In this instance Multi-WAN will perform a health check on the primary interface after a configurable period. If the health checks pass for the configured number of recovery health checks then the primary will be used.

25.1 Configuration package used

Package	Sections
multiwan	config wan

25.2 Configuring Multi-WAN using the web interface

In the top menu, select **Network -> Multi-Wan**. The Multi-WAN page appears.

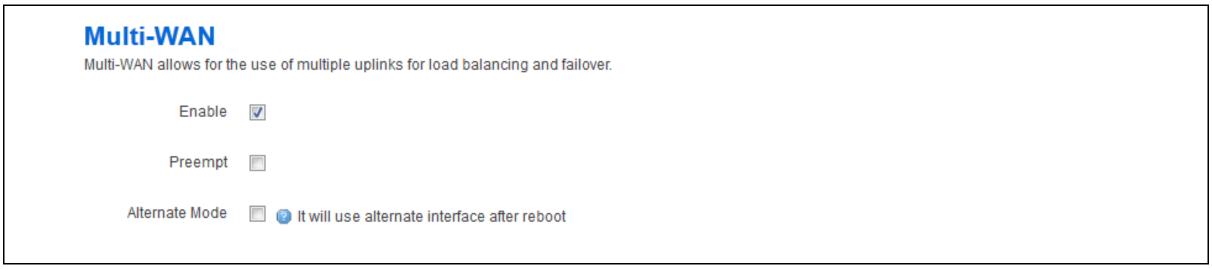

Figure 117: The multi-WAN page

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Web Field/UCI/Package Option	Description
Web: Enable UCI: multiwan.config.enabled Opt: enabled	Enables or disables Multi-WAN. 0 — Disabled. 1 — Enabled.
Web: Preempt UCI: multiwan.config.preempt Opt: preempt	Enables or disables pre-emption for Multi-WAN. If enabled the router will keep trying to connect to a higher priority interface depending on timer set by ifup_retry_sec 0 — Disabled. 1 — Enabled.
Web: Alternate Mode UCI: multiwan.config.alt_mode Opt: alt_mode	Enables or disables alternate mode for Multi-WAN. If enabled the router will use an alternate interface after reboot. 0 — Disabled. 1 — Enabled.

Table 72: Information table for multi-WAN page

When you have enabled Multi-WAN, you can add the interfaces that will be managed by Multi-WAN, for example 3G interfaces.

The name used for Multi-WAN must be identical, including upper and lowercases, to the actual interface name defined in your network configuration. To check the names and settings are correct, select **Network -> Interfaces** and view the Interfaces Overview page.

In the WAN interfaces section, enter the name of the WAN interface to configure, and then click **Add**. The new section for configuring specific parameters appears.

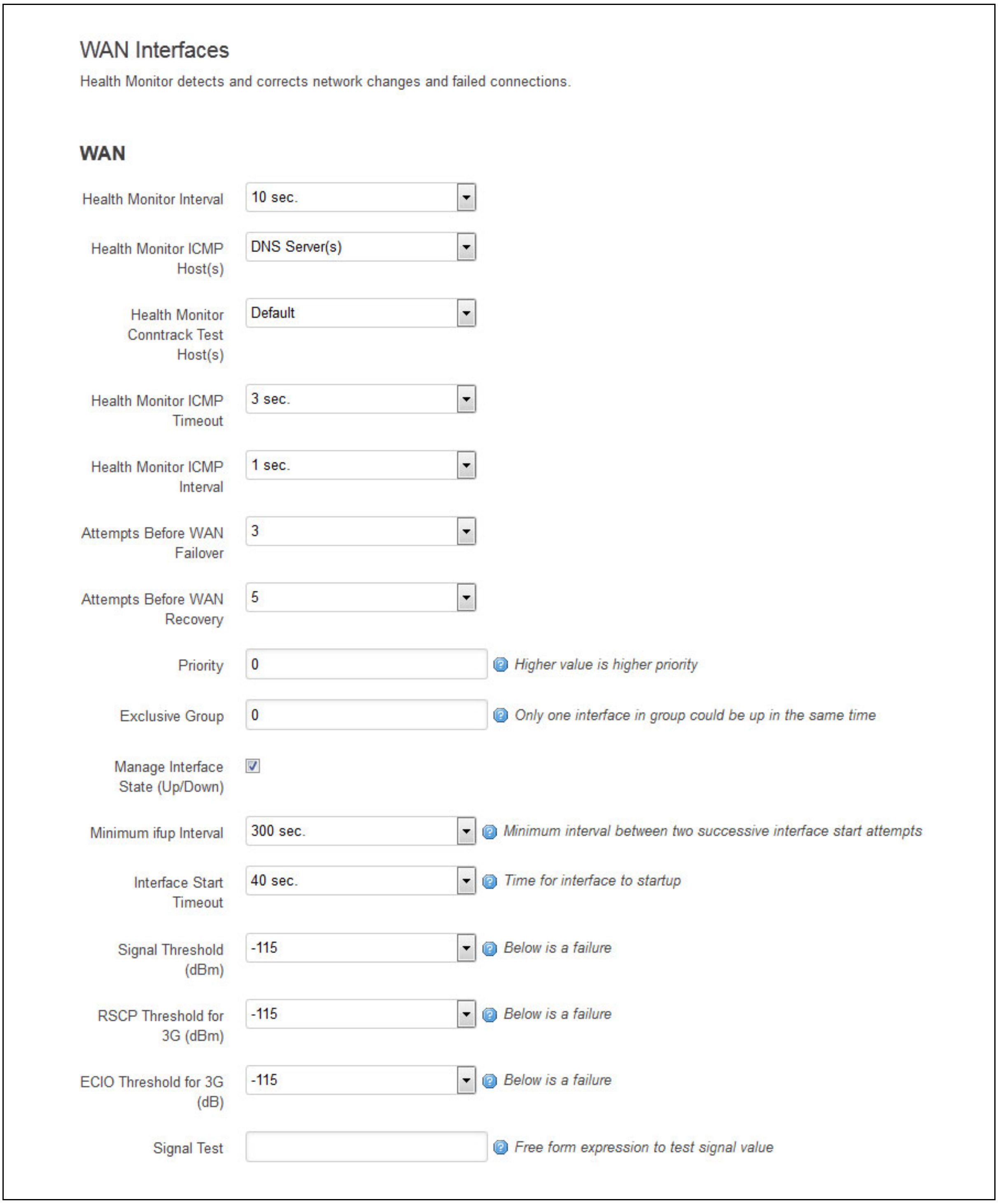

Figure 118: Example interface showing failover traffic destination as the added multi-WAN interface

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Health Monitor Interval
UCI: multiwan.wan.health_interval
Opt: health_interval</td><td>Sets the period to check the health status of the interface. The Health Monitor interval will be used for:
• Interface state checks
• Ping interval
• Signal strength checks
The health monitor interval has a granularity of 5 seconds. Configured values will be rounded up to the next 5 second value.<table><tr><td>10</td><td>Perform a health check every 10 seconds.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Host(s)
UCI: multiwan.wan.icmp_hosts
Opt: icmp_hosts</td><td>Sends health ICMPs to configured value DNS servers by default. Configure to any address.<table><tr><td>Disable</td><td>Disables the option.</td></tr><tr><td>DNS servers</td><td>DNS IP addresses will be used.</td></tr><tr><td>WAN Gateway</td><td>Gateway IP address will be used.</td></tr><tr><td>Custom</td><td>Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example:
option icmp_hosts ‘1.1.1.1,2.2.2.2’</td></tr></table></td></tr>
<tr><td>Web: Health Monitor Conntrack Test Host(s)
UCI: multiwan.wan.conntrack_hosts
Opt: conntrack_hosts</td><td>Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval.
The Conntrack_hosts option defines the IP for conntrack to track, usually the icmp_host IP is used.
If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host; otherwise a ping is sent as normal to the icmp_host.
By default, the conntrack_hosts is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated.
Conntrack is generally used to limit the traffic sent on a GSM network.<table><tr><td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td></tr><tr><td>Disable</td><td>Conntrack disabled.</td></tr><tr><td>Custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Timeout
UCI: multiwan.wan.timeout
Opt: timeout</td><td>Sets Ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at.<table><tr><td>3</td><td>Wait 3 seconds for ping reply.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Interval
UCI: multiwan.wan.icmp_interval
Opt: icmp_interval</td><td>Defines the interval between multiple pings sent at each health check<table><tr><td>1</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Count
UCI: multiwan.wan.icmp_count
Opt: icmp_count</td><td>Defines the number of pings to send at each health check.<table><tr><td>1</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Attempts Before WAN Failover
UCI: multiwan.wan.health_fail_retries
Opt: health_fail_retries</td><td>Sets the amount of health monitor retries before the interface is considered a failure.<table><tr><td>3</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Attempts Before WAN Recovery
UCI:
multiwan.wan.health_recovery_retries
Opt: health_recovery_retries</td><td>Sets the number of health monitor checks before the interface is considered healthy. Only relevant if pre-empt mode is enabled.<table><tr><td>5</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

<table>
<tr><td>Web: Priority
UCI: multiwan.wan.priority
Opt: priority</td><td>Specifies the priority of the interface. The higher the value, the higher the priority.<table><tr><td>0</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Manage Interface State (Up/Down)
UCI: multiwan.wan.manage_state
Opt: manage_state</td><td>Defines whether multi-wan will start and stop the interface.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
<tr><td>Web: Exclusive Group
UCI: multiwan.wan.exclusive_group
Opt: exclusive_group</td><td>Defines the group to which the interface belongs; only one interface can be active.<table><tr><td>0</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Minimum ifup Interval
UCI: multiwan.wan.ifup_retry_sec
Opt: ifup_retry_sec</td><td>Specifies the interval in seconds before retrying the primary interface when pre-empt mode is enabled.<table><tr><td>300</td><td>Retry primary interface every 300 seconds.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Interface Start Timeout
UCI: multiwan.wan.ifup_timeout
Opt: ifup_timeout</td><td>Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail.<table><tr><td>40</td><td>40 seconds.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Signal Threshold (dBm)
UCI: multiwan.wan.signal_threshold
Opt: signal_threshold</td><td>Specifies the minimum signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for sig_dbm in mobile diagnostics.-115.<table><tr><td></td><td>Disabled</td></tr><tr><td>Range</td><td>-46 to -115 dBm</td></tr></table></td></tr>
<tr><td>Web: RSCP Threshold (dBm)
UCI: multiwan.wan.rscp_threshold
Opt: rscp_threshold</td><td>Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics.<table><tr><td>-115</td><td>Disabled</td></tr><tr><td>Range</td><td>-46 to -115 dBm</td></tr></table></td></tr>
<tr><td>Web: ECIO Threshold (dB)
UCI: multiwan.wan.ecio_threshold
Opt: ecio_threshold</td><td>Specifies the minimum ECIO signal strength in dB before considering if the interface fails signal health check. Uses the value stored for ecio_db in mobile diagnostics.<table><tr><td>-115</td><td>Disabled</td></tr><tr><td>Range</td><td>-46 to -115 dB</td></tr></table></td></tr>
<tr><td>Web: Signal Test
UCI: multiwan.wan.signal_test
Opt: signal_test</td><td>Defines a script to test various signal characteristics in multiwan signal test. For example:
<code>option signal_test '(tech == 0) then (sig_dbm > -70) else (rscp_dbm > -105 and ecio_db > -15)'</code>
This states that when technology is GSM, a health fail is determined when signal strength is less than -70dBm. When technology is not GSM a health fail occurs when either rscp_dbm falls below -105dBm or ecio_db falls below -15dB
Tech values are:<table><tr><td>0</td><td>GSM</td></tr><tr><td>1</td><td>GSM Compact</td></tr><tr><td>2</td><td>UTRAN</td></tr><tr><td>3</td><td>GSM w/EGPRS</td></tr><tr><td>4</td><td>UTRAN w/HSPDA</td></tr><tr><td>5</td><td>UTRAN w/HSUPA</td></tr><tr><td>6</td><td>UTRAN w/HSUPA and HSDPA</td></tr><tr><td>7</td><td>E-UTRAN</td></tr></table>Note: a signal test can also take a UDS script name as a parameter. For example:
<code>Option signal_test ‘uds(script_name)’</code></td></tr>
</table>

Table 73: Information table for multi-WAN interface page

25.3 Configuring Multi-WAN using UCI

Multi-WAN UCI configuration settings are stored on /etc/config/multiwan.

Run `UCI export` or `show` commands to see multiwan UCI configuration settings. A sample is shown below.

```
root@VA_router:~# uci export multiwan

package multiwan

config multiwan 'config'
        option preempt 'yes'
        option alt_mode 'no'
        option enabled 'yes'
config interface 'wan'
        option disabled '0'
        option health_interval '10'        option health_fail_retries '3'
        option health_recovery_retries '5'
        option priority '2'
        option manage_state 'yes'
        option exclusive_group '0'
        option ifup_retry_sec '40'
        option icmp_hosts 'disable'
        option icmp_interval ‘1’
        option timeout ‘3’
        option icmp_count ‘1’
        option conntrack_hosts ‘disable’        option signal_threshold '-
111'
        option rscp_threshold '-90'
        option ecio_threshold '-15'
        option ifup_timeout_sec '120'

root@VA_router:~# uci show multiwan
multiwan.config=multiwan
multiwan.config.preempt=yes
multiwan.config.alt_mode=no
multiwan.config.enabled=yes
multiwan.wan=interface
```

```
multiwan.wan.disabled=0
multiwan.wan.health_interval=10multiwan.wan.health_fail_retries=3
multiwan.wan.health_recovery_retries=5
multiwan.wan.priority=2
multiwan.wan.manage_state=yes
multiwan.wan.exclusive_group=0
multiwan.wan.ifup_retry_sec=36000
multiwan.wan.icmp_hosts=disable
multiwan.wan.timeout=3
multiwan.wan.icmp_interval ‘1’
multiwan.wan.timeout ‘3’
multiwan.wan.icmp_count ‘1’
multiwan.wan.conntrack_hosts ‘disable’
multiwan.wan.signal_threshold=-111
multiwan.wan.rscp_threshold=-90
multiwan.wan.ecio_threshold=-15
```

25.4 Multi-WAN diagnostics

The multiwan package is linked to the network interfaces within /etc/config/network.

Note: Multi-WAN will not work if the WAN connections are on the same subnet and share the same default gateway.

To view the multiwan package, enter:

```
root@VA_router:~# uci export multiwan
package multiwan

config multiwan 'config'
        option enabled 'yes'
        option preempt 'yes'
        option alt_mode 'no'

config interface 'ADSL'
        option health_interval '10'
        option icmp_hosts 'dns'
        option timeout '3'
        option health_fail_retries '3'
        option health_recovery_retries '5'
```

```
        option priority '1'
        option manage_state 'yes'
        option exclusive_group '0'
        option ifup_retry_sec '300'
        option ifup_timeout_sec '40'

config interface 'Ethernet'
        option health_interval '10'
        option icmp_hosts 'dns'
        option timeout '3'
        option health_fail_retries '3'
        option health_recovery_retries '5'
        option priority '2'
        option manage_state 'yes'
        option exclusive_group '0'
        option ifup_retry_sec '300'
        option ifup_timeout_sec '40'
```

The following output shows the multiwan standard stop/start commands for troubleshooting.

```
root@VA_router:~# /etc/init.d/multiwan
Syntax: /etc/init.d/multiwan [command]
```

Available commands:

```
        start   Start the service
        stop    Stop the service
        restart Restart the service
        reload  Reload configuration files (or restart if that fails)
        enable  Enable service autostart
        disable Disable service autostart
```

When troubleshooting, make sure that the routing table is correct using `route –n`.

Ensure all parameters in the multiwan package are correct. The name used for Multi-WAN interfaces must be identical, including upper and lowercases, to the interface name defined in the network configuration.

To check the names and settings are correct, browse to **Network -> interfaces** (or alternatively, run: cat/etc/config/network through CLI).

Enter the name of the WAN interface to configure, and then click **Add**. The new section for configuring specific parameters will appear.

26 Automatic operator selection

This section describes how to configure and operate the Automatic Operator Selection feature of a Virtual Access router.

When the roaming SIM is connected, the radio module has the ability to scan available networks. The router, using mobile and multiwan packages, finds available networks to create and sort interfaces according to their signal strength. These interfaces are used for failover purposes.

26.1 Configuration package used

Package	Sections
Multiwan	General, interfaces
Mobile	Main, template interface
Network	2G/3G/4G interface

26.2 Configuring automatic operator selection via the web interface

While the router boots up it checks for mobile networks. Based on available networks, the router creates interfaces and the multiwan package is used to run failover between interfaces. Typically, these auto-generated interfaces are sorted by signal strength.

Details for these interfaces are provided in the mobile package. When you have created the interfaces, Multi-WAN manages the operation of primary (predefined) and failover (auto created) interfaces.

Multi-WAN periodically does a health check on the active interface. A health check comprises of a configurable combination of the following:

- interface state
- pings to an ICMP target
- signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks results in an overall fail. After a configurable number of health check failures, multiwan will move to the next highest priority interface. Multi-WAN will optionally stop the failed interface and start the new interface, if required.

In some circumstances, particulary in mobile environments, it is desirable for a primary interface to be used whenever possible. In this instance, if the active interface is a not the primary interface, multiwan will perform a health check on the primary interface after a configurable period. If the health checks pass for the configured number of recovery health checks then the primary interface will be used.

There are typcailly three scenarios:

- Primary Mobile Provider (PMP) + roaming: pre-empt enabled
- PMP + roaming: pre-empt disabled
- No PMP + roaming

26.2.1 Scenario 1: PMP + roaming: pre-empt enabled

26.2.1.1 Overview

In this scenario, the PMP interface is used whenever possible.

The PMP interface is attempted first. When the health checks fail on the PMP interface, and Multi-WAN moves to an autogenerated interface, a timer is started `multiwan option ifup_retry_sec`. On expiration of this timer, multiwan will disconnect the current interface and retry the PMP interface.

The PMP interface will then be used if the configurable number of health checks pass the checks.

26.2.1.2 Software operation

1. multiwan first attemts to bring up the PMP interface. If the PMP interface connects within the time set by multiwan option ifup_timeout continue to step 2. Otherwise go to step 4.
2. A health check is periodically done on the PMP interface as determined by the multiwan option health_interval. If the health check fails for the number of retries (multiwan option health_fail_retries), disconnect the PMP interface.
3. Connect the first auto-generated interface.
4. If the interface connects within the time set by multiwan option ifup_timeout continue to step 5, otherwise multiwan moves to the next auto-generated interface.
5. Wait until the health check fails on the auto-generated interface, or until the PMP interface is available to connect after it was disconnected in step 2. (multiwan option ifup_retry_sec).
6. Disconnect auto-generated interface.
7. If the interface was disconnected due to health check failure then connect the next auto-generated interface and repeat step 4. If the interface was disconnected because ifup_retry_sec of PMP interface timed out, then go back to step 1 and repeat the process.

The PMP predefined interface is defined in the network package. Ensure the interface name matches the interface name defined in the multiwan package.

26.2.1.3 Create a primary predefined interface

In the web interface top menu, go to **Network -> Interfaces**. The Interfaces page appears.

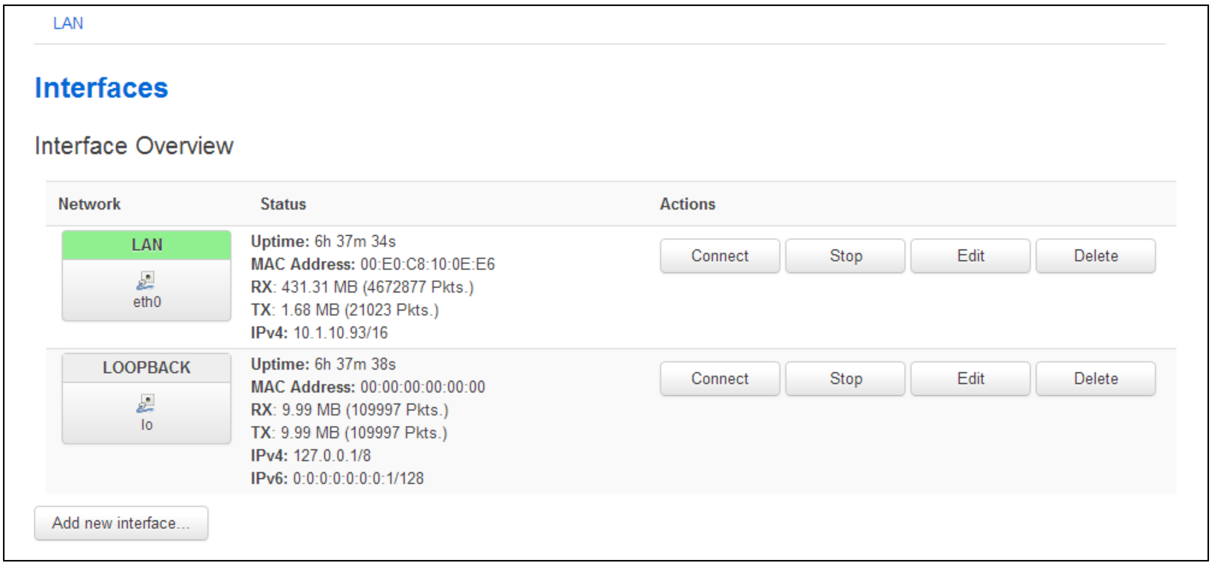

Figure 119: The interface overview page

Click **Add new interface...** The Create Interface page appears.

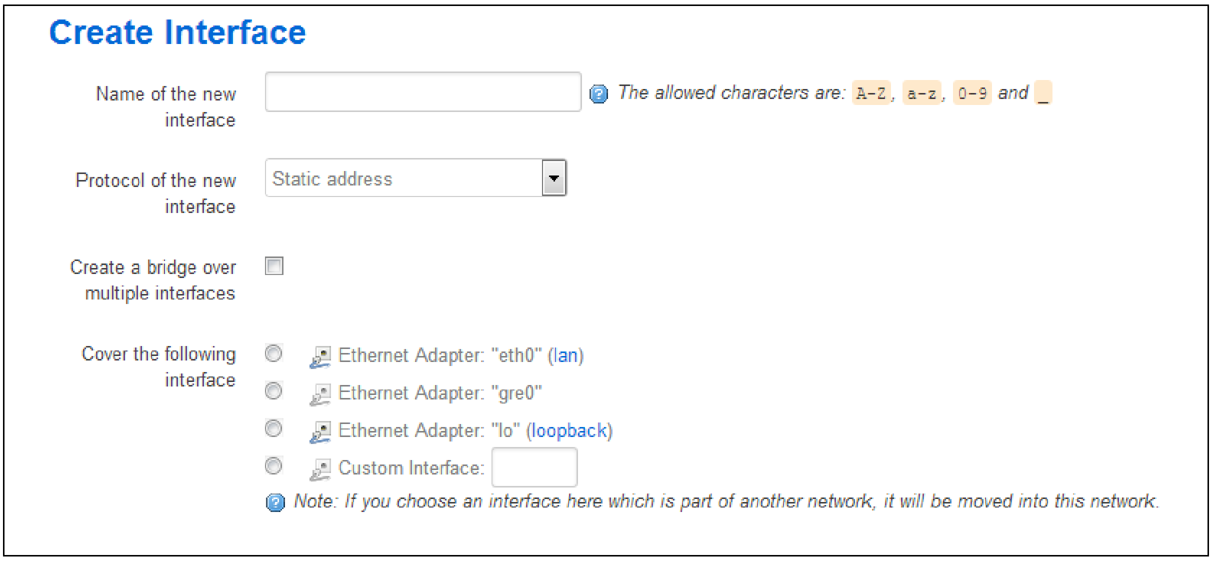

Figure 120: The create interface page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name of the new interface
UCI: network.3g_s<sim-number>_<short-operator-name>.
Opt: 3g_s<sim-number>_<short-operator-name>.</td><td>Type the name of the new interface.
Type the interface name in following format:
3g_s<sim-number>_<short-operator-name>. Where <sim-number> is number of roaming SIM (1 or 2) and <short-operator-name> is first four alphanumeric characters of operator name (as reported by 'AT+COPS=?' command).
Type the short operator name in lower case, for example:
<table>
<tr><th>Operator name</th><th>First four alphanumeric numbers</th></tr>
<tr><td>Vodafone UK</td><td>voda</td></tr>
<tr><td>O2 – UK</td><td>o2uk</td></tr>
<tr><td>Orange</td><td>oran</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Web: Protocol of the new interface
UCI: network.[..x..].proto
Opt: proto</td><td>Protocol type. Select LTE/UMTS/GPRS/EV-DO.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>IPv4 tunnels that carry IPv6.</td></tr>
<tr><td>IPv6 over IPv4</td><td>IPv6 over IPv4 tunnel.</td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation.</td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol.</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol.</td></tr>
<tr><td>PPPoE</td><td>Point to Point Protocol over Ethernet.</td></tr>
<tr><td>PPPoATM</td><td>Point to Point Protocol over ATM.</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
<tr><td>Web: Create a bridge over multiple interfaces
UCI: network.[..x..].type
Opt: type</td><td>Enables bridge between two interfaces.
<table>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
</table></td></tr>
<tr><td>Web: Cover the following interface
Opt: ifname</td><td>Selects interfaces for bridge connection.</td></tr>
</table>

Table 74: Information table for the create interface page

Click **Submit**. The Common Configuration page appears.

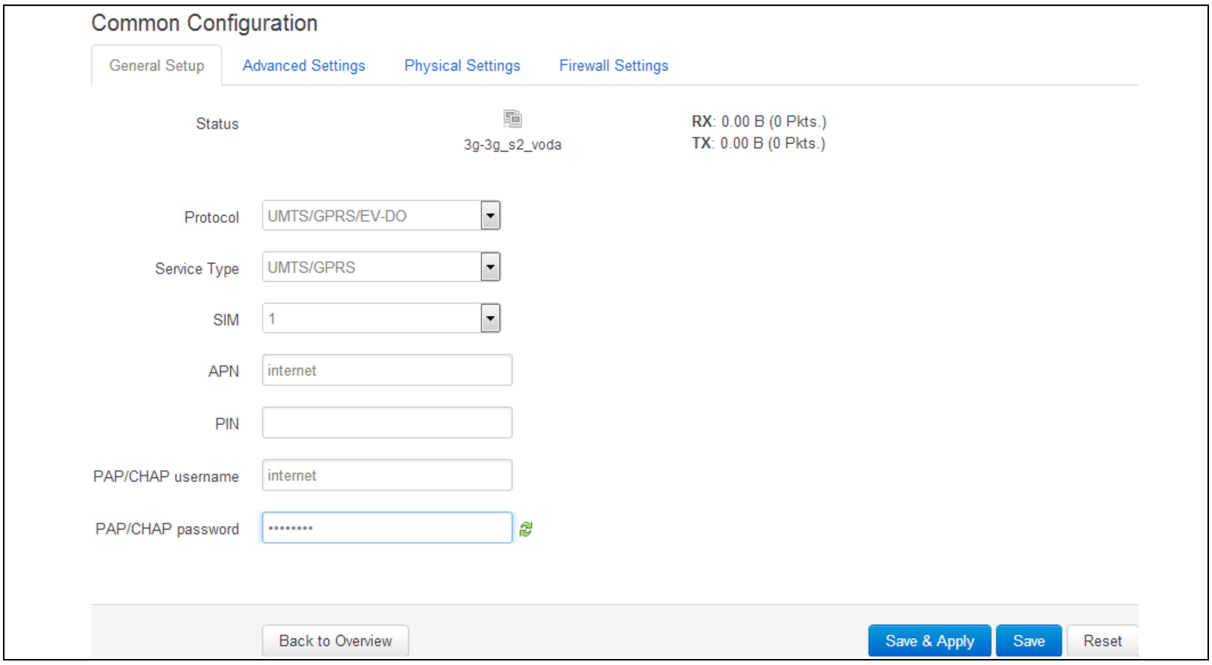

Figure 121: The common configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Protocol
UCI: network.[..x..].proto
Opt: proto</td><td>Protocol type. Select LTE/UMTS/GPRS/EV-DO.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>IPv4 tunnels that carry IPv6.</td></tr>
<tr><td>IPv6 over IPv4</td><td>IPv6 over IPv4 tunnel.</td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation.</td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol.</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol.</td></tr>
<tr><td>PPPoE</td><td>Point to Point Protocol over Ethernet.</td></tr>
<tr><td>PPPoATM</td><td>Point to Point Protocol over ATM.</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
<tr><td>Web: Service Type
UCI: network.[..x..].service
Opt: service</td><td>Service type that will be used to connect to the network.
<table>
<tr><td>gprs_only</td><td>Allows GSM module to only connect to GPRS network.</td></tr>
<tr><td>lte_only</td><td>Allows GSM module to only connect to LTE network.</td></tr>
<tr><td>cdma</td><td>Allows GSM module to only connect to CDMA network.</td></tr>
<tr><td>auto</td><td>GSM module will automatically detect the best available technology code.</td></tr>
</table></td></tr>
<tr><td>Web: SIM
UCI: network.[..x..].sim
Opt: sim</td><td>Select SIM 1 or SIM 2.
<table>
<tr><td>auto</td><td>Automatically detects which SIM slot is used.</td></tr>
<tr><td>SIM 1</td><td>Selects SIM from slot 1.</td></tr>
<tr><td>SIM 2</td><td>Selects SIM from slot 2.</td></tr>
</table></td></tr>
<tr><td>Web: APN
UCI: network.[..x..].apn
Opt: apn</td><td>APN name of Mobile Network Operator.</td></tr>
<tr><td>Web: APN username
UCI: network.[..x..].username
Opt: username</td><td>Username used to connect to APN.</td></tr>
<tr><td>Web: APN password
UCI: network.[..x..].password
Opt: password</td><td>Password used to connect to APN.</td></tr>
<tr><td>Web: Modem Configuration
UCI: N/A
Opt: N/A</td><td>Click the link if you need to configure additional options from Mobile Manager.</td></tr>
</table>

Table 75: Information table for the general set up section

Click **Save & Apply**.

26.2.1.4 Set multi-WAN options for primary predefined interface

On the web interface go to **Network -> Multi-Wan**. The Multi-WAN page appears.

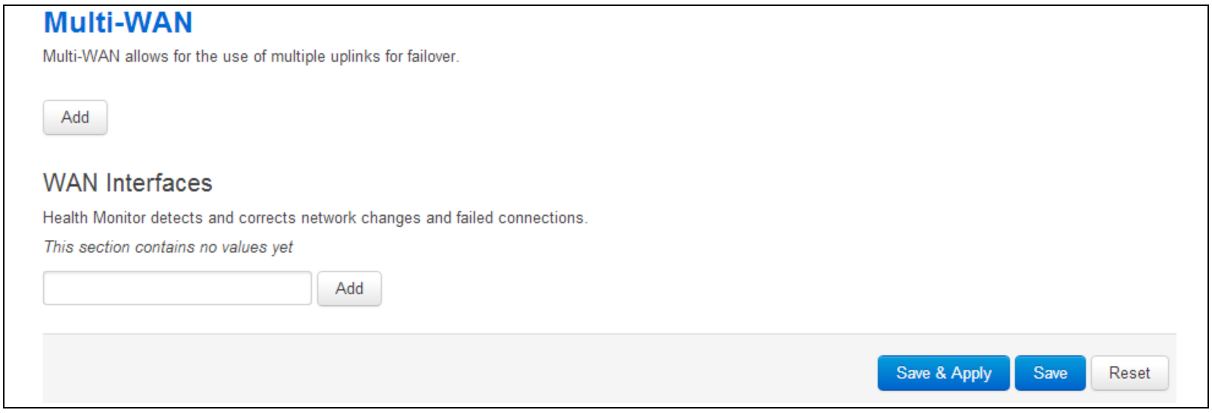

Figure 122: The multi-WAN page

In the WAN Interfaces section, type in the name of the Multi-WAN interface.

Click **Add**. The Multi-WAN page appears.

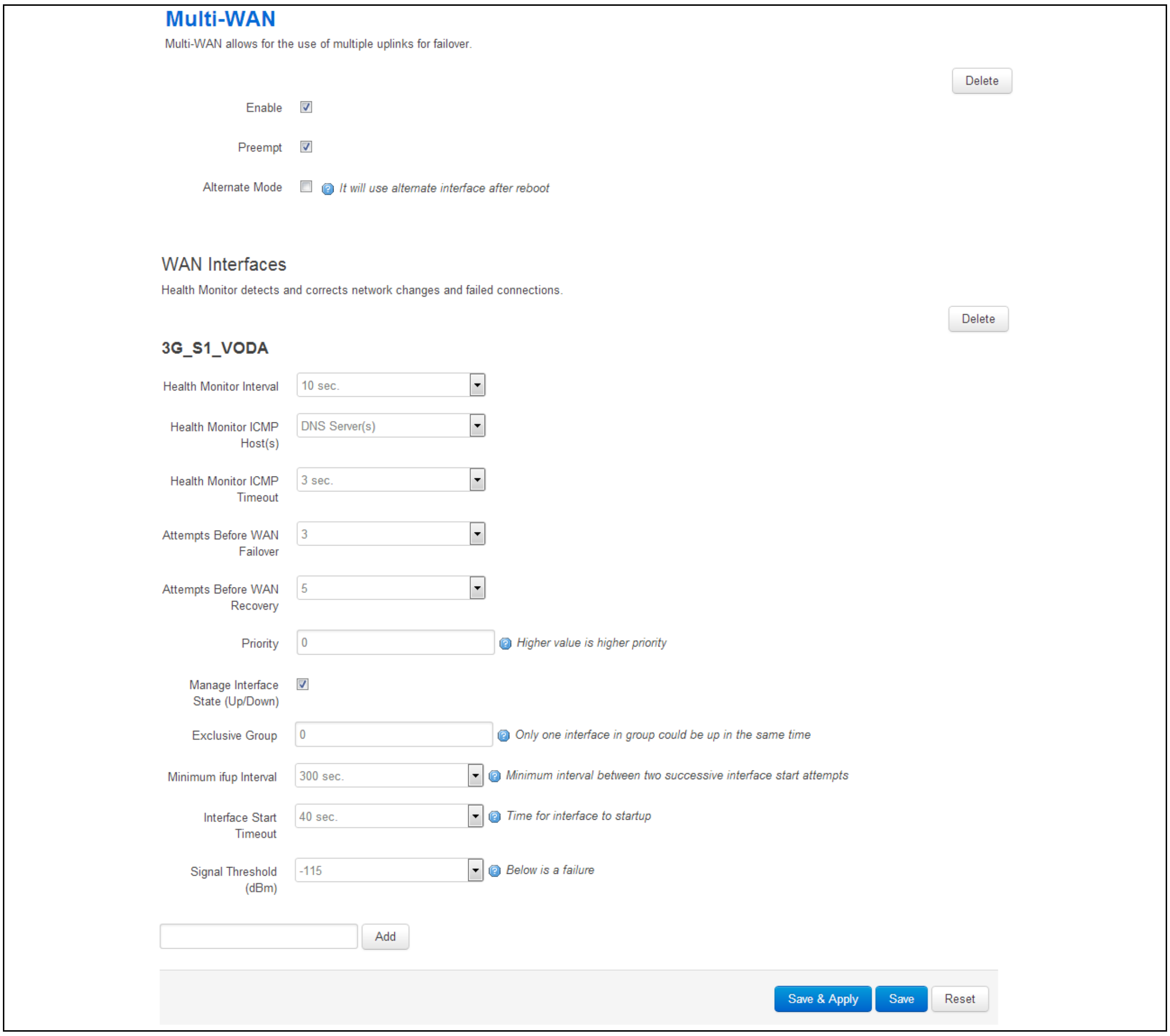

Figure 123: The multi-WAN page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enable
UCI: multiwan.config.enabled
Opt: enabled</td><td>Enables multiwan.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Preempt
UCI: multiwan.config.preempt
Opt: preempt</td><td>Enables or disables pre-emption for multiwan. If enabled, the router will keep trying to connect to a higher priority interface depending on timer set.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Alternate Mode
UCI: multiwan.config.alt
Opt: alt</td><td>Enables or disables alternate mode for multiwan. If enabled, the router will use an alternate interface after reboot.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: WAN Interfaces
UCI: multiwan.3g_s<sim-number>_<short-operator-name>
Opt: 3g_s<sim-number>_<short-operator-name></td><td>Provide the same interface name as chosen in multiwan section below and click Add.</td></tr>
<tr><td>Web: Health Monitor Interval
UCI: multiwan.[..x..].health_interval
Opt: health_interval</td><td>Sets the period to check the health status of the interface. The Health Monitor interval will be used for:
Interface state checks
Ping interval
Signal strength checks</td></tr>
<tr><td>Web: Health Monitor ICMP Host(s)
UCI: multiwan.[..x..].icmp_hosts
Opt: icmp_hosts</td><td>Specifies the target IP address for ICMP packets.<table><tr><td>Disable</td><td>Disables the option.</td></tr><tr><td>DNS servers</td><td>DNS IP addresses will be used.</td></tr><tr><td>WAN Gateway</td><td>Gateway IP address will be used.</td></tr><tr><td>custom</td><td>Ability to provide IP address.</td></tr></table></td></tr>
<tr><td>Web: Health Monitor Conntrack Test Host(s)
UCI: multiwan.wan.conntrack_hosts
Opt: conntrack_hosts</td><td>Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval.
Conntrack_hosts option defines the IP for conntrack to track – usually the icmp_host IP is used.
If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host otherwise a ping is sent as normal to the icmp_host.
By default, the conntrack_host is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated.
Conntrack is generally used to limit the traffic sent on a GSM network.<table><tr><td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td></tr><tr><td>Disable</td><td>Conntrack disabled.</td></tr><tr><td>Custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Timeout
UCI: multiwan.[..x..].timeout
Opt: timeout</td><td>Sets ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at.<table><tr><td>3</td><td>Wait 3 seconds for ping reply.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Interval
UCI: multiwan.wan.icmp_interval
Opt: icmp_interval</td><td>Defines the interval between multiple pings sent at each health check.<table><tr><td>1</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Count
UCI: multiwan.wan.icmp_count
Opt: icmp_count</td><td>Defines the number of pings to send at each health check.<table><tr><td>1</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Web: Attempts Before WAN Failover UCI: multiwan. [..x..].health_fail_retries Opt: health_fail_retries	Sets the amount of health monitor retries before the interface is considered a failure. 3 Range
Web: Attempts Before WAN Recovery UCI: multiwan. [..x..].health_recovery_retries Opt: health_recovery_retries	Sets the number of health monitor checks before the interface is considered healthy. Only relevent if pre-empt mode is enabled. 5 Range
Web: Priority UCI: multiwan.[..x..].priority Opt: priority	Specifies the priority of the interface. The higher the value, the higher the priority. This multiwan interface priority must be higher than the one specified in the priority field in the 'Roaming Interface Template' page described in the following section. 0 Range
Web: Exclusive Group UCI: multiwan.[..x..].exclusive_group Opt: exclusive_group	Defines the group to which the interface belongs; only one interface can be active. 0 Range
Web: Manage Interface State (Up/Down) UCI: multiwan.[..x..].manage_state Opt: manage_state	Defines whether multiwan will start and stop the interface. Select **Enabled**. 0 — Disabled. 1 — Enabled.
Web: Minimum ifup Interval UCI: multiwan.[..x..].ifup_retry_sec Opt: ifup_retry_sec	Specifies the interval in seconds before retrying the primary interface when pre-empt mode is enabled.
Web: Interface Start Timeout UCI: multiwan.[..x..].ifup_timeout Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail. Choose timer greater than 120 seconds. 40 — 40 seconds Range
Web: Signal Threshold (dBm) UCI: multiwan.[..x..].signal_threshold Opt: signal_threshold	Specifies the minimum signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for sig_dbm in mobile diagnostics. -115 — Disabled. Range — -46 to -115 dBm
Web: RSCP Threshold (dBm) UCI: multiwan.[..x..].rscp_threshold Opt: rscp_threshold	Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics. -115 — Disabled. Range — -46 to -115 dBm
Web: ECIO Threshold (dB) UCI: multiwan.[..x..].ecio_threshold Opt: ecio_threshold	Specifies the minimum ECIO signal strength in dB before considering if the interface fails signal health check. Uses the value stored for ecio_db in mobile diagnostics. -115 — Disabled. Range — -46 to -115 dB

<table>
<tr>
<td>Web: Signal Test
UCI: multiwan.[..x..].signal_test
Opt: signal_test</td>
<td>Defines script to test various signal characteristics in multiwan signal test. For example:
option signal_test '(tech == 0) then (sig_dbm > -70) else (rscp_dbm > -105 and ecio_db > -15)'
This states that when technology is GSM a health fail is determined when signal strength is less than -70dBm. When technology is not GSM a health fail occurs when either rscp_dbm falls below -105dBm or ecio_db falls below -15dB.
Tech values are:
<table>
<tr><td>0</td><td>GSM</td></tr>
<tr><td>1</td><td>GSM Compact</td></tr>
<tr><td>2</td><td>UTRAN</td></tr>
<tr><td>3</td><td>GSM w/EGPRS</td></tr>
<tr><td>4</td><td>UTRAN w/HSPDA</td></tr>
<tr><td>5</td><td>UTRAN w/HSUPA</td></tr>
<tr><td>6</td><td>UTRAN w/HSUPA and HSDPA</td></tr>
<tr><td>7</td><td>E-UTRAN</td></tr>
</table>
</td>
</tr>
</table>

Table 76: Information table for multi-WAN page

Click **Save**.

26.2.2 Set options for automatically created interfaces (failover)

From the top menu on the web interface page, select **Services -> Mobile Manager**. The Mobile Manager page appears.

There are five sections in the mobile manager page:

Section	Description
Basic settings	Enable SMS, configure SIM pin code, select roaming SIM, collect ICCCIDs and set IMSI.
Advanced	Configure advanced options such as collect ICCIDs and temperature polling interval.
CDMA*****	CDMA configuration
Callers	Configure callers that can use SMS.
Roaming Interface Template	Configure Preferred Roaming List options.
*****Option available only for Telit CE910-SL module.	

26.2.3 Mobile manager: basic settings

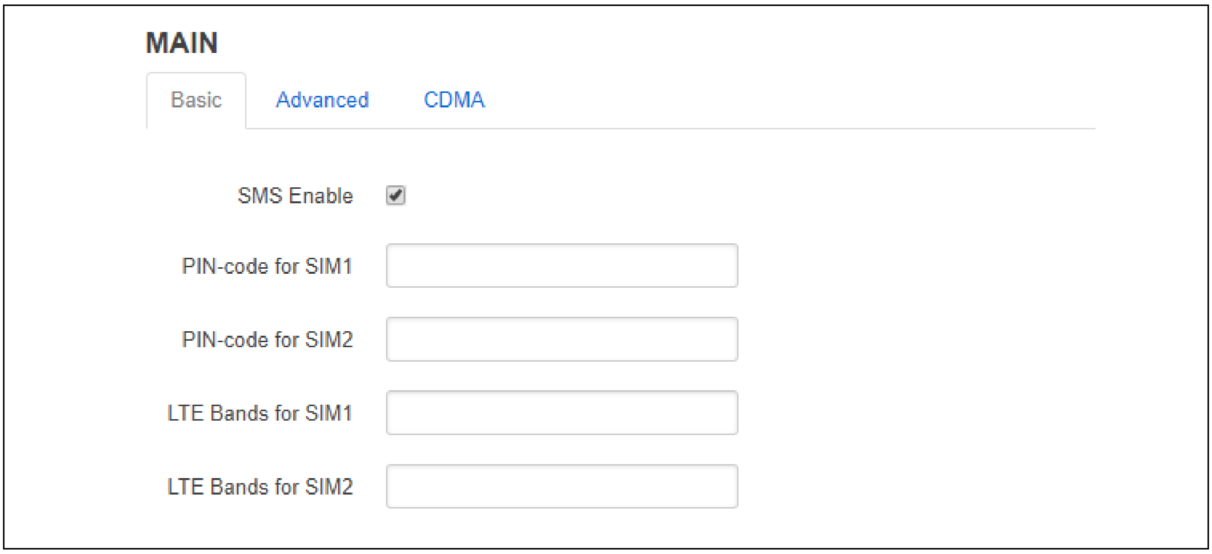

Figure 124: The mobile manager basic page

Web Field/UCI/Package Option	Description
Web: SMS Enable UCI: mobile.main.sms Opt: sms	Enables or disables SMS functionality. 0 — Disabled. 1 — Enabled.
Web: PIN code for SIM1 UCI: mobile.main.sim1pin Opt: sim1pin	Depending on the SIM card specifies the pin code for SIM 1. Blank — Range — Depends on the SIM provider.
Web: PIN code for SIM2 UCI: mobile.main.sim2pin Opt: sim2pin	Depending on the SIM card specify the pin code for SIM 2. Blank — Range — Depends on the SIM provider.

Web: LTE bands for SIM1
UCI: mobile.main.sim1_lte_bands
Opt: sim1_lte_bands
	Depending on the SIM card specify the LTE bands for SIM 1. Comma delimiter. Example:
	`option sim1_lte_bands '3,20'`
	`Limits LTE bands to 3 and 20.`
	Note: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200 and Asiatel.
	Blank —
	Range — LTE bands range from 1 to 70.

Web: LTE bands for SIM2
UCI: mobile.main.sim2_lte_bands
Opt:sim2_lte_bands
	Depending on the SIM card specifies the LTE bands for SIM 2. Comma delimiter. Example:
	`option sim1_lte_bands '3,20'`
	`Limits LTE bands to 3 and 20.`
	Note: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200 and Asiatel.
	Blank —
	Range — LTE bands range from 1 to 70.

Table 77: Information table for mobile manager basic settings

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26.2.4 Mobile manager: advanced settings

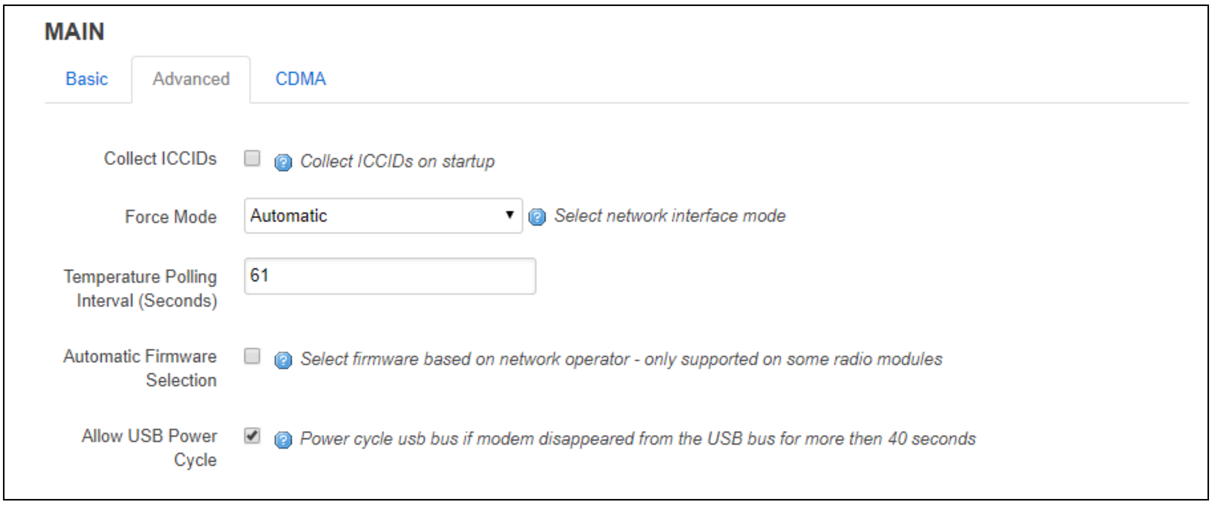

Figure 125: The mobile manager advanced page

Web Field/UCI/Package Option	Description
Web: Collect ICCIDs UCI: mobile.main.init_get_iccids Opt: init_get_iccids	Enables or disables integrated circuit card identifier ICCID's collection functionality. If enabled then both SIM 1 and SIM 2 ICCIDs will be collected otherwise it will default to SIM 1. This will be displayed under mobile stats. 0 — Disabled. 1 — Enabled.
Web: Force Mode UCI: mobile.main.force_mode Opt: force_mode	Defines whether to operate mobile modem in PPP or Ethernet mode. The mode will be dependent on the service provided by the mobile provider. In general, this is Ethernet mode (default). Automatic — Ethernet mode (option not present). PPP — Enable PPP mode.
Web: Temperature Polling Interval UCI: mobile.main.temp_poll_interval_sec Opt: temp_poll_interval_sec	Defines the time in seconds to poll the mobile module for temperature. Set to **0** to disable. 61 — 61 seconds. Range
Web: Automatic Firmware Selection UCI: mobile.main.enable_firmware_autoselect Opt: enable_firmware_autoselect	Defines whether to use time obtained from the mobile carrier to update the system clock when NTP is enabled. 0 — Disabled. 1 — Enabled.
Web: Allow USB Power Cycle UCI: mobile.main.allow_usb_powercycle Opt: allow_usb_powercycle	Enables the selection of an operator-specific firmware in the radio module. The selection is based on the ICCID of the used SIM. At module initialisation the IMSI is checked and if necessary the correct firmware image in the module will be activated. **Note:** activation of the firmware will lead to delayed startup of the network interface associated with the radio module. **Note:** this feature is currently only supported for the Telit LE910NA V2 module. Here a Verizon-specific firmware will be selected if the ICCID starts with "891480". 0 — Disabled. 1 — Enabled.
Web: n/a UCI: mobile.main.disable_time Opt: disable_time	Defines whether to use time obtained from the mobile carrier to update the system clock when NTP is enabled. 0 — Disabled. 1 — Enabled.

Table 78: Information table for mobile manager advanced settings

26.2.5 Mobile manager: CDMA settings

This configuration page is only supported for the Telit CE910-SL CDMA module.

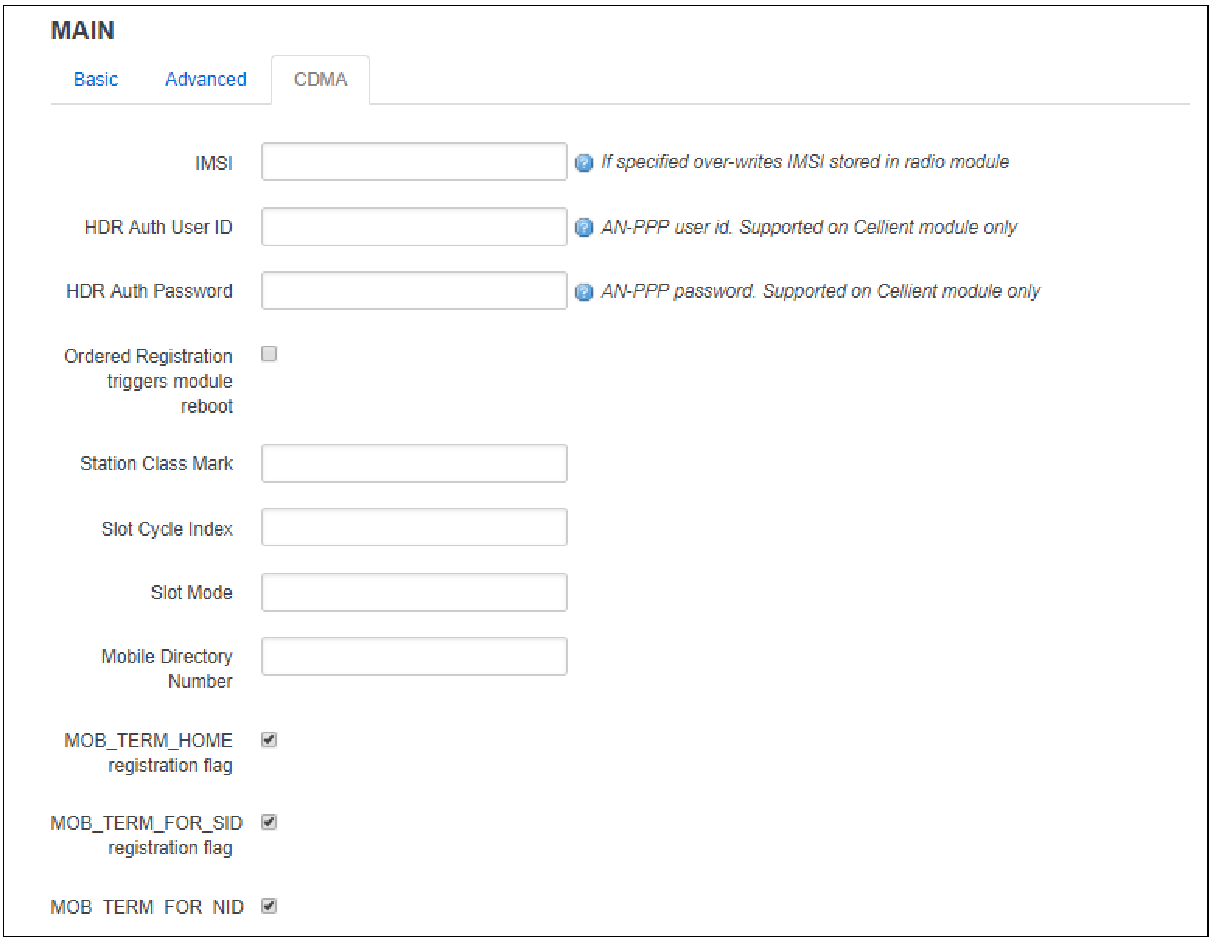

Figure 126: The mobile manager CDMA page

Web Field/UCI/Package Option	Description
Web: IMSI UCI: mobile.main.imsi Opt: imsi	Allows the IMSI (International Mobile Subscriber Identity) to be changed. Default: Programmed in module. Digits: Up to 15 digits.
Web: HDR Auth User ID UCI: mobile.main.hdr_userid Opt: hdr_userid	AN-PPP user ID. Supported on Cellient (CDMA) modem only. Blank Range: Depends on the CDMA provider.
Web: HDR Auth User Password UCI: mobile.main.hdr_password Opt: hdr_password	AN-PPP password. Supported on Cellient (CDMA) modem only. Blank Range: Depends on the CDMA provider.
Web: Ordered Registration triggers module reboot UCI: mobile.main. mobile.main.cdma_ordered_registration_reboot_enabled Opt: cdma_ordered_registration_reboot_enabled	Enables or disables rebooting the module after an Order Registration command is received from a network. 0: Disabled. 1: Enabled.

Web: Station Class Mark UCI: mobile.main.cdma_station_class_mark Opt: cdma_station_class_mark	Allows the station class mark for the MS to be changed. 58 0-255
Web: Slot Cycle Index UCI: mobile.main.cdma_slot_cycle_index Opt: cdma_slot_cycle_index	The desired slot cycle index if different from the default. 2 0-7
Web: Slot Mode UCI: mobile.main.cdma_slot_mode Opt: cdma_slot_mode	Specifies the slot mode. 0
Web: Mobile Directory Number UCI: mobile.main.cdma_mobile_directory_number Opt: cdma_mobile_directory_number	Allows the mobile directory number (MDN) to be changed. Default: Programmed in module. Digits: Up to 15 digits.
Web: MOB_TERM_HOME registration flag UCI: mobile.main. cdma_mob_term_home_registration_flag Opt: cdma_mob_term_home_registration_flag	The MOB_TERM_HOME registration flag. 0: Disabled. 1: Enabled.
Web: MOB_TERM_FOR_SID registration flag UCI: mobile.main. cdma_mob_term_for_sid_registration_flag Opt: cdma_mob_term_for_sid_registration_flag	The MOB_TERM_FOR_SID registration flag. 0: Disabled. 1: Enabled.
Web: MOB_TERM_FOR_NID registration flag UCI: mobile.main. cdma_mob_term_for_nid_registration_flag Opt: cdma_mob_term_for_nid_registration_flag	The MOB_TERM_FOR_NID registration flag 0: Disabled. 1: Enabled.
Web: Access Overload Control UCI: mobile.main.cdma_access_overload_control Opt: cdma_access_overload_control	Allows the access overload class to be changed. Default: Programmed into module as part of IMSI. Range: 0-7
Web: Preferred Serving System UCI: mobile.main.cdma_preferred_serving_system Opt: cdma_preferred_serving_system	The CDMA Preferred Serving System(A/B). 5
Web: Digital Analog Mode Preference UCI: cdma_digital_analog_mode_preference Opt: cdma_digital_analog_mode_preference	Digital/Analog Mode Preference. 4
Web: Primary Channel A UCI: mobile.main.cdma_primary_channel_a Opt: cdma_primary_channel_a.	Allows the primary channel (A) to be changed. 283 1-2016: Any band class 5 channel number.
Web: Primary Channel B UCI: mobile.main.cdma_primary_channel_b Opt: cdma_primary_channel_b	Allows the primary channel (B) to be changed. 384 1-2016: Any band class 5 channel number
Web: Secondary Channel A UCI: mobile.main.cdma_secondary_channel_a Opt: cdma_secondary_channel_a	Allows the secondary channel (A) to be changed. 691 1-2016: Any band class 5 channel number.
Web: Secondary Channel B UCI: mobile.main.cdma_secondary_channel_b Opt: cdma_secondary_channel_b	Allows the secondary channel (B) to be changed. 777 1-2016: Any band class 5 channel number.

Web: Preferred Forward & Reverse RC UCI: mobile.main.cdma_preferred_forward_and_reverse_rc Opt:cdma_preferred_forward_and_reverse_rc	The Preferred Forward & Reverse RC value, this takes the form "forward_rc,reverse_rc" Format: forward radio channel, reverse radio channel Default: 0,0
Web: SID-NID pairs UCI: mobile.main.cdma_sid_nid_pairs Opt:cdma_sid_nid_pairs	Allows specification of SID:NID pairs, this takes the form "SID1,NID1,SID2,NID2, … Format: SID1 (0-65535),NID (0-65535) Default: 0,65535

Table 79: Information table for mobile manager CDMA settings

26.2.6 Mobile manager: callers

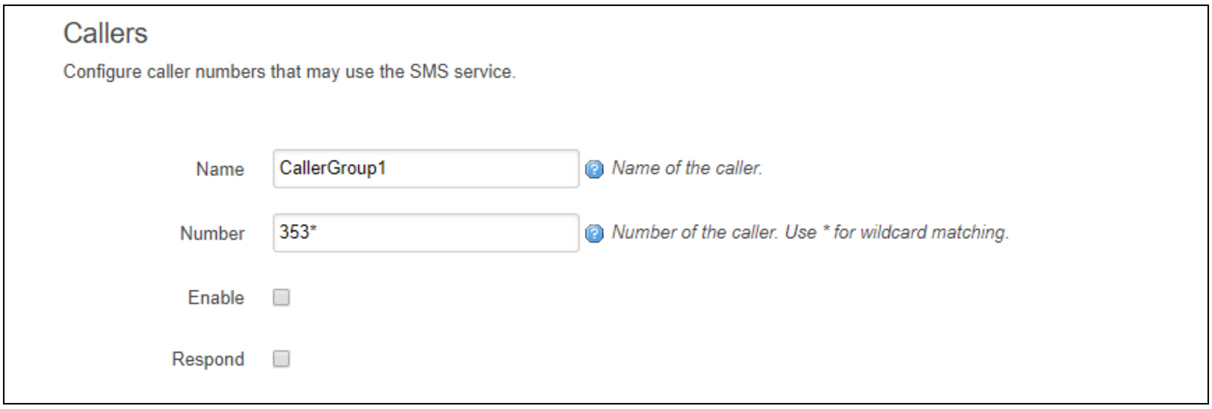

Figure 127: The mobile manager CDMA page

Web Field/UCI/Package Option	Description
Web: Name UCI: mobile.@caller[0].name Opt:name	Name assigned to the caller. Blank | Range | No limit.
Web: Number UCI: mobile.@caller[0].number Opt:number	Number of the caller allowed to SMS the router. Add in specific caller numbers or use the * wildcard symbol. Blank | Range | No limit. Characters | Global value (*) is accepted. International value (+) is accepted.
Web: Enable UCI: mobile.@caller[0].enabled Opt:enabled	Enables or disables incoming caller ID. 0 | Disabled. 1 | Enabled.
Web: Respond UCI: mobile.@caller[0].respond Opt: respond	If checked, the router will return an SMS. Select **Respond** if you want the router to reply. 0 | Disabled. 1 | Enabled.

Table 80: Information table for mobile manager callers settings

26.2.7 Roaming interface template

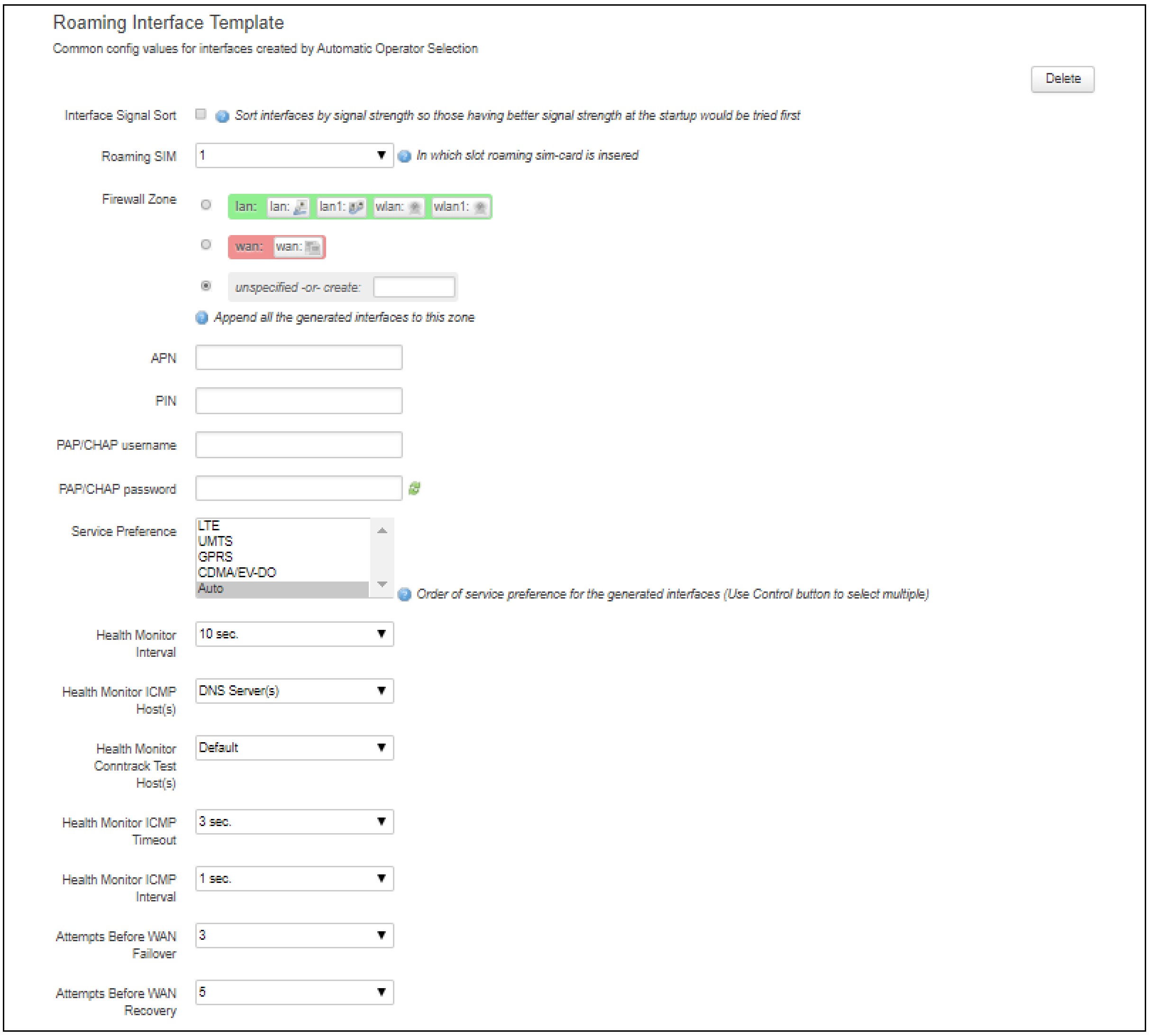

Figure 128: The roaming interface template page

Web Field/UCI/Package Option	Description
Web: Interface Signal Sort UCI: mobile.@roaming_template[0].sort_sig_strength Opt: sort_sig_strength	Sorts interfaces by signal strength priority, so those that have a better signal strength will be tried first. 0 – Disabled. 1 – Enabled.
Web: Roaming SIM UCI: mobile.main.roaming_sim Opt: roaming_sim	Sets in which slot to insert roaming SIM card. 1 – SIM slot 1. 2 – SIM slot 2.
Web: Firewall Zone UCI: mobile.@roaming_template[0].firewall_zone Opt: firewall_zone	Adds all generated interfaces to this zone. Select existing zone or click **unspecified** or **create** to create new zone.
Web: APN UCI: mobile.@roaming_template[0].apn Opt: apn	APN name of Mobile Network Operator.

Web: PIN UCI: mobile.@roaming_template[0].pincode Opt: pincode	SIM card's PIN number.
Web: PAP/CHAP username UCI: mobile.@roaming_template[0].username Opt: username	Username used to connect to APN.
Web: PAP/CHAP password UCI: mobile.@roaming_template[0].password Opt: password	Password used to connect to APN.
Web: Service Order UCI: mobile.@roaming_template[0].service_order Opt: service_order	Defines a space separated list of services, in preferred order. Valid options are `gprs, umts, lte, auto.` If no valid_service order is defined, then the configured Service Type is used. Example: `mobile.@roaming_template[0].service_order="gprs umts lte auto"` Blank: Automatically detect best service. Range: gprs umts lte auto
Web: Health Monitor Interval UCI: mobile.@roaming_template[0].health_interval Opt: health_interval	Sets the period, in seconds, to check the health status of the interface. The Health Monitor interval will be used for: Interface state checks Ping interval Signal strength checks 10: Health check every 10 seconds. Range:
Web: Health Monitor ICMP Host(s) UCI: mobile.@roaming_template[0].icmp_hosts Opt: icmp_hosts	Specifies target IP address for ICMP packets. **Web** / **Description** / **UCI** Disable / Disables the option. / disable DNS servers / DNS IP addresses will be used. / dns WAN gateway / Gateway IP address will be used. / gateway custom / Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example: option icmp_hosts '1.1.1.1,2.2.2.2' /

<table>
<tr><td>Web: Health Monitor Conntrack Test Host(s)
UCI: mobile.@roaming_template[0].conntrack_hosts
Opt: conntrack_hosts</td><td>Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval.
The Conntrack_hosts option defines the IP for conntrack to track, usually the icmp_host IP is used.
If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host; otherwise a ping is sent as normal to the icmp_host.
By default, the conntrack_host is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated.
Conntrack is generally used to limit the traffic sent on a GSM network.
<table>
<tr><th>Web</th><th>Description</th><th>UCI</th></tr>
<tr><td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td></td></tr>
<tr><td>Disable</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td>disable</td></tr>
<tr><td>custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Health Monitor ICMP Timeout
UCI: mobile.@roaming_template[0].timeout
Opt: timeout</td><td>Specifies the time in seconds that Health Monitor ICMP will timeout at.
Sets ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at.
<table>
<tr><td>3</td><td>Wait 3 seconds for ping reply.</td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Health Monitor ICMP Interval
UCI: mobile.@roaming_template[0].interval
Opt: icmp_interval</td><td>Defines the interval, in seconds, between multiple pings sent at each health check.
<table>
<tr><td>1</td><td></td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Attempts Before WAN Failover
UCI: mobile.@roaming_template[1].health_fail_retries
Opt: health_fail_retries</td><td>Defines the number of health check failures before interface is disconnected.
<table>
<tr><td>3</td><td></td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Attempts Before WAN Recovery
UCI: mobile.@roaming_template[0].health_recovery_retries
Opt: health_recovery_retries</td><td>Sets the number of health check passes before the interface is considered healthy. This field is not used for a roaming template.
<table>
<tr><td>5</td><td></td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Priority
UCI: mobile.@roaming_template[0].priority
Opt: priority</td><td>Type the priority number. The higher the value, the higher the priority.
This multi-WAN interface priority must be lower than the one specified in the priority field for the PMP interface.
<table>
<tr><td>0</td><td></td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Multi-WAN: Exclusive Group
UCI: mobile.@roaming_template[0].multiwan_exclusive_group
Opt: multiwan_exclusive_group</td><td>Specifies the Multi-WAN group for the generated roaming interfaces. Defaults to ‘3g’ if not specified.</td></tr>
<tr><td>Web: Minimum ifup interval
UCI: multiwan.wan.ifup_retry_sec
Opt: ifup_retry_sec</td><td>Not used for a roaming interface.
<table>
<tr><td>300</td><td>Retry primary interface every 300 seconds.</td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
</table>

Web: Interface Start Timeout UCI: mobile.@roaming_template[0].ifup_timeout_sec Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail. 40 — 40 seconds Range —
Web: Signal Threshold (dBm) UCI: mobile.@roaming_template[0].signal_threshold Opt: signal_threshold	Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics. Range — -46 to -115 dBm -115dBm —

Table 81: Information table for roaming interface template

When you have configured your settings, click **Save & Apply**.

In the top menu, select **System -> Reboot**. The System page appears.

Figure 129: The reboot page

Check the **Reboot now** check box and then click **Reboot**.

26.2.8 Scenario 2: PMP + roaming: pre-empt disabled

As in the previous section, Multi-WAN connects the PMP interface and uses auto-created interfaces for failover.

However, in this scenario, the auto-created interface will not be disconnected as soon as the `ifup_retry_sec` expires for the PMP interface. The primary interface will be reconnected when the current auto-created interface fails multiwan health checks after expiration of the `ifup_retry_sec` timer.

Follow the instructions in the section above for creation of the PMP interface, Multi-WAN and Mobile Manager roaming interfaces. The only change in configuration compared to the PMP + roaming: pre-empt enabled scenario is that you must disable the pre-empt option in the multi-WAN package.

26.2.8.1 Set multi-WAN options for pre-empt disabled

To disable PMP + roaming pre-empt, in the top menu, select **Network -> Multi-Wan**.

In the Multi-WAN page, ensure Preempt is not selected.

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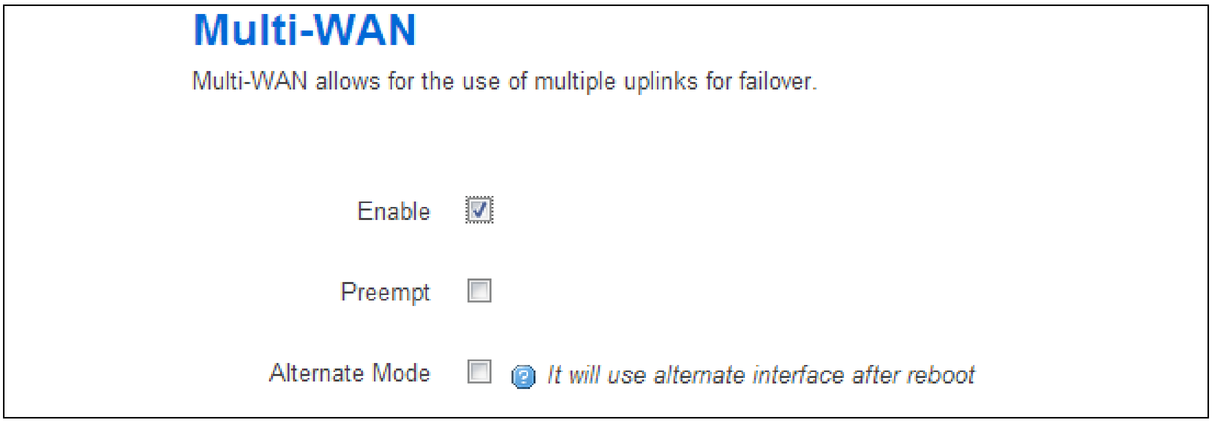

Figure 130: The multi-wan page, pre-empt not selected

Click **Save & Apply**.

In the top menu, select **System -> Reboot**. The System Reboot page appears.

Figure 131: The system reboot page

Check the **Reboot now** check box and then click **Reboot**.

26.2.9 Scenario 3: No PMP + roaming

In this scenario there is no PMP interface that can be used for a connection. The router scans the available mobile networks at boot and sorts the networks according to signal strength.

The network that offers the best signal strength will be the first to connect. Multi-WAN then controls the failover between the available networks.

Multi-WAN periodically does a health check on the interface. A health check comprises of a configurable combination of the following:

- Interface state
- Pings to an ICMP target

- Signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks results in a fail. After a configurable number of health check failures, Multi-WAN will disconnect the failed interface and attempt to connect to the next best roaming interface.

26.2.10 Set options for automatically created interfaces (failover)

In the top menu on the web interface page, select **Services -> Mobile Manager**. The Mobile Manager page appears.

There are three sections:

Basic settings	Configure SMS, select roaming SIM and collect ICCCIDs.
Callers	Configure callers that can use SMS.
Roaming Interface Template	Configure common values for interface created by Automatic Operator Selection.

26.2.10.1 Basic settings

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: SMS Enable
UCI: mobile.main.sms
Opt: sms</td><td>Enables SMS.<table><tr><td>no</td><td>Disabled.</td></tr><tr><td>yes</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Collect ICCIDs
UCI: mobile.main.init_get_iccids
Opt: init_get_iccids</td><td>Enables or disables integrated circuit card identifier ICCID’s collection functionality. If enabled then both SIM 1 and SIM 2 ICCIDs will be collected otherwise it will default to SIM 1. This will be display under mobile stats.<table><tr><td>no</td><td>Disabled.</td></tr><tr><td>yes</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: PIN code for SIM1
UCI: mobile.main.sim2pin
Opt: sim2pin</td><td>Depending on the SIM card specify the pin code for SIM 1.<table><tr><td>Blank</td><td></td></tr><tr><td>range</td><td></td></tr></table></td></tr>
<tr><td>Web: PIN code for SIM2
UCI: mobile.main.sim2pin
Opt: sim2pin</td><td>Depending on the SIM card specify the pin code for SIM 2.<table><tr><td>Blank</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: HDR Auto User ID
UCI: mobile.main.hdr_userid
Opt: hdr_userid</td><td>AN-PPP user ID. Supported on Cellient (CDMA) modem only.<table><tr><td>Blank</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 82: Information table for mobile manager basic settings

26.2.10.2 Caller settings

Web Field/UCI/Package Option	Description
Web: Name UCI: mobile.@caller[0].name Opt: name	Name assigned to the caller. Blank Range
Web: Number UCI: mobile.@caller[0].number Opt: number	Number of the caller allowed to SMS the router. Add in specific caller numbers or use the wildcard symbol. Blank Range
Web: Enable UCI: mobile.@caller[0].enabled Opt: enabled	Enables or disables incoming caller ID. no: Disabled. yes: Enabled.
Web: Respond UCI: mobile.@caller[0].respond Opt: respond	If checked, the router will return an SMS. Select **Respond** if you want the router to reply. 0: Disabled. 1: Enabled.

Table 83: Information table for mobile manager caller settings

26.2.11 Roaming interface template

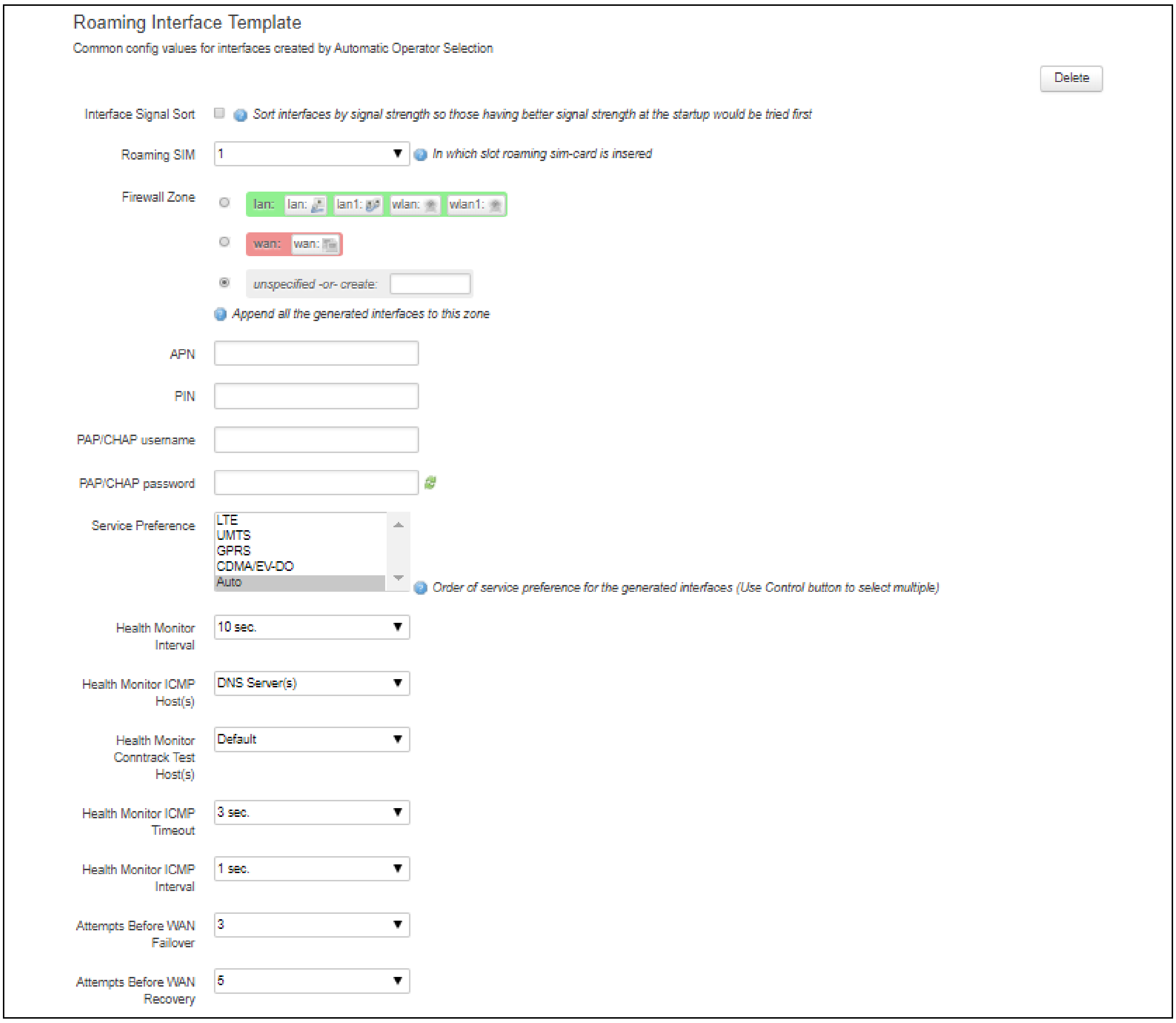

Figure 132: The roaming interface template page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Interface Signal Sort
UCI: mobile.@roaming_template[0].sort_sig_strength
Opt: sort_sig_strength</td><td>Sorts interfaces by signal strength priority so those that have a better signal strength will be tried first.</td></tr>
<tr><td>Web: Roaming SIM
UCI: mobile.main.roaming_sim
Opt: roaming_sim</td><td>Sets which slot to insert roaming SIM card.<table><tr><td>1</td><td>SIM slot 1.</td></tr><tr><td>2</td><td>SIM slot 2.</td></tr></table></td></tr>
<tr><td>Web: Firewall Zone
UCI: mobile.@roaming_template[0].firewall_zone
Opt: firewall_zone</td><td>Adds all generated interfaces to this zone.
Select existing zone or click unspecified or create to create a new zone.</td></tr>
<tr><td>Web: APN
UCI: mobile.@roaming_template[0].apn
Opt: apn</td><td>APN name of Mobile Network Operator.</td></tr>
<tr><td>Web: PIN
UCI: mobile.@roaming_template[0].pincode
Opt: pincode</td><td>SIM card’s PIN number.</td></tr>
<tr><td>Web: PAP/CHAP username
UCI: mobile.@roaming_template[0].username
Opt: username</td><td>Username used to connect to APN.</td></tr>
<tr><td>Web: PAP/CHAP password
UCI: mobile.@roaming_template[0].password
Opt: password</td><td>Password used to connect to APN.</td></tr>
<tr><td>Web: Service Order
UCI: mobile.@roaming_template[0].service_order
Opt: service_order</td><td>Defines a space separated list of services, in preferred order. Valid options are <code>gprs, umts, lte, auto.</code>
If no valid_service order is defined, then the configured Service Type is used. Example:
<code>mobile.@roaming_template[0].service_order=”gprs umts lte auto”</code><table><tr><td>Blank</td><td>Automatically detect best service</td></tr><tr><td>Range</td><td>gprs umts lte auto</td></tr></table></td></tr>
<tr><td>Web: Health Monitor Interval
UCI: mobile.@roaming_template[0].health_interval
Opt: health_interval</td><td>Sets the period to check the health status of the interface. The Health Monitor interval will be used for:
Interface state checks
Ping interval
Signal strength checks
<table><tr><td>10</td><td>health check every 10 seconds</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

<table>
<tr><td>Web: Health Monitor ICMP Host(s)
UCI: mobile.@roaming_template[0].icmp_hosts
Opt: icmp_hosts</td><td>Specifies target IP address for ICMP packets.
<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Disable</td><td>Disables the option.</td><td>disable</td></tr><tr><td>DNS servers</td><td>DNS IP addresses will be used.</td><td>dns</td></tr><tr><td>WAN gateway</td><td>Gateway IP address will be used.</td><td>gateway</td></tr><tr><td>custom</td><td>Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example:
option icmp_hosts ‘1.1.1.1,2.2.2.2’</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor Conntrack Test Host(s)
UCI: mobile.@roaming_template[0].conntrack_hosts
Opt: conntrack_hosts</td><td>Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval.
The Conntrack_hosts option defines the IP for conntrack to track, usually the icmp_host IP is used.
If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host; otherwise a ping is sent as normal to the icmp_host.
By default, the conntrack_hosts is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated.
Conntrack is generally used to limit the traffic sent on a GSM network.
<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td></td></tr><tr><td>Disable</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td>disable</td></tr><tr><td>custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Timeout
UCI: mobile.@roaming_template[0].timeout
Opt: timeout</td><td>Sets ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at.
<table><tr><td>3</td><td>Wait 3 seconds for ping reply.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Health Monitor ICMP Interval
UCI: mobile.@roaming_template[0].interval
Opt: icmp_interval</td><td>Defines the interval, in seconds, between multiple pings sent at each health check
<table><tr><td>1</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Attempts Before WAN Failover
UCI: mobile.@roaming_template[1].health_fail_retries
Opt: health_fail_retries</td><td>Defines the number of health check failures before interface is disconnected.
<table><tr><td>3</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Attempts Before WAN Recovery
UCI: mobile.@roaming_template[0].health_recovery_retries
Opt: health_recovery_retries</td><td>Sets the number of health check passes before the interface is considered healthy. This field is not used for a roaming template.</td></tr>
<tr><td>Web: Priority
UCI: mobile.@roaming_template[0].priority
Opt: priority</td><td>Type the priority number. The higher the value, the higher the priority.
<table><tr><td>0</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Web: Minimum ifup interval UCI: mobile.@roaming_template[0].ifup_retry_sec Opt: ifup_retry_sec	Specifies the interval in seconds before retrying the primary interface when pre-empt mode is enabled. 300 — Retry primary interface every 300 seconds. Range —
Web: Interface Start Timeout UCI: mobile.@roaming_template[0].ifup_timeout_sec Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail It is recommended to configure a value greater than 120 seconds. 40 — Range —
Web: Signal Threshold (dBm) UCI: mobile.@roaming_template[0].signal_threshold Opt: signal_threshold	Specifies the minimum signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for sig_dbm in mobile diagnostics.-115 dBm. — Disabled Range — -46 to -115 dBm

Table 84: Information table for roaming interface template

When you have configured your settings, click **Save & Apply**.

26.2.11.1 Set multi-WAN operation

From the top menu, select **Network -> Multi-Wan**. The Multi-WAN page appears.

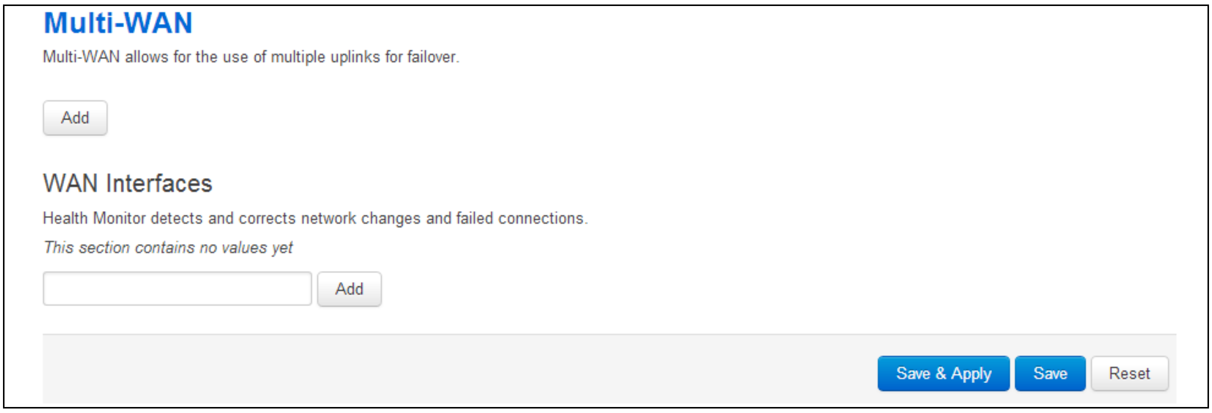

Figure 133: The multi-WAN page

In the Multi-WAN section click **Add**.

Web Field/UCI/Package Option	Description
Web: Enable UCI: multiwan.config.enabled Opt: enabled	Enables multiwan. Select this option. 0 — Disabled. 1 — Enabled.
Web: Preempt UCI: multiwan.config.preempt Opt: pre-empt	Enables or disables pre-emption for multiwan. If enabled the router will keep trying to connect to a higher priority interface depending on timer set by ifup_retry_sec. Leave this option unselected. 0 — Disabled. 1 — Enabled.
Web: Alternate Mode UCI: multiwan.config.alt Opt: alt	Enables or disables alternate mode for multiwan. If enabled the router will use an alternate interface after reboot. Leave this option unselected. 0 — Disabled. 1 — Enabled.

Table 85: Information table for multi-WAN operation

26.3 Configuring via UCI

26.3.1 PMP + roaming: pre-empt enabled & disabled via UCI

26.3.1.1 PMP interface configuration

The PMP interface is configured in the network package /etc/config/network. To view the network configuration file, enter:

```
root@VA_router:~# uci export network
package network

config interface 'loopback'
        option ifname 'lo'
        option proto 'static'
        option ipaddr '127.0.0.1'
        option netmask '255.0.0.0'

config interface 'lan'
        option ifname 'eth0'
        option proto 'static'
        option ipaddr '192.168.100.1'
        option netmask '255.255.255.0'

config interface '3g_s1_voda'
        option auto '0'
        option proto '3g'
        option service_order 'auto lte umts gprs'
        option apn 'testIE'
        option username 'test'
        option password 'test'
        option sim '1'        option operator 'vodafone IE'
```

To view uci commands, enter:

```
root@VA_router:~# uci show network
network.loopback=interface
network.loopback.ifname=lo
network.loopback.proto=static
network.loopback.ipaddr=127.0.0.1
network.loopback.netmask=255.0.0.0
```

```
network.lan=interface
network.lan.ifname=eth0
network.lan.proto=static
network.lan.ipaddr=192.168.100.1
network.lan.netmask=255.255.255.0
network.3g_s1_voda=interface
network. 3g_s1_voda.auto=0
network. 3g_s1_voda.proto=3g
network. 3g_s1_voda.service_order='auto lte umts gprs'
network. 3g_s1_voda.apn=test IE
network. 3g_s1_voda.username=test
network. 3g_s1_voda.password=test
network. 3g_s1_voda.sim=1
network. 3g_s1_voda.operator=vodafone IE
```

26.3.1.2 Roaming interface configuration

The roaming interface configurations are stored in the mobile package /etc/config/mobile.

To view the mobile configuration file, enter: `root@VA_router:~# uci export mobile`

```
config mobile 'main'
        option sms 'yes'
        option roaming_sim '1'
        option init_get_iccids 'no'
config caller
        option name 'Test'
        option number '*'
        option enabled 'yes'
        option respond 'yes'
config roaming_template
        option roaming_sim '1'
        option firewall_zone 'wan'
        option apn 'test IE'
        option username 'test'
        option password 'test'
        option service 'umts'
        option health_interval '4'
        option icmp_hosts 'disable'
```

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```
        option timeout 'disable'
        option health_fail_retries '3'
        option signal_threshold '-95'
        option priority '5'
        option ifup_retry_sec '120'
        option ifup_timeout_sec '180'
        option defaultroute 'yes'
        option sort_sig_strength 'yes'
```

To view the uci command of package mobile, enter:

```
root@VA_router:~#uci show mobile
mobile.main=mobile
mobile.main.sms=yes
mobile.main.roaming_sim=1
mobile.main.init_get_iccids=no
mobile.@caller[0]=caller
mobile.@caller[0].name=Test
mobile.@caller[0].number=*
mobile.@caller[0].enabled=yes
mobile.@caller[0].respond=yes
mobile.@roaming_template[0]=roaming_template
mobile.@roaming_template[0].roaming_sim=1
mobile.@roaming_template[0].firewall_zone=wan
mobile.@roaming_template[0].apn=test IE
mobile.@roaming_template[0].username=test
mobile.@roaming_template[0].password=test
mobile.@roaming_template[0].service=umts
mobile.@roaming_template[0].health_interval=4
mobile.@roaming_template[0].icmp_hosts=disable
mobile.@roaming_template[0].timeout=disable
mobile.@roaming_template[0].health_fail_retries=3
mobile.@roaming_template[0].signal_threshold=-95
mobile.@roaming_template[0].priority=5
mobile.@roaming_template[0].ifup_retry_sec=120
mobile.@roaming_template[0].ifup_timeout_sec=180
mobile.@roaming_template[0].defaultroute=yes
mobile.@roaming_template[0].sort_sig_strength=yes
```

26.3.1.3 Multi-WAN configuration using UCI

The configuration file for package multiwan is stored on **/etc/config/multiwan**

To see configuration file of mobile package, enter:

```
root@VA_router:~# cat /etc/config/multiwan
config multiwan 'config'
        option enabled '1'
        option preempt '1'

config interface '3g_s1_voda'
        option health_fail_retries '3'
        option health_interval '3'
        option timeout '1'
        option icmp_hosts 'disable'
        option priority '10'
        option exclusive_group '3g'
        option signal_threshold '-95'
        option ifup_retry_sec '350'
        option ifup_timeout_sec '180'
        option manage_state '1'
```

To view the uci command of package multiwan, enter:

```
root@VA_router:~# uci show multiwan
multiwan.config=multiwan
multiwan.config.enabled=1
multiwan.config.preempt=1
multiwan.main_voda=interface
multiwan.main_voda.health_fail_retries=3
multiwan.main_voda.health_interval=3
multiwan.3g_s1_voda.timeout=1
multiwan.3g_s1_voda.icmp_hosts=disable
multiwan.3g_s1 main _voda.priority=10
multiwan.3g_s1_voda.exclusive_group=3g
multiwan.3g_s1_voda.signal_threshold=-95
multiwan.3g_s1_voda.ifup_retry_sec=350
multiwan.3g_s1_voda.ifup_timeout_sec=180
multiwan.3g_s1_voda.manage_state=1
```

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The difference between PMP + roaming: pre-empt enabled and disabled is setting one option parameter. To disable pre-empt, enter:

```
uci set multiwan.config.preempt=0
uci commit
```

Note: available values are:

0	Disabled
1	Enabled

26.4 Configuring no PMP + roaming using UCI

The roaming interface configuration file is stored in the mobile package **/etc/config/mobile**. To view the mobile package, enter:

```
root@VA_router:~# uci export mobile


package mobile
config mobile 'main'
        option sms 'yes'
        option roaming_sim '1'
        option debug '1'


config caller
        option name 'Eval'
        option number '*'
        option enabled 'yes'
        option respond 'yes'


config roaming_template
        option roaming_sim '1'
        option firewall_zone 'wan'
        option apn 'test IE'
        option username 'test'
        option password 'test'
        option service 'umts'
        option health_fail_retries '2'
        option signal_threshold '-100'
        option priority '5'
        option ifup_timeout_sec '180'
        option defaultroute 'yes'
```

```
        option sort_sig_strength 'yes'
        option ifup_retry_sec '200'
        option health_interval '120'
        option icmp_hosts '172.31.4.129'
        option timeout '3'
        option health_recovery_retries '3'
```

To view the mobile package via uci commands, enter:

```
root@VA_router:~# uci show mobile
mobile.main=mobile
mobile.main.sms=yes
mobile.main.roaming_sim=1
mobile.main.debug=1
mobile.@caller[0]=caller
mobile.@caller[0].name=Eval
mobile.@caller[0].number=*
mobile.@caller[0].enabled=yes
mobile.@caller[0].respond=yes
mobile.@roaming_template[0]=roaming_template
mobile.@roaming_template[0].roaming_sim=1
mobile.@roaming_template[0].firewall_zone=wan
mobile.@roaming_template[0].apn=stream.co.uk
mobile.@roaming_template[0].username=default
mobile.@roaming_template[0].password=void
mobile.@roaming_template[0].service=umts
mobile.@roaming_template[0].health_fail_retries=2
mobile.@roaming_template[0].signal_threshold=-100
mobile.@roaming_template[0].priority=5
mobile.@roaming_template[0].ifup_timeout_sec=180
mobile.@roaming_template[0].defaultroute=yes
mobile.@roaming_template[0].sort_sig_strength=yes
mobile.@roaming_template[0].ifup_retry_sec=200
mobile.@roaming_template[0].health_interval=120
mobile.@roaming_template[0].icmp_hosts=172.31.4.129
mobile.@roaming_template[0].timeout=3
mobile.@roaming_template[0].health_recovery_retries=3
```

The multiwan package is stored on **/etc/config/multiwan**. To view the multiwan package, enter:

```
root@VA_router:~# uci export multiwan
package multiwan

config multiwan 'config'
        option enabled 'yes'
        option preempt 'no'
        option alt_mode 'no'
To see multiwan package via uci, enter:
root@VA_router:~# uci show multiwan
multiwan.config=multiwan
multiwan.config.enabled=yes
multiwan.config.preempt=no
multiwan.config.alt_mode=no
```

26.5 Automatic operator selection diagnostics via the web interface

26.5.1 Checking the status of the multiwan package

When interfaces are auto-created they are presented in the network and in the multiwan package.

To check interfaces created in the multiwan package, from the top menu, select **Network -> Multi-WAN**.

To check interfaces that have been created in the network package, from the top menu, select **Network -> Interfaces**.

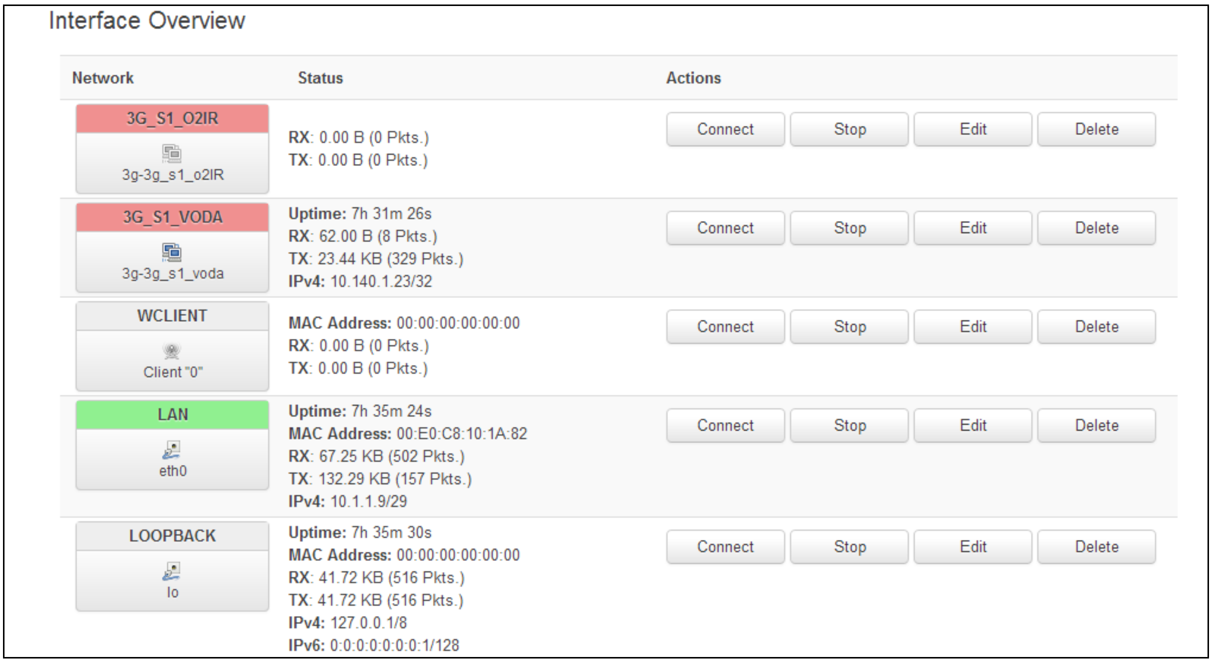

Figure 134: The interface overview page

To check the status of the interface you are currently using, in the top menu, click **Status**. The Interface Status page appears.

Scroll down to the bottom of the page to view Multi-WAN Stats.

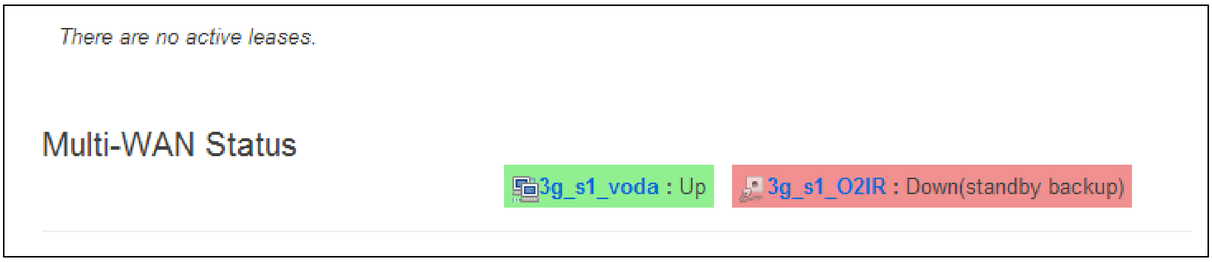

Figure 135: The status page: multi-WAN status section page

26.6 Automatic operator selection diagnostics via UCI

26.6.1 Check roaming interfaces discovered

Roaming interfaces discovered during roaming search are stored at **/var/const_state/roaming**. This file contains a section for each discovered operator/service combination, along with signal strength, if tested. Time taken to scan is also available along with the time of scan and number of services found.

To check roaming interfaces discovered, enter

```
root@VA_router:~# cat /var/const_state/roaming
roaming.main2_voda_lte=service
roaming.main2_voda_lte.name=vodafone IE
roaming.main2_voda_lte.shortname=voda IE
```

```
roaming.main2_voda_lte.opnum=27201
roaming.main2_voda_lte.interface=main2_voda
roaming.main2_voda_lte.servicetype=7
roaming.main2_voda_lte.sim=2
roaming.main2_voda_lte.tested=0
roaming.main2_voda_lte.signalstrength=0
roaming.main2_voda_umts=service
roaming.main2_voda_umts.name=vodafone IE
roaming.main2_voda_umts.shortname=voda IE
roaming.main2_voda_umts.opnum=27201
roaming.main2_voda_umts.interface=main2_voda
roaming.main2_voda_umts.servicetype=2
roaming.main2_voda_umts.sim=2
roaming.main2_voda_umts.tested=1
roaming.main2_voda_umts.signalstrength=-79
roaming.main2_voda_gprs=service
roaming.main2_voda_gprs.name=vodafone IE
roaming.main2_voda_gprs.shortname=voda IE
roaming.main2_voda_gprs.opnum=27201
roaming.main2_voda_gprs.interface=main2_voda
roaming.main2_voda_gprs.servicetype=0
roaming.main2_voda_gprs.sim=2
roaming.main2_voda_gprs.tested=0
roaming.main2_voda_gprs.signalstrength=0
roaming.main2_o2IR_umts=service
roaming.main2_o2IR_umts.name=o2 IRL
roaming.main2_o2IR_umts.shortname=o2 - IRL
roaming.main2_o2IR_umts.opnum=27202
roaming.main2_o2IR_umts.interface=main2_o2IR
roaming.main2_o2IR_umts.servicetype=2
roaming.main2_o2IR_umts.sim=2
roaming.main2_o2IR_umts.tested=1
roaming.main2_o2IR_umts.signalstrength=-85
roaming.main2_o2IR_gprs=service
roaming.main2_o2IR_gprs.name=o2 IRL
roaming.main2_o2IR_gprs.shortname=o2 - IRL
roaming.main2_o2IR_gprs.opnum=27202
```

```
roaming.main2_o2IR_gprs.interface=main2_o2IR
roaming.main2_o2IR_gprs.servicetype=0
roaming.main2_o2IR_gprs.sim=2
roaming.main2_o2IR_gprs.tested=0
roaming.main2_o2IR_gprs.signalstrength=0
roaming.status=status
roaming.status.num_services=5
roaming.status.scan_update_time=Thu Feb 22 05:02:38 2018
roaming.status.scan_duration=185
```

Roaming operators are also stored in MIB `vaModemRoaming.mib`.

26.6.2 Check interfaces created in multiwan

To check interfaces created in the multiwan package, enter:

```
root@VA_router:~# cat /var/const_state/multiwan
multiwan.main2_3IRL=interface
multiwan.main2_3IRL.timeout=disable
multiwan.main2_3IRL.health_recovery_retries=5
multiwan.main2_3IRL.exclusive_group=3g
multiwan.main2_3IRL.manage_state=yes
multiwan.main2_3IRL.signal_threshold=-80
multiwan.main2_3IRL.ifup_timeout_sec=150
multiwan.main2_3IRL.icmp_hosts=disable
multiwan.main2_3IRL.health_interval=4
multiwan.main2_3IRL.priority=5
multiwan.main2_3IRL.ifup_retry_sec=120
multiwan.main2_3IRL.health_fail_retries=3
multiwan.main2_o2IR=interface
multiwan.main2_o2IR.timeout=disable
multiwan.main2_o2IR.health_recovery_retries=5
multiwan.main2_o2IR.exclusive_group=3g
multiwan.main2_o2IR.manage_state=yes
multiwan.main2_o2IR.signal_threshold=-80
multiwan.main2_o2IR.ifup_timeout_sec=150
multiwan.main2_o2IR.icmp_hosts=disable
multiwan.main2_o2IR.health_interval=4
multiwan.main2_o2IR.priority=5
multiwan.main2_o2IR.ifup_retry_sec=120
multiwan.main2_o2IR.health_fail_retries=3
```

26.6.3 Check interfaces created in network

To check interfaces created in the network package, enter:

```
root@VA_router:~# cat /var/const_state/network
network.main2_3IRL=interface
network.main2_3IRL.snmp_alias_ifindex=3
network.main2_3IRL.sim=2
network.main2_3IRL.defaultroute=yes
network.main2_3IRL.username=campen1
```

```
network.main2_3IRL.apn=vpn.amylan.co.uk
network.main2_3IRL.opformat=2
network.main2_3IRL.phy=1-1
network.main2_3IRL.roaming_sim=2
network.main2_3IRL.operator=27205
network.main2_3IRL.password=campen1
network.main2_3IRL.auto=no
network.main2_3IRL.service_order=auto
network.main2_3IRL.proto=3g
network.main2_o2IR=interface
network.main2_o2IR.snmp_alias_ifindex=3
network.main2_o2IR.sim=2
network.main2_o2IR.defaultroute=yes
network.main2_o2IR.username=campen1
network.main2_o2IR.apn=vpn.amylan.co.uk
network.main2_o2IR.opformat=2
network.main2_o2IR.phy=1-1
network.main2_o2IR.roaming_sim=2
network.main2_o2IR.operator=27202
network.main2_o2IR.password=campen1
network.main2_o2IR.auto=no
network.main2_o2IR.service_order=auto
network.main2_o2IR.proto=3g
```

26.6.4 Check current interface

To check the SIM status of the interface you are currently using, enter:

```
root@VA_router:~# cat /var/const_state/mobile
mobile.3g_1_1=status
mobile.3g_1_1.sim2_iccid=89314404000075920976
mobile.3g_1_1.imei=866802020194140
mobile.3g_1_1.hw_rev=4534B04SIM7100E
mobile.3g_1_1.sim_select=yes
```

To check mobile status of the interface you are currently using, enter:

```
root@VA_router:~# cat /var/state/mobile
mobile.3g_1_1=status
mobile.3g_1_1.auto_info=/tmp/3g_1-1.auto
mobile.3g_1_1.scan_update_time=Thu Feb 22 05:02:38 2018
mobile.3g_1_1.imsi=204043726930595
mobile.3g_1_1.imsi2=204043726930595
mobile.3g_1_1.lte_band=3
mobile.3g_1_1.last_error=no network service
mobile.3g_1_1.mcc=272
mobile.3g_1_1.last_error_time=2018-02-22 10:41:27
mobile.3g_1_1.lac=11
mobile.3g_1_1.cell=46542698
mobile.3g_1_1.mnc=05
mobile.3g_1_1.operator_code=27205
mobile.3g_1_1.operator_name=3 IRL DATA ONLY
mobile.3g_1_1.rscp_dbm=-86
mobile.3g_1_1.ecio_db=-8.5
mobile.3g_1_1.sig_dbm=-51
mobile.3g_1_1.temperature=37
mobile.3g_1_1.vam_state=connecting
mobile.3g_1_1.sim_slot=2
mobile.3g_1_1.sim_in=yes
mobile.3g_1_1.technology=UMTS
mobile.3g_1_1.registered=Roaming
mobile.3g_1_1.reg_code=5
mobile.3g_1_1.registered_pkt=Searching
mobile.3g_1_1.reg_code_pkt=2
```

27 Configuring Connection Watch (cwatch)

Connection Watch is a recovery feature to enable dynamic recovery of an interface. You can configure multiple instances of Connection Watch.

Connection Watch consists of the following configurable instances:

- Interface(s) to be monitored
- Failure periods
- Recovery actions

If no data is received over the monitored interface during the configured duration, then the recovery action is performed. If more than one interface is specified under a single Connection Watch, the recovery action will be performed only if no data is received on both of the interfaces for the defined period.

Currently three configurable periods and associated recovery actions can be defined. Recovery actions are prioritised based on their configured failure periods, the smallest failure period having the lowest priority. Lowest priority actions are repeated until the next highest priority action executes at which point it then stops leaving only the new action to execute at configured intervals.

Example:

- Failure time 1 = 1 hour; Failure action 1= interface up
- Failure time 2 = 10 hours; Failure action 2 = interface restart
- Failure time 3 = 24 hours; Failure action 3 = reboot

In the above example action execution priorities are action 3 > action 2 > action 1. In the case of failure to detect incoming packets, action 1 is triggered first and is executed at intervals of one hour until action 2 is due. When action 2 is executed, action 1 gets disabled and thereafter only action 2 is executed every 10 hours until action 3 is due.

If the status of the interface is detected as ‘up’ at any stage then no subsequent failure action will occur and all failure timers are reset. In the case of any subsequent failure, all failure actions are re-enabled and the action sequence is repeated.

27.1 Configuration package used

Package	Sections
cwatch	watch

27.2 Configuring Connection Watch using the web interface

To configure Connection Watch using the web interface, select **Services - >Connection Watch**. The Connection Watch page appears.

If no Connection Watch configuration exists in the configuration file, first enter a name for the Connection Watch instance and select **Add**.

Figure 136: The add connection watch configuration page

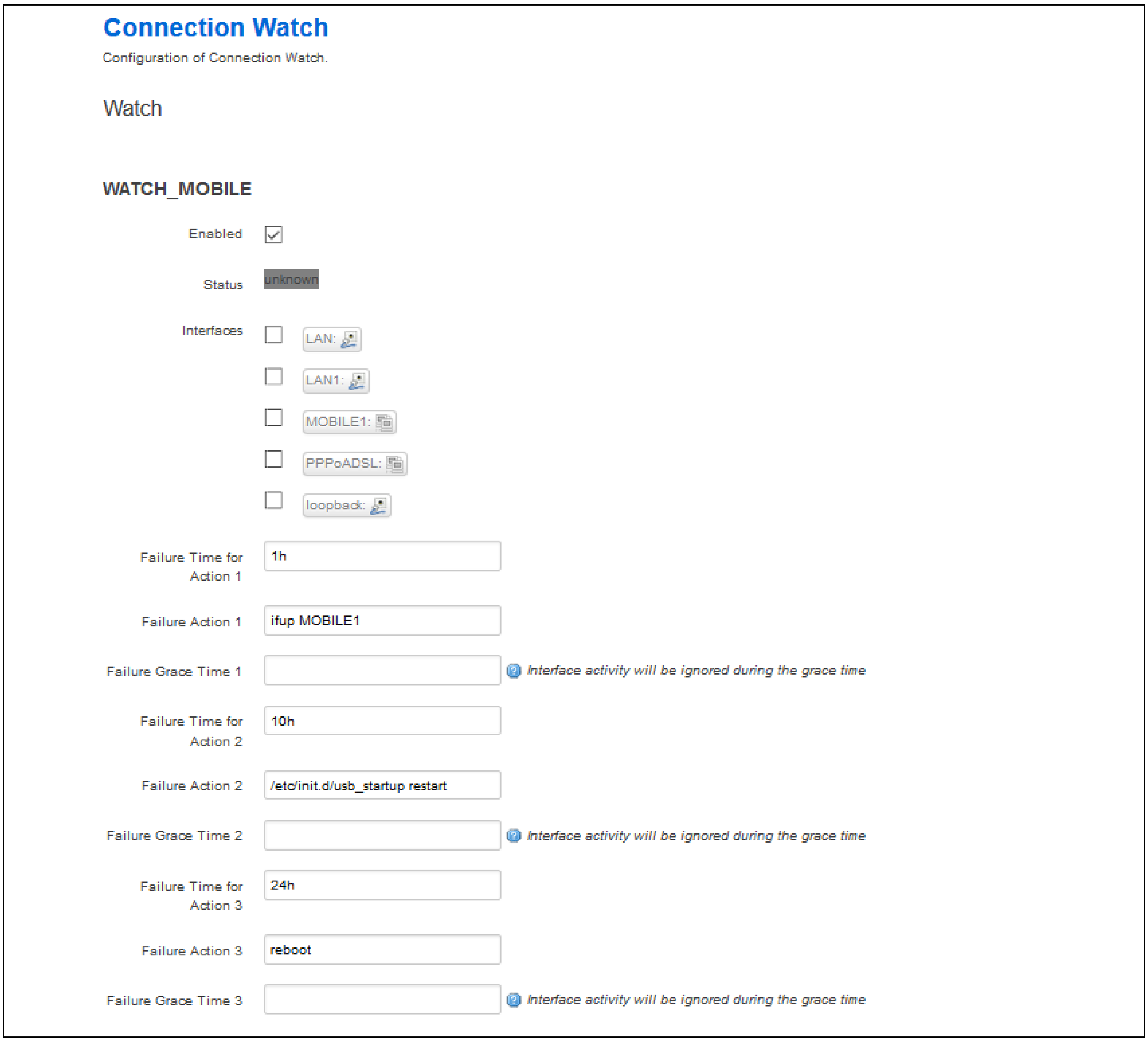

Figure 137: The connection watch configuration page

Web Field/UCI/Package Option	**Description**
Web: Enabled UCI: cwatch.@watch[0].enabled Opt: enabled	Enables a cwatch instance. 0 — Disabled. 1 — Enabled.
Web: Interfaces UCI: cwatch.@watch[0].test_ifaces Opt: test_ifaces	Defines the interface name(s) to monitor. Multiple interfaces are delimited by space separator. Example: `option test_ifaces 'WANADSL WANMOBILE'` If multiple interfaces are defined the failure action will only be triggered if no traffic is received on all interfaces for the defined period.
Web: Failure Time for Action 1 UCI: cwatch.@watch[0].failure_time_1 Opt: failure_time_1	Defines a duration to monitor an interface for receive traffic. Duration can be specified in seconds, minutes, hours, days. 1h Range — s; m; h; d;
Web: Failure Action 1 UCI: cwatch.@watch[0].failure_action_1 Opt: failure_action_1	Defines the failure action associated with failure_time_1. Example to force up interface: `option failure_action_1 'ifup wan'` blank Range
Web: Failure Grace Time 1 UCI: cwatch.@watch[0].failure_grace_time_1 Opt: failure_grace_time_1	Defines a grace time during which interface activity will be ignored after 'Failure Action 1' is executed. Connection Watch will assume the interface to be down during the grace period and will not reset the failure action timers even if packets are received during this grace time. This can be used to overcome the situation where packets can be received after a failure action even though the interface eventually fails to connect. For example, during a USB restart on a mobile interface, a small number of packets can be registered as being received while a mobile connection is attempted but fails registration. 0 — No grace time Range — s; m; h; d;
Web: Failure Time for Action 2 UCI: cwatch.@watch[0].failure_time_2 Opt: failure_time_2	Defines a second duration to monitor an interface for receive traffic. Duration can be specified in seconds, minutes, hours, days. 10h Range — s; m; h; d;
Web: Failure Action 2 UCI: cwatch.@watch[0].failure_action_2 Opt: failure_action_2	Defines the failure action associated with failure_time_2. Example to reset usb: `option failure_action_1 '/etc/init.d/usb_startup restart'` blank Range
Web: Failure Grace Time 2 UCI: cwatch.@watch[0].failure_grace_time_2 Opt: failure_grace_time_2	Defines a grace time during which interface activity will be ignored after 'Failure Action 2' is executed. Connection Watch will assume the interface to be down during the grace period and will not reset the failure action timers even if packets are received during this grace time. This can be used to overcome the situation where packets can be received after a failure action even though the interface eventually fails to connect. For example, during a USB restart on a mobile interface, a small number of packets can be registered as being received while a mobile connection is attempted but fails registration. 0 — No grace time Range — s; m; h; d;

Web: Failure Time for Action 3 UCI: cwatch.@watch[0].failure_time_3 Opt: failure_time_3	Defines a third duration to monitor an interface for receive traffic. Duration can be specified in seconds, minutes, hours, days. 24h | Range | s; m; h; d;
Web: Failure Action 3 UCI: cwatch.@watch[0].failure_action_3 Opt: failure_action_3	Defines the failure action associated with failure_time_3. Example to reset usb: `option failure_action_3 ‘reboot’` blank | Range |
Web: Failure Grace Time 3 UCI: cwatch.@watch[0].failure_grace_time_3 Opt: failure_grace_time_3	Defines a grace time during which interface activity will be ignored after ’Failure Action 3’ is executed. Connection Watch will assume the interface to be down during the grace period and will not reset the failure action timers even if packets are received during this grace time. This can be used to overcome the situation where packets can be received after a failure action even though the interface eventually fails to connect. For example, during a USB restart on a mobile interface, a small number of packets can be registered as being received while a mobile connection is attempted but fails registration. 0 | No grace time Range | s; m; h; d;

Table 86: Information table for cwatch section

27.3 Configuring cwatch using command line

By default, all cwatch instances are named ‘watch’, the cwatch instance is identified by `@watch` then the watch position in the package as a number. For example, for the first route in the package using UCI:

```
cwatch.@watch[0]=watch
cwatch.@watch[0].enabled=1
```

Or using package options:

```
config watch
        option enabled ‘1’
```

However, to better identify it, we recommend giving the cwatch instance a name. For example, a watch named ‘WATCH_MOBILE’ will be `cwatch.WATCH_MOBILE`.

To define a named cwatch instance using UCI, enter:

```
cwatch.WATCH_MOBILE=watch
cwatch.WATCH_MOBILE.enabled=1
```

To define a named cwatch instance using package options, enter:

```
config watch 'WATCH_MOBILE'
        option 'enabled' '1'
```

27.3.1 cwatch using UCI

```
root@VA_router:~# uci show cwatch
cwatch.WATCH_MOBILE=watch
cwatch.WATCH_MOBILE.enabled=1
cwatch.WATCH_MOBILE.test_ifaces=wan
cwatch.WATCH_MOBILE.failure_time_1=1h
cwatch.WATCH_MOBILE.failure_action_1=ifup wan
cwatch.WATCH_MOBILE.failure_time_2=10h
cwatch.WATCH_MOBILE.failure_action_2=/etc/init.d/usb_startup restart
cwatch.WATCH_MOBILE.failure_time_3=24h
cwatch.WATCH_MOBILE.failure_action_3=reboot
```

27.3.2 cwatch using package options

```
root@VA_router:~# uci export cwatch
package cwatch

config watch 'WATCH_MOBILE'
        option enabled '1'
        option test_ifaces wan
        option failure_time_1 '1h'
        option failure_action_1 'ifup wan
        option failure_grace_time_1 `30s`
        option failure_time_2 '10h'
        option failure_action_2 '/etc/init.d/usb_startup restart'
        option failure_grace_time_2 `2m`
        option failure_time_3 '24h'
        option failure_action_3 'reboot'
```

27.4 cwatch diagnostics

27.4.1 Syslog

A syslog message will be generated when cwatch starts:

```
cwatch[x]: cwatch configuration OK. Entering main loop...
```

Syslog messages will be generated when the failure action is triggered:

```
cwatch[x]: Watch WATCH_MOBILE executed action 1 grace time [x]
```

```
cwatch[x]: Watch WATCH_MOBILE executed action 2 grace time [x]
cwatch[x]: Watch WATCH_MOBILE executed action 3 grace time [x]
```

A syslog message will be generated if there is a problem with the configured cwatch instance.

```
cwatch[x]: Watch WATCH_MOBILE test_ifaces not defined. Watch ignored
```

28 Configuring DHCP server and DNS (Dnsmasq)

Dynamic Host Configuration Protocol (DHCP) server is responsible for assigning IP addresses to hosts. IP addresses can be given out on different interfaces and different subnets. You can manually configure lease time as well as setting static IP to host mappings.

Domain Name Server (DNS) is responsible for resolution of IP addresses to domain names on the internet.

Dnsmasq is the application which controls DHCP and DNS services. Dnsmasq has two sections; one to specify general DHCP and DNS settings and one or more DHCP pools to define DHCP operation on the desired network interface.

28.1 Configuration package used

Package	Sections
dhcp	dnsmasq
	dhcp
	host

28.2 Configuring DHCP and DNS using the web interface

In the top menu, select **Network -> DHCP and DNS**. The DHCP and DNS page appears. There are three sections: Server Settings, Active Leases, and Static Leases.

Figure 138: The DHCP and DNS page

28.2.1 Dnsmasq: general settings

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Domain required
UCI: dhcp.@dnsmasq[0].domainneeded
Opt: domainneeded</td><td>Defines whether to forward DNS requests without a DNS name. Dnsmasq will never forward queries for plain names, without dots or domain parts, to upstream nameservers. If the name is not known from /etc/hosts or DHCP then a "not found" answer is returned.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
<tr><td>Web: Authoritative
UCI: dhcp.@dnsmasq[0]. authoritative
Opt: authoritative</td><td>Forces authoritative mode. This accelerates DHCP leasing. Used if this is the only server in the network.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
<tr><td>Web: Interfaces
UCI: dhcp.@dnsmasq[0].interface
Opt: list interface</td><td>Defines the list of interfaces to be served by dnsmasq. If you do not select a specific interface, dnsmasq will serve on all interfaces. Configured interfaces are shown via the web GUI.<table><tr><td>Lan</td><td>Serve only on LAN interface.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Local Server
UCI: dhcp.@dnsmasq[0].local
Opt: local</td><td>Specifies the local domain. Names matching this domain are never forwarded and are resolved from DHCP or host files only.<table><tr><td>/lan/</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Local Domain
UCI: dhcp.@dnsmasq[0].domain
Opt: domain</td><td>Specifies local domain suffix appended to DHCP names and hosts file entries.<table><tr><td>lan</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Log Queries
UCI: dhcp.@dnsmasq[0].logqueries
Opt: logqueries</td><td>Writes received DNS requests to syslog.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: DNS Forwardings
UCI: dhcp.@dnsmasq[0].server
Opt: list server</td><td>List of DNS servers to forward requests to. To forward specific domain requests only, use // syntax. When using UCI, enter multiple servers with a space between them.<table><tr><td></td><td>No DNS server configured.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Rebind Protection
UCI: dhcp.@dnsmasq[0].rebind_protection
Opt: rebind_protection</td><td>Enables DNS rebind attack protection by discarding upstream RFC1918 responses.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Allow Localhost
UCI: dhcp.@dnsmasq[0].rebind_localhost
Opt: rebind_localhost</td><td>Defines whether to allow upstream responses in the 127.0.0.0/8 range. This is required for DNS-based blacklist services. Only takes effect if rebind protection is enabled.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Domain Whitelist
UCI: dhcp.@dnsmasq[0].rebind_domain
Opt: list rebind_domain</td><td>Defines the list of domains to allow RFC1918 responses to. Only takes effect if rebind protection is enabled. When using UCI multiple servers, enter the domains with a space between them.<table><tr><td></td><td>No list configured.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 87: Information table for general server settings

28.2.2 Dnsmasq: resolv and host files

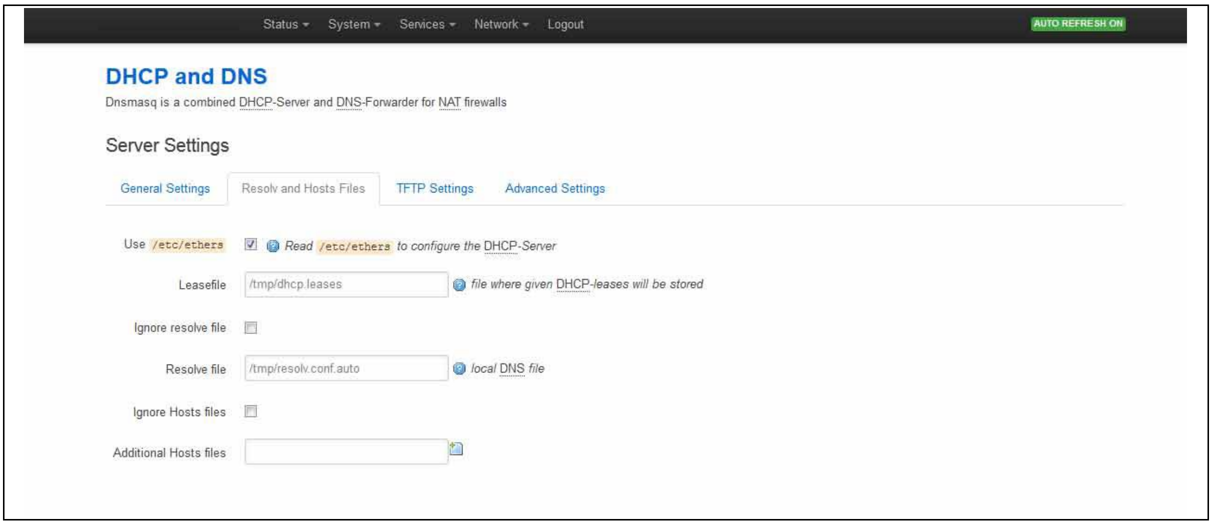

Figure 139: The resolv and host files section

Web Field/UCI/Package Option	Description
Web: Use /etc/ethers UCI: dhcp.@dnsmasq[0].readethers Opt: readethers	Defines whether static lease entries are read from /etc/ethers. 1 — Enabled. 0 — Disabled.
Web: Leasefile UCI: dhcp.@dnsmasq[0].leasefile Opt: leasefile	Defines the file where given DHCP leases will be stored. The DHCP lease file allows leases to be picked up again if dnsmasq is restarted. /tmp/dhcp.leases — Store DHCP leases in this file. Range
Web: Ignore resolve file UCI: dhcp.@dnsmasq[0].noresolv Opt: noresolv	Defines whether to use the local DNS file for resolving DNS. 0 — Use local DNS file. 1 — Ignore local DNS file.
Web: Resolve file UCI: dhcp.@dnsmasq[0].resolvfile Opt: resolvfile	Defines the local DNS file. /tmp/resolv.conf.auto Range
Web: Ignore Hosts files UCI: dhcp.@dnsmasq[0].nohosts Opt: nohosts	Defines whether to use local host's files for resolving DNS. 0 — Use local hosts file. 1 — Ignore local hosts file.
Web: Additional Hosts files UCI: dhcp.@dnsmasq[0].addnhosts Opt: list addnhosts	Defines local host's files. When using UCI multiple servers should be entered with a space between them.

Table 88: Information table for resolv and host files section

28.2.3 Dnsmasq: TFTP settings

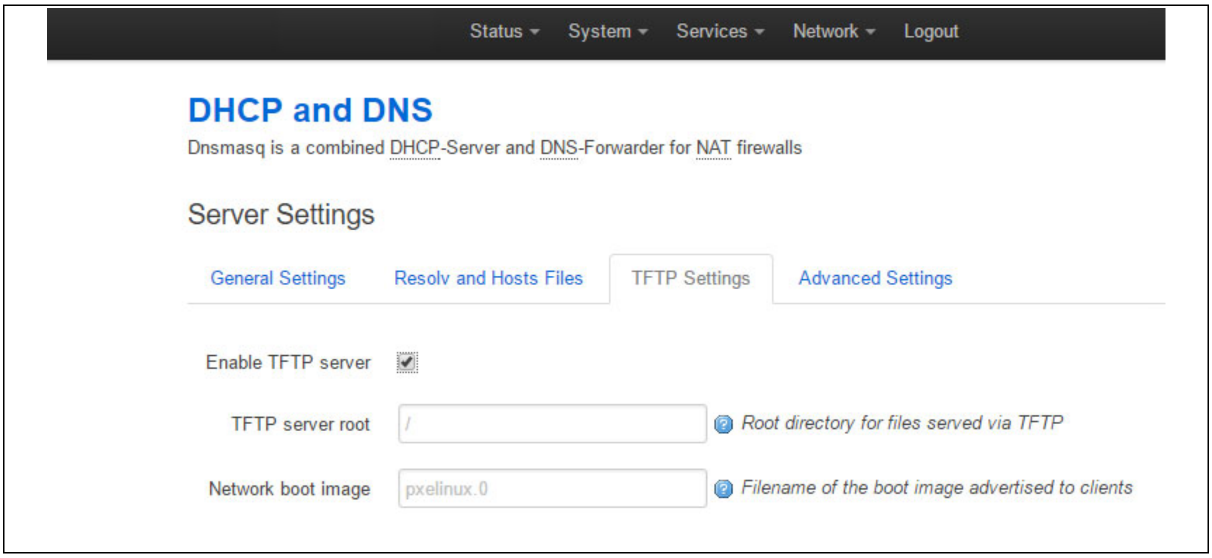

Figure 140: The TFTP settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enable TFTP server
UCI: dhcp.@dnsmasq[0].enable_tftp
Opt: enable_tftp</td><td>Enables the TFTP server.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: TFTP server Root
UCI: dhcp.@dnsmasq[0].tftp_root
Opt: tftp_root</td><td>Defines root directory for file served by TFTP.</td></tr>
<tr><td>Web: Network boot image
UCI: dhcp.@dnsmasq[0].dhcp_boot
Opt: dhcp_boot</td><td>Defines the filename of the boot image advertised to clients. This specifies BOOTP options, in most cases just the file name.</td></tr>
</table>

Table 89: Information table for TFTP settings

28.2.4 Dnsmasq: advanced settings

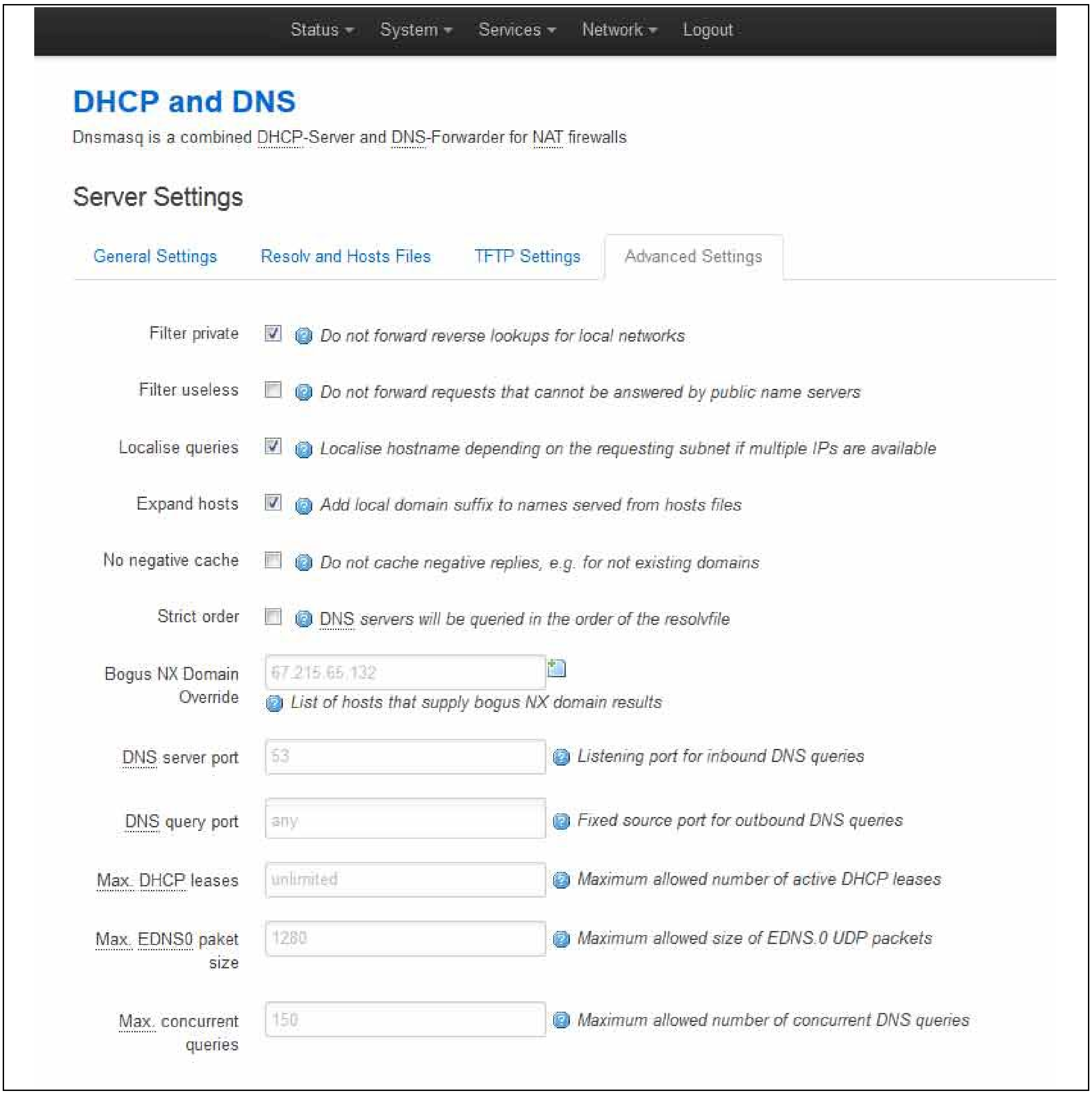

Figure 141: The advanced settings page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Filter private
UCI: dhcp.@dnsmasq[0].
Opt: boguspriv</td><td>Enables disallow option for forwarding reverse lookups for local networks. This rejects reverse lookups to private IP ranges where no corresponding entry exists in /etc/hosts.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
<tr><td>Web: Filter useless
UCI: dhcp.@dnsmasq[0].filterwin2k
Opt: filterwin2k</td><td>Enables disallow option for forwarding requests that cannot be answered by public name servers. Normally enabled for dial on demand interfaces.<table><tr><td>1</td><td>Enabled.</td></tr><tr><td>0</td><td>Disabled.</td></tr></table></td></tr>
</table>

Web: Localise queries UCI: dhcp.@dnsmasq[0].localise_queries Opt: localise_queries	Defines whether to use an IP address to match the incoming interface if multiple addresses are assigned to a host name in /etc/hosts. 1: Enabled. 0: Disabled.
Web: Expand hosts UCI: dhcp.@dnsmasq[0].expandhosts Opt: expandhosts	Adds a local domain suffix to names served from host files. 1: Enabled. 0: Disabled.
Web: No negative cache UCI: dhcp.@dnsmasq[0].nonegcache Opt: nonegcache	Enable this to stop caching of negative replies. For example, non-existing domains. 1: Enabled. 0: Disabled.
Web: Strict order UCI: dhcp.@dnsmasq[0].strictorder Opt: strictorder	Enable this to query DNS servers in the order of the resolve file. 1: Enabled. 0: Disabled.
Web: Bogus NX Domain override UCI: dhcp.@dnsmasq[0].bogusnxdomain Opt: list bogusnxdomain	A list of hosts that supply bogus NX domain results. When using UCI multiple servers, enter the server names with a space between them. Empty list Range
Web: DNS server port UCI: dhcp.@dnsmasq[0].port Opt: port	Listening port for inbound DNS queries. 53: Set to **0** to disable DNS functionality. Range: 0 - 65535
Web: DNS query port UCI: dhcp.@dnsmasq[0].queryport Opt: queryport	Defines fixed source port for outbound DNS queries. any Range: any; 0 - 65535
Web: Max DHCP leases UCI: dhcp.@dnsmasq[0].dhcpleasemax Opt:dhcpleasemax	Defines the maximum allowed number of active DHCP leases. unlimited Range
Web: Max EDNS0 packet size UCI: dhcp.@dnsmasq[0].ednspacket_max Opt: ednspacket_max	Defines the maximum allowed size of EDNS.0 UDP packets in bytes. 1280: 1280 bytes Range
Web: Max concurrent queries UCI: dhcp.@dnsmasq[0].dnsforwardmax Opt: dnsforwardmax	Maximum allowed number of concurrent DNS queries. 150: 1280 bytes Range

Table 90: Information table for advanced settings

28.2.5 Active leases

This section displays all currently active leases.

Figure 142: The active leases section

Web Field/UCI/Package Option	Description
Web: Hostname UCI: n/a Opt: n/a	Displays the hostname of the client.
Web: IPv4 Address UCI: n/a Opt: n/a	Displays the IP address of the client.
Web: MAC Address UCI: n/a Opt: n/a	Displays the MAC address of the client.
Web: Lease time remaining UCI: n/a Opt: n/a	Displays the remaining lease time.

Table 91: Information table for active leases section

28.2.6 Static leases

Use static leases to assign fixed IP addresses and symbolic hostnames to DHCP clients. Static leases are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served. Click **Add** to add a new lease entry.

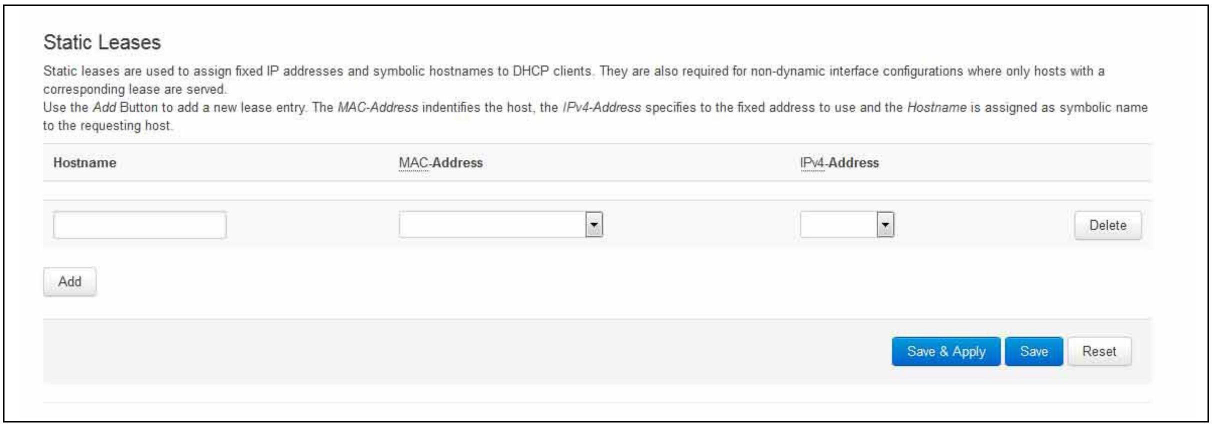

Figure 143: The static leases section

Web Field/UCI/Package Option	Description
Web: Hostname UCI: dhcp.@host[0].name Opt: name	Defines the optional symbolic name to assign to this static DHCP entry. 1 — Enabled. 0 — Disabled.
Web: MAC Address UCI: dhcp.@host[0].mac Opt: mac	Defines the hardware address that identifies the host.
Web: IPv4 Address UCI: dhcp.@host[0].ip Opt: ip	The IPv4 address specifies the fixed address to use for this host.

Table 92: Information table for static leases

28.2.7 Configuring DHCP pools using the web

DHCP pools are configured via the interface configuration.

Select **Network -> Interfaces**. Choose the interface you want to add the DHCP pool to and select **Edit.** Scroll to **DNCP Server** section.

Note: this section is only available for interfaces with a static IP address.

To assign a DHCP Server to the interface, click **Setup DHCP Server**.

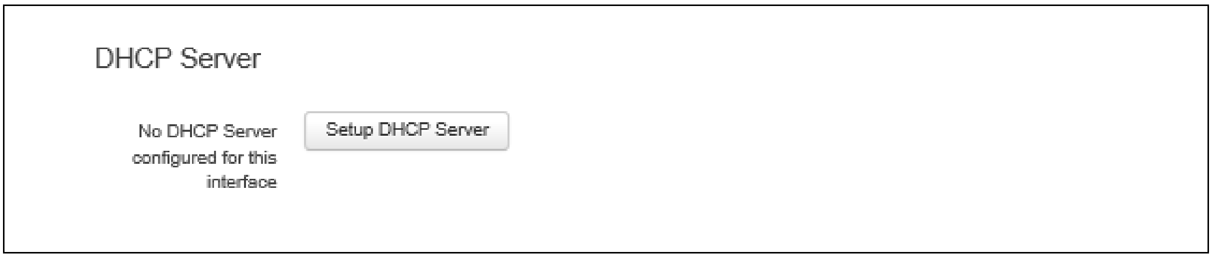

Figure 144: The DHCP Server settings section

The DHCP Server configuration options will appear. The DHCP Server is divided into two sub sections: General Setup and Advanced Settings.

28.2.7.1 DHCP server: general setup

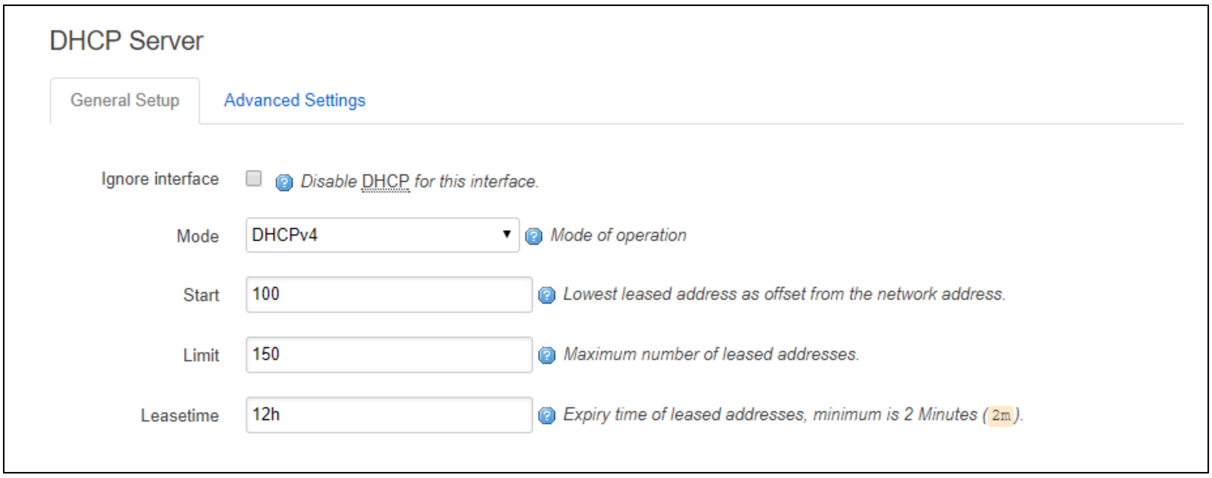

Figure 145: The DHCP server general setup section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Ignore interface
UCI: dhcp.@dhcp[x].ignore
Opt: ignore</td><td>Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then the default is disabled i.e. dhcp pool enabled.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
</table>

<table>
<tr><td>Web: Mode
UCI: dhcp.@dhcp[x].mode
Opt: mode</td><td>Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then the default is disabled i.e. dhcp pool enabled.
<table>
<tr><th>Web</th><th>Description</th><th>UCI</th></tr>
<tr><td>DHCPv4</td><td>DHCP for IPv4</td><td>ipv4</td></tr>
<tr><td>DHCPv6</td><td>DHCP for IPv6</td><td>ipv6_dhcp</td></tr>
<tr><td>IPv6 Router Advertisements</td><td>IPv6 RA</td><td>ipv6_ra</td></tr>
<tr><td>DHCPv6 Prefix Delegation</td><td>DHCPv6 prefix delegation</td><td>ipv6_pd</td></tr>
</table></td></tr>
<tr><td>Web: Start
UCI: dhcp.@dhcp[x].start
Opt: start</td><td>Defines the offset from the network address for the start of the DHCP pool.
Example: for network address 192.168.100.10/24, start=100, DHCP allocation pool will start at 192.168.100.100.
For subnets greater than /24, it may be greater than 255 to span subnets. Alternatively, specify in IP address notation using the wildcard ‘0’ where the octet is required to inherit bits from the interface IP address.
Example: to define a DHCP scope starting from 10.1.20.0 on an interface with 10.1.0.0/16 address, set start to 0.0.20.1
<table>
<tr><td>100</td><td></td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Limit
UCI: dhcp.@dhcp[x].limit
Opt: limit</td><td>Defines the size of the address pool.
Example: For network address 192.168.100.10/24, start=100, limit=150, DHCP allocation pool will be .100 to .249
<table>
<tr><td>150</td><td>Limits DHCP allocation pool to 150 available address.</td></tr>
<tr><td>Range</td><td>0 – 255</td></tr>
</table></td></tr>
<tr><td>Web: Leasetime
UCI: dhcp.@dhcp[x].leasetime
Opt: leasetime</td><td>Defines the lease time of addresses handed out to clients, for example 12h or 30m.
<table>
<tr><td>12h</td><td>12 hours</td></tr>
<tr><td>Range</td><td></td></tr>
</table></td></tr>
<tr><td>Web: n/a
UCI: dhcp.@dhcp[x].interface
Opt: interface</td><td>Defines the interface that is served by this DHCP pool. This must be one of the configured interfaces.
When configured through the web UI this will be automatically populated with the interface name.</td></tr>
</table>

Table 93: Information table for DHCP server general setup page

28.2.7.2 DHCP server: advanced settings

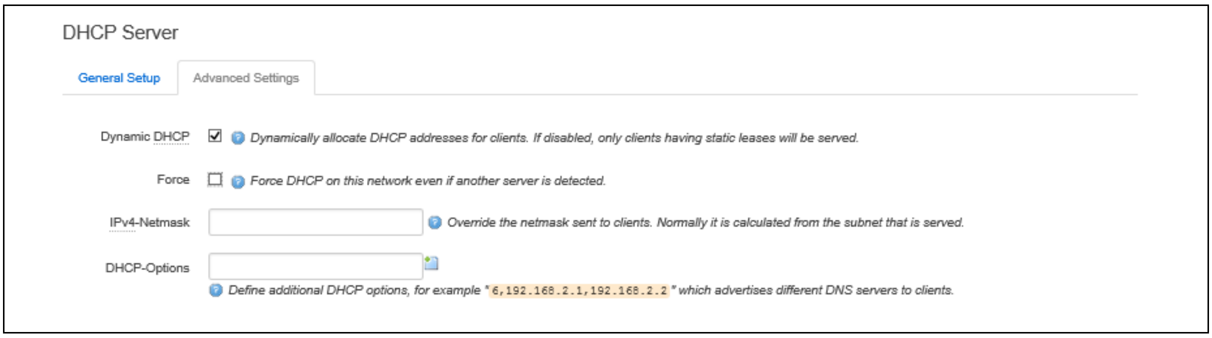

Figure 146: The DHCP server advanced settings section

Web Field/UCI/Package Option	Description
Web: Dynamic DHCP UCI: dhcp.@dhcp[x].dynamicdhcp Opt: dynamicdhcp	Defines whether to dynamically allocate DHCP leases. 1: Dynamically allocate leases. 0: Use /etc/ethers file for serving DHCP leases.
Web: Force UCI: dhcp.@dhcp[x].force Opt: force	Forces DHCP serving on the specified interface even if another DHCP server is detected on the same network segment. 0: Disabled. 1: Enabled.
Web: IPv4-Netmask UCI: dhcp.@dhcp[x].netmask Opt: netmask	Defines a netmask sent to clients that overrides the netmask as calculated from the interface subnet. (default): Use netmask from interface subnet. Range
Web: DHCP-Options UCI: dhcp.@dhcp[x].dhcp_option Opt: list dhcp_option	Defines additional options to be added for this dhcp pool. For example, with 'list dhcp_option 26,1470' or 'list dhcp_option mtu, 1470' you can assign a specific MTU per DHCP pool. Your client must accept the MTU option for this to work. Options that contain multiple values should be separated by a comma. Example: list dhcp_option 6,192.168.2.1,192.168.2.2 (default): No options defined. Syntax: Option_number, option_value
Web: n/a UCI: dhcp.@dhcp[x].networkid Opt: networkid	Assigns a network-id to all clients that obtain an IP address from this pool. (default): Use network from interface subnet. Range

Table 94: Information table for DHCP advanced settings page

28.3 Configuring DHCP and DNS using command line

Possible section types of the DHCP configuration file include Common Options (dnsmasq), DHCP Pools (dhcp) and Static Leases (host). Not all types may appear in the file and most of them are only needed for special configurations.

28.3.1 Dnsmasq using command line

The configuration section type **dnsmasq** determines values and options relevant to the overall operation of dnsmasq and the DHCP options on all interfaces served.

28.3.1.1 Dnsmasq using UCI

```
root@VA_router:~# uci show dhcp
dhcp.@dnsmasq[0]=dnsmasq
dhcp.@dnsmasq[0].domainneeded=1
dhcp.@dnsmasq[0].boguspriv=1
dhcp.@dnsmasq[0].filterwin2k=0
dhcp.@dnsmasq[0].localise_queries=1
dhcp.@dnsmasq[0].logqueries=1
dhcp.@dnsmasq[0].rebind_protection=1
dhcp.@dnsmasq[0].rebind_localhost=1
```

```
dhcp.@dnsmasq[0].local=/lan/
dhcp.@dnsmasq[0].domain=lan
dhcp.@dnsmasq[0].expandhosts=1
dhcp.@dnsmasq[0].nonegcache=0
dhcp.@dnsmasq[0].authoritative=1
dhcp.@dnsmasq[0].readethers=1
dhcp.@dnsmasq[0].leasefile=/tmp/dhcp.leases
dhcp.@dnsmasq[0].noresolve=0
dhcp.@dnsmasq[0].resolvfile=/tmp/resolv.conf.auto
dhcp.@dnsmasq[0].nohosts=0
dhcp.@dnsmasq[0].addnhosts=hostfile1 hostfile2
dhcp.@dnsmasq[0].interface=lan
dhcp.@dnsmasq[0].server=1.1.1.1 2.2.2.2
dhcp.@dnsmasq[0].rebind domain=tes.domain
dhcp.@dnsmasq[0].enable_tftp=0
dhcp.@dnsmasq[0].tftp_root=/tmp/tftp
dhcp.@dnsmasq[0].dhcp_boot=boot.image
dhcp.@dnsmasq[0].nonegcache=0
dhcp.@dnsmasq[0].strictorder=0
dhcp.@dnsmasq[0].bogusnxdomain=1.1.1.1  2.2.2.2
dhcp.@dnsmasq[0].port=53
dhcp.@dnsmasq[0].dhcpleasemax=150
dhcp.@dnsmasq[0].ednspacket_max=1280
dhcp.@dnsmasq[0].dnsforwardmax=150
```

28.3.1.2 Dnsmasq using package options

```
root@VA_router:~# uci show dhcp
config 'dnsmasq'
      option domainneeded '1'
        option rebind_protection '1'
        option rebind_localhost '1'
        option local '/lan/'
        option domain 'lan'
        option authoritative '1'
        option readethers '1'
        option leasefile '/tmp/dhcp.leases'
        list interface 'lan'
```

```
        list server '1.2.3.4'
        list server '4.5.6.7'
        list rebind_domain 'test1.domain'
        list rebind_domain 'tes2.domain'
        option logqueries '1'
        option resolvfile '/tmp/resolv1.conf.auto'
        list addnhosts 'hosts1'
        list addnhosts 'hosts2'
        option enable_tftp '1'
        option tftp_root '/tmp/tftp'
        option dhcp_boot 'boot.image'
        option filterwin2k '1'
        option nonegcache '1'
        option strictorder '1'
        list bogusnxdomain '1.1.1.1 '
        list bogusnxdomain '2.2.2.2'
        option port '53'
        option dhcpleasemax '150'
        option ednspacket_max '1280'
        option dnsforwardmax '150'
```

Options `local` and `domain` enable dnsmasq to serve entries in /etc/hosts as well as the DHCP client's names as if they were entered into the LAN DNS domain.

For options `domainneeded`, `boguspriv`, `localise_queries`, and `expandhosts` make sure that requests for these local host names (and the reverse lookup) never get forwarded to the upstream DNS servers.

28.3.2 Configuring static leases using command line

Static leases are configured under the **dhcp** package, stored at **/etc/config/dhcp**.

By default, all static leases instances are named **host**. The static lease is identified by `@host` then the static lease position in the package as a number. For example, for the first static lease in the package using UCI:

```
dhcp.@host[0]=dhcp
dhcp.@host[0].name=mypc
```

Or using package options:

```
config host
        option name ‘mypc’
```

However, to better identify, it is recommended to give the static lease instance a name. For example, to create a static instance named mypc.

To define a named static lease instance using UCI, enter:

```
dhcp.mypc=host
dhcp.mypc.name=mypc
```

To define a named static lease instance using package options, enter:

```
config dhcp 'mypc'
        option name 'mypc'
```

The following example adds the fixed IP address 192.168.1.2 and the name "mypc" for a machine with the (Ethernet) hardware address 00:11:22:33:44:55.

Example of static leases using UCI

```
root@VA_router:~# uci show dhcp.mypc
dhcp.mypc=host
dhcp.mypc.ip=192.168.1.2
dhcp.mypc.mac=00:11:22:33:44:55
dhcp.mypc.name=mypc
```

Example of static leases using package options

```
root@VA_router:~# uci export dhcp
package dhcp
……
config host 'mypc'
        option ip       '192.168.1.2'
        option mac      '00:11:22:33:44:55'
        option name     'mypc'
```

28.3.3 Configuring DHCP pools using command line

DHCP pools are configured under the dhcp package, stored at **/etc/config/dhcp**.

Sections of the type **dhcp** specify per interface lease pools and settings. Typically, there is at least one section of this type present in the /etc/config/dhcp file to cover the LAN interface.

You can disable a lease pool for a specific interface by specifying the ignore option in the corresponding section.

You can configure multiple dhcp pools.

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By default, all dhcp pool instances are named 'dhcp'. The instance is identified by `@dhcp` then the dhcp pool position in the package as a number. For example, for the first dhcp pool in the package using UCI:

```
dhcp.@dhcp[0]=dhcp
dhcp.@dhcp[0].interface=LAN
```

Or using package options:

```
config dhcp
        option interface 'LAN'
```

However, to better identify, it is recommended to give the dhcp pool instance a name. For example, to create a dhcp pool instance named LAN.

To define a named dhcp pool instance using UCI, enter:

```
dhcp.LAN=dhcp
dhcp.LAN.interface=LAN
```

To define a named dhcp pool instance using package options, enter:

```
config dhcp 'LAN'
        option interface 'LAN'
```

28.3.3.1 Configuring DHCP pools using UCI

```
root@VA_router:~# uci show dhcp.LAN
dhcp.LAN=dhcp
dhcp.LAN.interface=lan
dhcp.LAN.start=100
dhcp.LAN.limit=150
dhcp.LAN.leasetime=12h
dhcp.LAN.ignore=0
```

28.3.3.2 Configuring DHCP pools using package options

```
root@VA_router:~# uci export dhcp
package dhcp
…..
config 'dhcp' 'LAN'
      option 'interface'   'LAN'
      option 'start'       '100'
      option 'limit'        '150'
      option 'leasetime'   '12h'
      option ignore   0
```

29 Configuring DHCP client

This section describes how to configure an interface as a DHCP client. This section will only detail the configuration for DHCP client. For information on how to configure other interface options such as firewall zone, mapping of switch ports, etc, read the standard interface configuration document.

29.1 Configuration packages used

Package	Sections
network	interface

29.2 Configuring DHCP client using the web interface

DHCP client is configured under the interface configuration by setting the interface protocol to DHCP Client. To create and edit interfaces via the web interface, in the top menu, click **Network -> Interfaces**. The Interfaces overview page appears.

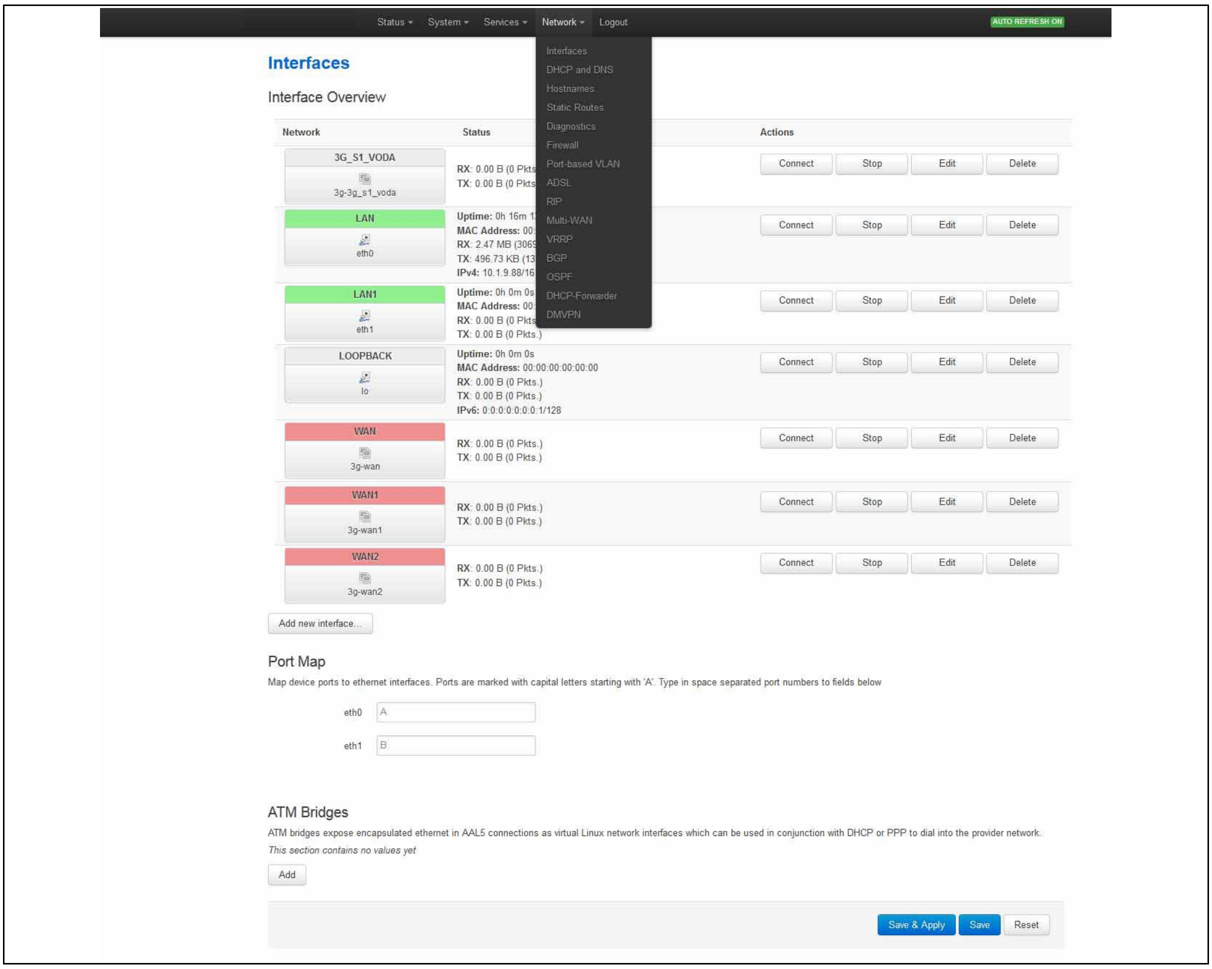

Figure 147: The interfaces overview page

There are three sections in the Interfaces page.

Section	Description
Interface Overview	Shows existing interfaces and their status. You can create new, and edit existing interfaces here.
Port Map	In this section you can map device ports to Ethernet interfaces. Ports are marked with capital letters starting with 'A'. Type in space-separated port character in the port map fields.
ATM Bridges	ATM bridges expose encapsulated Ethernet in AAL5 connections as virtual Linux network interfaces, which can be used in conjunction with DHCP or PPP to dial into the provider network.

29.2.1 Editing an existing interface for DHCP client

To edit an existing interface, from the interface tabs at the top of the page, select the interface you wish to configure. Alternatively, click **Edit** in the interface's row.

29.2.2 Creating a new interface for DHCP client

To create a new interface, in the Interface Overview section, click **Add new interface**. The Create Interface page appears.

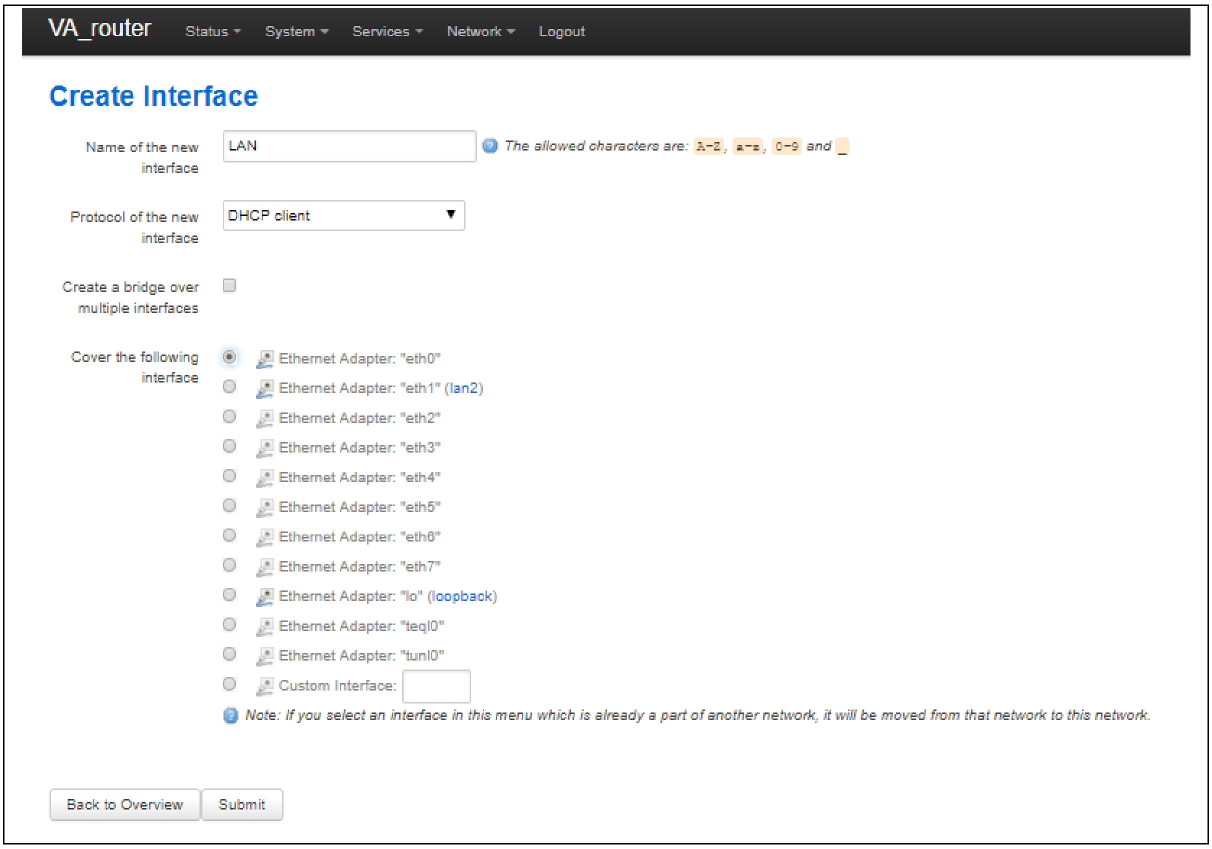

Figure 148: The create interface page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name of the new interface
UCI: network.<if name>
Opt: config interface</td><td>Assigns a logical name to the interface. The network interface section will assign this name (<if name>).
Type the name of the new interface.
Allowed characters are A-Z, a-z, 0-9 and _</td></tr>
<tr><td>Web: Protocol of the new interface
UCI: network.<if name>.proto
Opt: proto</td><td>Specifies what protocol the interface will operate on. Select DHCP Client.
<table>
<tr><th>Option</th><th>Description</th><th>UCI</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td><td>Static</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td><td>dhcp</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td><td>Empty</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td><td></td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td><td></td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td><td></td></tr>
<tr><td>IOT</td><td></td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td><td></td></tr>
<tr><td>PPP</td><td>Point to Point Protocol</td><td></td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td><td></td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td><td></td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td><td></td></tr>
</table></td></tr>
<tr><td>Web: Create a bridge over multiple interfaces
UCI: network.<if name>.type
Opt: type</td><td>If you select this option, then the new logical interface created will act as a bridging interface between the chosen existing physical interfaces.
<table>
<tr><td>Empty</td><td></td></tr>
<tr><td>Bridge</td><td>Configures a bridge over multiple interfaces.</td></tr>
</table></td></tr>
<tr><td>Web: Cover the following interface
UCI: network.<if name>.ifname
Opt: ifname</td><td>Physical interface name to assign to this logical interface. If creating a bridge over multiple interfaces select two interfaces to bridge. When using UCI, the interface names should be separated by a space e.g. option ifname ‘eth2 eth3’.</td></tr>
</table>

Table 95: Information table for the create new interface page

Click **Submit**. The Interface configuration page appears. There are three sections:

Section	Description
Common Configuration	Configure the interface settings such as protocol, IP address, gateway, netmask, custom DNS servers, MTU and firewall configuration.
IP-Aliases	Assign multiple IP addresses to the interface.
DHCP Server	Configure DHCP server settings for this interface.

29.2.3 Common configuration

The Common Configuration section has four sub-sections.

Section	Description
General Setup	Configure the basic interface settings such as protocol, IP address, gateway, netmask, custom DNS servers.
Advanced Settings	'Bring up on boot', 'Monitor interface state', Override MAC address, Override MTU and 'Use gateway metric'.
Physical Settings	Bridge interfaces, VLAN PCP to SKB priority mapping.
Firewall settings	Assign a firewall zone to the interface.

Only General Setup and Advanced Settings have DHCP client option configuration options

29.2.3.1 Common configuration: general setup

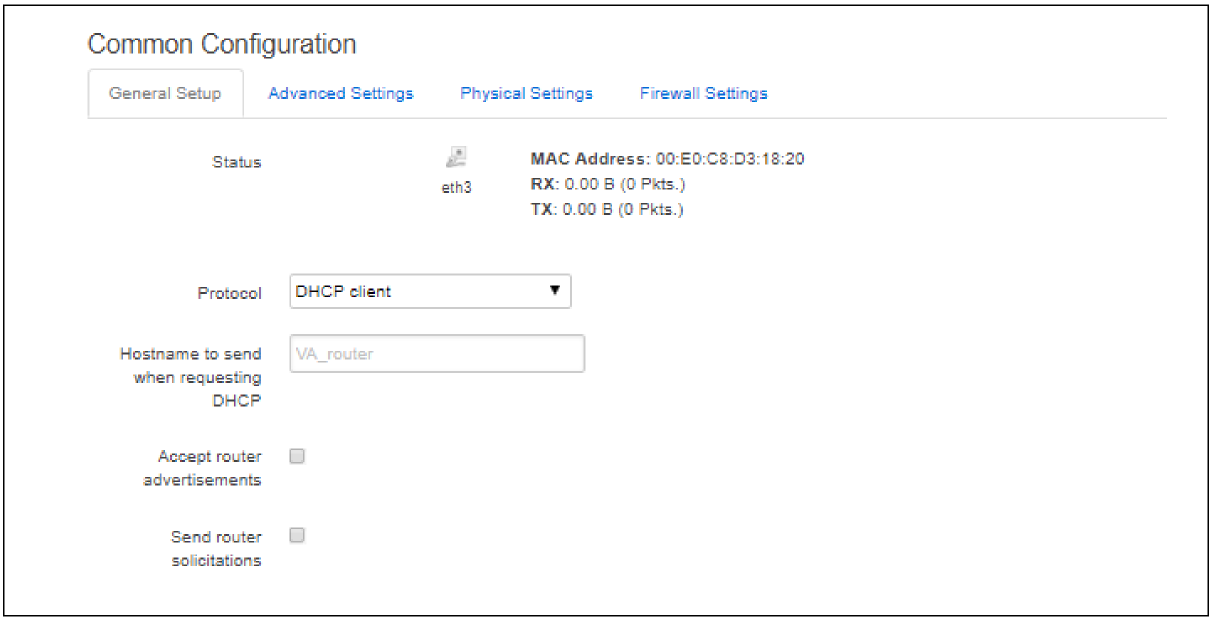

Figure 149: The interface general setup configuration page for DHCP client protocol

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Status</td><td>Shows the current status of the interface.</td></tr>
<tr><td>Web: Protocol
UCI: network.<if name>.proto
Opt: proto</td><td>Protocol type. The interface protocol may be one of the options shown below. The protocol selected in the previous step will be displayed as default but can be changed if required.
Select DHCP Client.
<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>Static</td><td>Static configuration with fixed address and netmask.</td></tr>
<tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr>
<tr><td>Unmanaged</td><td>Unspecified</td></tr>
<tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td></tr>
<tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td></tr>
<tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr>
<tr><td>IOT</td><td></td></tr>
<tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol.</td></tr>
<tr><td>PPP</td><td>Point-to-Point protocol</td></tr>
<tr><td>PPPoE</td><td>PPP over Ethernet</td></tr>
<tr><td>PPPoATM</td><td>PPP over ATM</td></tr>
<tr><td>LTE/UMTS/ GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem.</td></tr>
</table></td></tr>
<tr><td>Web: Hostname to send when requesting DHCP
UCI: network.<if name>.hostname
Opt: hostname</td><td>Defines the hostname to include in DHCP requests</td></tr>
<tr><td>Web: Accept router advertisements
UCI: network.<if name>.accept_ra
Opt: accept_ra</td><td>Specifies whether to accept IPv6 Router Advertisements on this interface (optional).
Note: default is 1 if protocol is set to DHCP, otherwise the setting defaults to 0.
<table>
<tr><td>0</td><td>Does not accept IPv6 router advertisements.</td></tr>
<tr><td>1</td><td>Accepts IPv6 router advertisements.</td></tr>
</table></td></tr>
<tr><td>Web: Send router solicitations
UCI: network.<if name>.send_rs
Opt: send_rs</td><td>Specifies whether to send router solicitations on this interface (optional).
Note: defaults to 1 for static protocol, otherwise the setting defaults to 0.
<table>
<tr><td>0</td><td>Does not send router solicitations.</td></tr>
<tr><td>1</td><td>Sends router solicitations.</td></tr>
</table></td></tr>
</table>

Table 96: Information table for general setup configuration settings for DHCP client protocol

29.2.3.2 Common configuration: advanced settings

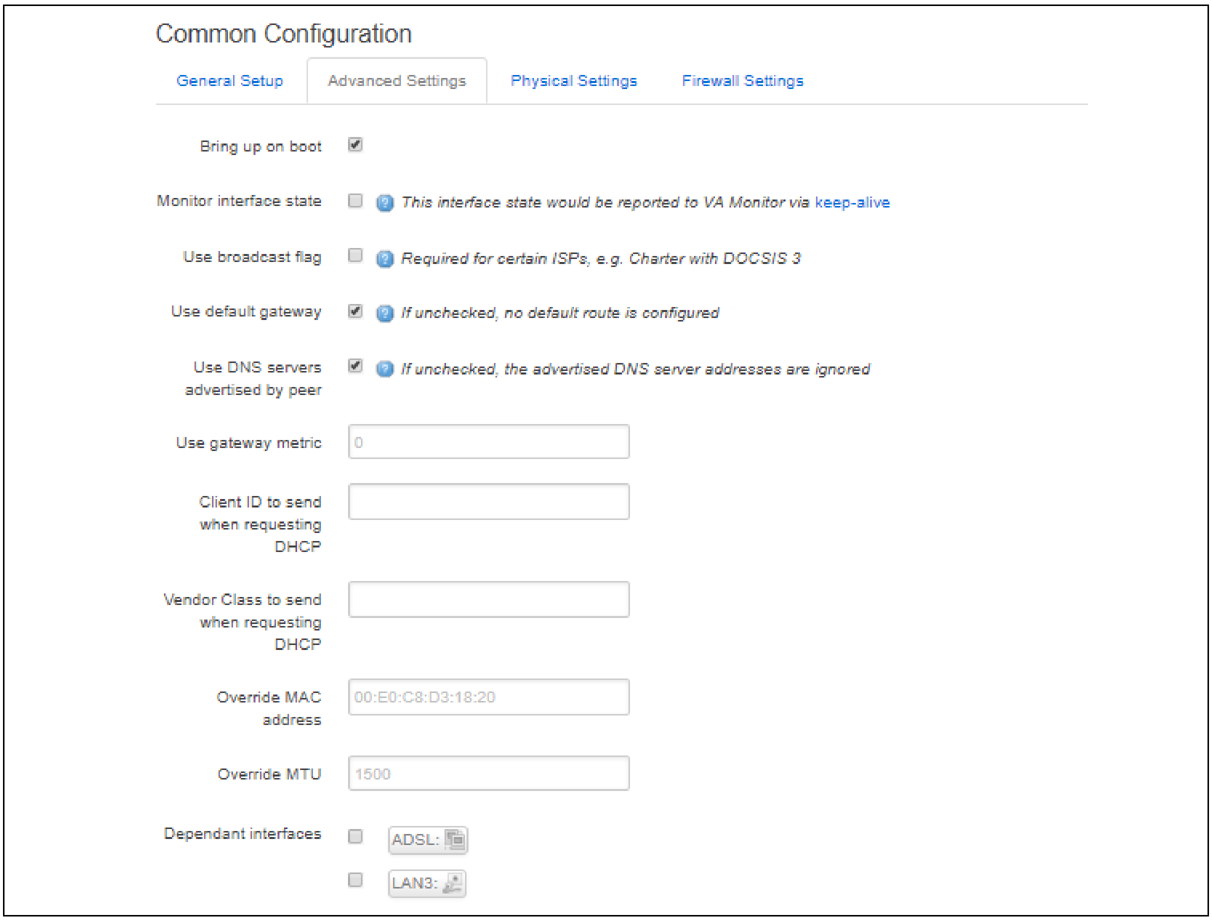

Figure 150: The interface advanced settings page for DHCP client protocol

Web Field/UCI/Package Option	Description
Web: Bring up on boot UCI: network.<if name>.auto Opt: auto	Enables the interface to connect automatically on boot up. 0 Disabled. 1 Enabled.
Web: Monitor interface state UCI: network.<if name>.monitored Opt: monitored	Enabled if the status of the interface is presented on the monitoring platform. 0 Disabled. 1 Enabled.
Web: Use broadcast flag UCI: network.<if name>.broadcast Opt: broadcast	Enables the broadcast flag in DHCP requests (required for certain ISPs). 0 Disabled. 1 Enabled.
Web: Use default gateway UCI: network.<if name>.gateway Opt: gateway	Defines whether to suppress the DHCP assigned default gateway. When disabled via web option, the gateway is set to 0.0.0.0. 0 Disabled (option gateway set to 0.0.0.0) 1 Enabled.
Web: Use DNS servers advertised by peer UCI: n/a Opt: n/a	Defines whether to override DHCP assigned DNS servers with configured list of DNS servers. When unchecked allows configuration of custom DNS servers via web. There is no uci option set when checking or unchecking this option.

<table>
<tr><td>Web: Use custom DNS servers
UCI: network.<if name>.dns
Opt: dns</td><td>Defines whether to override DHCP assigned DNS servers with configured list of DNS servers.
Multiple DNS Servers are separated by a space if using UCI. Example: <code>option dns '1.1.1.1 2.2.2.2'</code><table><tr><td>0</td><td>Disabled (option gateway set to 0.0.0.0)</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Use gateway metric
UCI: network.<if name>.metric
Opt: metric</td><td>Specifies the default route metric to use for this interface.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Client ID to send when requesting DHCP
UCI: network.<if name>. clientid
Opt: clientid</td><td>Defines whether to override the client identifier in DHCP requests.<table><tr><td>Blank</td><td>Do not override.</td></tr><tr><td>Range</td><td>Override.</td></tr></table></td></tr>
<tr><td>Web: Vendor Class to send when requesting DHCP
UCI: network.<if name>.vendorid
Opt: vendorid</td><td>Defines whether to override the vendor class in DHCP requests.<table><tr><td>Blank</td><td>Do not override.</td></tr><tr><td>Range</td><td>Override.</td></tr></table></td></tr>
<tr><td>Web: Override MAC address
UCI: network.<if name>.macaddr
Opt: macaddr</td><td>Overrides the MAC address assigned to this interface. Must be in the form: hh:hh:hh:hh:hh:hh, where h is a hexadecimal number.</td></tr>
<tr><td>Web: Override MTU
UCI: network.<if name>.mtu
Opt: mtu</td><td>Defines the value to override the default MTU on this interface.<table><tr><td>1500</td><td>1500 bytes</td></tr></table></td></tr>
<tr><td>Web: Dependant Interfaces
UCI: network.[if_name].dependants
Opt: dependants</td><td>Lists interfaces that are dependant on this parent interface. Dependant interfaces will go down when the parent interface is down and will start or restart when the parent interface starts.
Separate multiple interfaces by a space when using UCI.
Example: <code>option dependants 'PPPADSL MOBILE'</code>
This replaces the following previous options in child interfaces.<table><tr><td>gre</td><td>option local_interface</td></tr><tr><td>lt2p</td><td>option src_ipaddr</td></tr><tr><td>iot</td><td>option wan1 wan2</td></tr><tr><td>6in4</td><td>option ipaddr</td></tr><tr><td>6to4</td><td>option ipaddr</td></tr></table></td></tr>
<tr><td>Web: SNMP Alias ifIndex
UCI: network.@interface[X].snmp_alias_ifindex
Opt: snmp_alias_ifindex</td><td>Defines a static SNMP interface alias index for this interface, that can be polled using via the SNMP interface index (<code>snmp_alias_ifindex+1000</code>)<table><tr><td>Blank</td><td>No SNMP interface alias index</td></tr><tr><td>Range</td><td>0 - 4294966295</td></tr></table></td></tr>
</table>

Table 97: Information table for advanced settings for DHCP client protocol

29.3 Configuring DHCP client using command line

The configuration files for DHCP client are stored on **/etc/config/network**

29.3.1 DHCP client using UCI

```
root@VA_router:~# uci show network
      …..
network.DHCPCLIENTLAN=interface
network.DHCPCLIENTLAN.proto=dhcp
```

```
network.DHCPCLIENTLAN.ifname=eth3
network.DHCPCLIENTLAN.monitored=0
network.DHCPCLIENTLAN.broadcast=0
network.DHCPCLIENTLAN.accept_ra=1
network.DHCPCLIENTLAN.send_rs=0
network.DHCPCLIENTLAN.metric=1
```

29.3.2 DHCP client using package options

```
root@VA_router:~# uci export network
package network
      ……
config interface 'DHCPCLIENTLAN'
        option proto 'dhcp'
        option ifname 'eth3'
        option monitored '0'
        option broadcast '0'
        option accept_ra '1'
        option send_rs '0'
        option metric '1'
```

29.4 DHCP client diagnostics

29.4.1 Interface status

To view the IP address of DHCP client interface, enter:

```
root@VA_router:~# ifconfig
3g-CDMA  Link encap:Point-to-Point Protocol
         inet addr:10.33.152.100  P-t-P:178.72.0.237  Mask:255.255.255.255
         UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1400  Metric:1
         RX packets:6 errors:0 dropped:0 overruns:0 frame:0
         TX packets:23 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:3
         RX bytes:428 (428.0 B)  TX bytes:2986 (2.9 KiB)

eth0      Link encap:Ethernet  HWaddr 00:E0:C8:12:12:15
          inet addr:192.168.100.1  Bcast:192.168.100.255
Mask:255.255.255.0
```

```
          inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:6645 errors:0 dropped:0 overruns:0 frame:0
          TX packets:523 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:569453 (556.1 KiB)  TX bytes:77306 (75.4 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:385585 errors:0 dropped:0 overruns:0 frame:0
          TX packets:385585 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:43205140 (41.2 MiB)  TX bytes:43205140 (41.2 MiB)
```

To display a specific interface, enter:

```
root@VA_router:~# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:E0:C8:12:12:15
          inet addr:192.168.100.1  Bcast:192.168.100.255
Mask:255.255.255.0
          inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:7710 errors:0 dropped:0 overruns:0 frame:0
          TX packets:535 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:647933 (632.7 KiB)  TX bytes:80978 (79.0 KiB)
```

29.4.2 ARP table status

To show the current ARP table of the router, enter:

```
root@GW7314:~# arp
? (10.67.253.141) at 30:30:41:30:43:36 [ether]  on eth8
? (10.47.48.1) at 0a:44:b2:06 [ether]  on gre-gre1
```

29.4.3 Route status

To show the current routing status, enter:

```
root@VA_router:~# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.100.0   *               255.255.255.0   U     0      0        0 eth0
```

Note: a route will only be displayed in the routing table when the interface is up.

30 Configuring DHCP forwarding

This section describes how to configure the router to forward DHCP requests from an interface to a network DHCP server.

30.1 Configuration packages used

Package	Sections
dhcp_fwd	dhcpfwd

30.2 Configuring DHCP forwarding using the web interface

To configure DHCP forwarding using the web interface, in the top menu, click **Network -> DHCP-Forwarder**.

The DHCP forwarder page appears. The web GUI creates a dhcpfwd section called main so this will be used in the uci examples below.

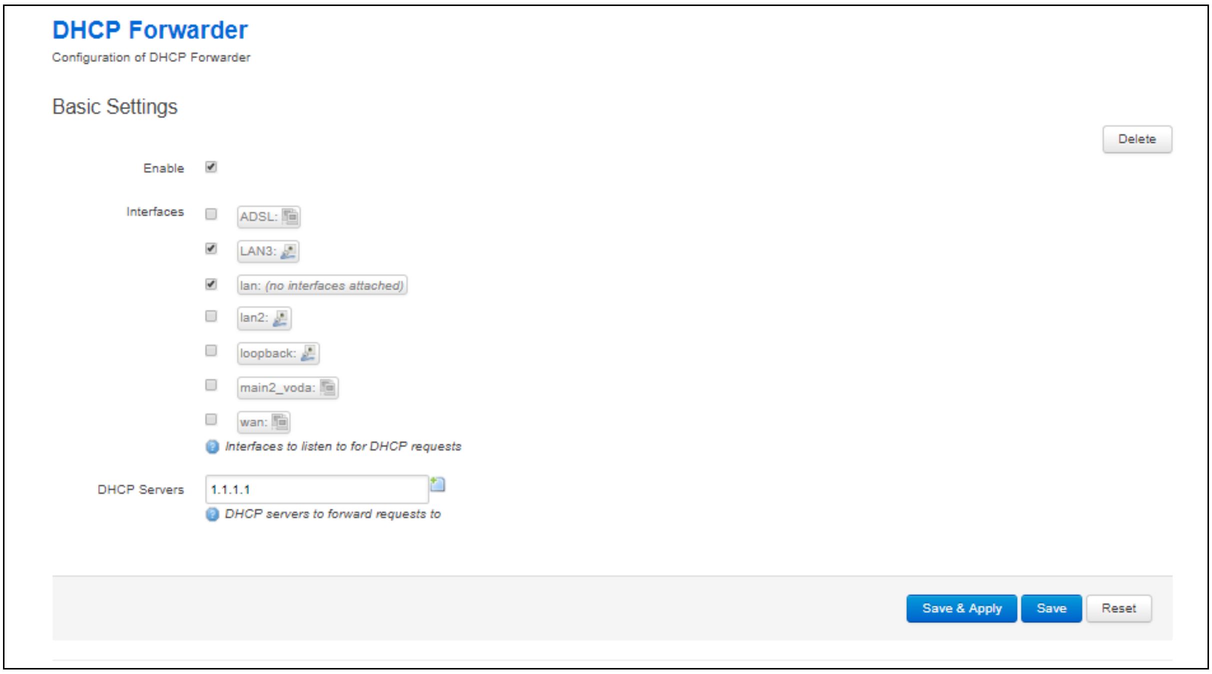

Figure 151: The DHCP forwarder configuration page

Web Field/UCI/Package Option	Description
Web: Enabled UCI: dhcp_fwd.main.enabled Opt: enabled	Defines whether DHCP forwarding is enabled or disabled. 0 — Do not send router solicitations. 1 — Send router solicitations.

Web: Interfaces
UCI: dhcp_fwd.main.listen_interface
Opt: list listen_interface
	Defines a list of the source interface name(s) to forward DHCP messages from. Multiple interface_name(s) are entered using `uci set` and `uci add_list` commands. Example:
	`uci set dhcp_fwd.main.listen_interface=LAN1`
	`uci add_list dhcp_fwd.main.listen_interface=LAN2`
	or using a list of options via package options
	`list listen_interface 'LAN1'`
	`list listen_interface 'LAN2'`

Web: DHCP Servers
UCI: dhcp_fwd.main.server
Opt: list server
	Defines a list of the network DHCP servers to forward DHCP messages to. Multiple interface_name(s) are entered using `uci set` and `uci add_list` commands. Example:
	`uci set dhcp_fwd.main.server=1.1.1.1`
	`uci add_list dhcp_fwd.main.main.server=2.2.2.2`
	or using a list of options via package options
	`list server '1.1.1.1'`
	`list server '2.2.2.2'`

Table 98: Information table for the DHCP forwarder section

30.3 Configuring DHCP forwarding using command line

The configuration files for DHCP client are stored in **/etc/config/dhcp_fwd**

30.3.1 DHCP forwarding using UCI

```
root@VA_router:~# uci show dhcp_fwd
dhcp_fwd.main=dhcpfwd
dhcp_fwd.main.enabled=1
dhcp_fwd.main.listen_interface=LAN3 lan2
dhcp_fwd.main.server=1.1.1.1
```

30.3.2 DHCP forwarding using package options

```
root@VA_router:~# uci export dhcp_fwd
package dhcp_fwd

config dhcpfwd 'main'
        option enabled '1'
        list listen_interface 'LAN3'
        list listen_interface 'lan2'
        list server '1.1.1.1'
```

30.4 DHCP forwarding over IPSec

DHCP messages are forwarded over the WAN interface using the IP address of the WAN interface as the source IP for the transmitted packet. This means that when forwarding over an IPSec tunnel a source NAT firewall rule is required to change the source IP to match an IPSec connection rule.

30.4.1 Configuration packages used

Package	Sections
firewall	redirect

30.4.2 Configuring source NAT for DHCP forwarding over IPsec

To enter a source NAT rule, browse to **Network -> Firewall**. Select **Traffic Rules** tab. The Firewall - Traffic Rules page appears. Configure a source NAT rule that changes the source IP for UDP destination port 67 from the required LAN.

For more information on configuring a source NAT rule, read the 'Configuring Firewall' section of the User Manual.

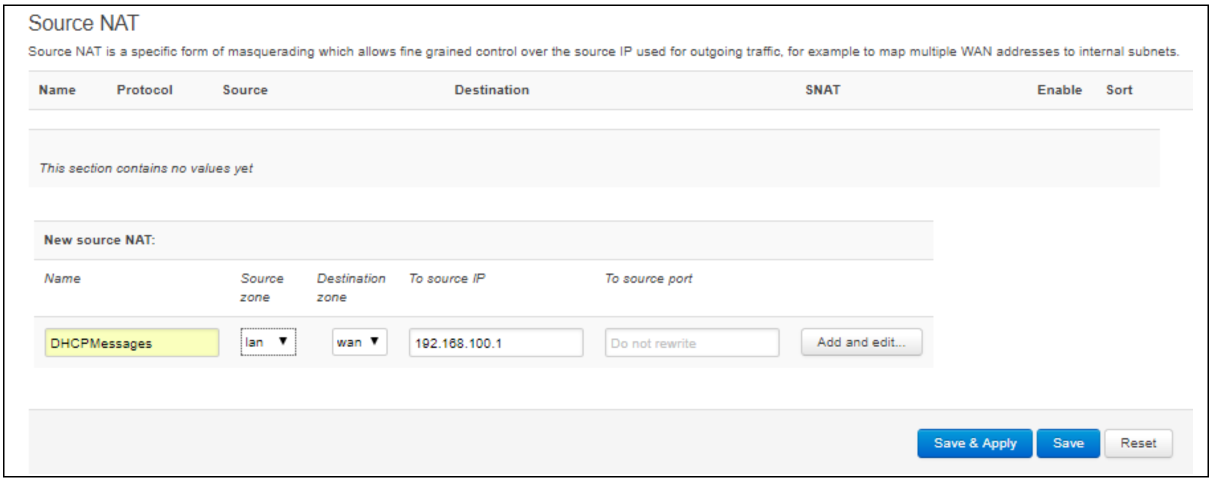

Figure 152: The firewall – traffic rules configuration page

Web Field/UCI/Package Option	Description
Web: Name UCI: firewall.@redirect[X].name Opt: name	Defines a name for the source NAT rule.
Web: Source Zone UCI: firewall.@redirect[X].src Opt: src	Defines the source interface for the source NAT rule. Select **the interface where the DHCP requests are originating**.
Web: Destination Zone UCI: firewall.@redirect[X].dest Opt: dest	Defines destination interface for the source NAT rule. Select **the interface where the DHCP requests are intended to be transmitted**.
Web: To source IP UCI: firewall.@redirect[X].src_dip Opt: src_dip	Defines the IP address to rewrite matched traffic souce IP. Select **the source IP address to match the required IPSec rule**.
Web: To source port UCI: firewall.@redirect[X].src_dport Opt: src_dport	Defines the port number to rewrite matched traffic souce port number. **Leave empty**.

Table 99: Information table for the souce NAT configuration

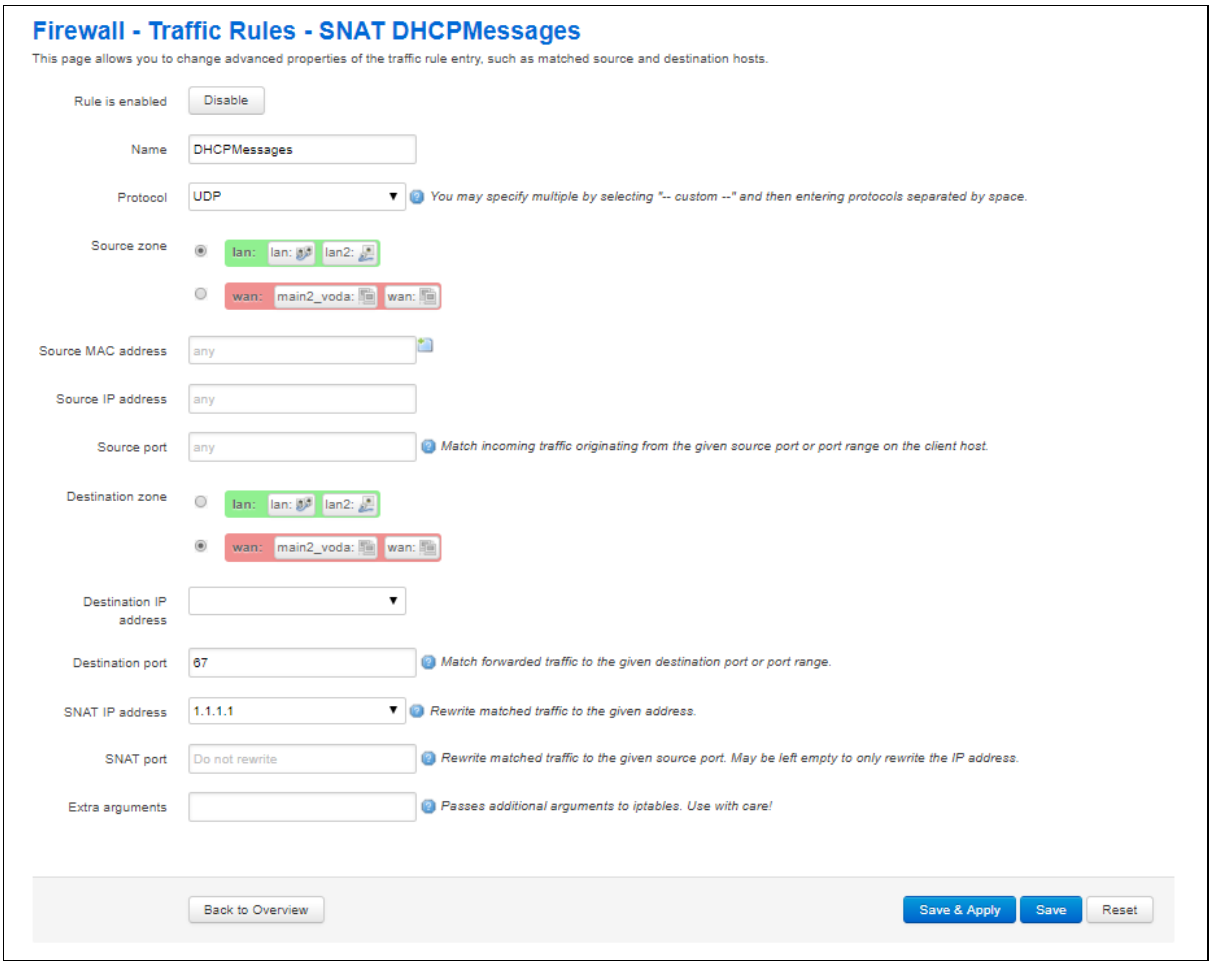

Figure 153: The firewall – traffic rules – SNAT configuration page

Web Field/UCI/Package Option	Description
Web: Rule is enabled UCI: firewall.@redirect[X].enabled Opt: enabled	Defines whether source NAT rule is enabled. 0 Disabled 1 Enabled
Web: Name UCI: firewall.@redirect[X].name Opt: name	Defines a name for the source NAT rule.
Web: Protocol UCI: firewall.@redirect[X].proto Opt: proto	Defines the protocol for the souce NAT rule to match. Select **UDP**. **Option** / **Description** / **UCI** All protocols / Match all protocols / all TCP+UDP / Match TCP and UDP protocols / tcp upd TCP / Match TCP protocol / tcp UDP / Match UDP protocol / udp ICMP / Match ICMP protocol / icmp Custom / Enter custom protocol /
Web: Source Zone UCI: firewall.@redirect[X].src Opt: src	Defines the source interface for the source NAT rule. Select **the interface where the DHCP requests are originating**.
Web: Destination Zone UCI: firewall.@redirect[X].dest Opt: dest	Defines destination interface for the source NAT rule. Select **the interface where the DHCP requests are intended to be transmitted**.
Web: Destination port UCI: firewall.@redirect[X].port Opt: port	Defines the destination port number to match. Select **67**.
Web: SNAT IP address UCI: firewall.@redirect[X].src_dip Opt: src_dip	Defines the IP address to rewrite matched traffic. Select **the source IP address to match the required IPSec rule**.

Table 100: Information table for the advanced source NAT configuration

30.4.3 Configuring source NAT for DHCP forwarding over IPSec using command line

30.4.3.1 Source NAT for DHCP forwarding over IPSec using UCI

```
root@VA_router:~# uci show firewall
……
firewall.@redirect[0]=redirect
firewall.@redirect[0].target=SNAT
firewall.@redirect[0].src=lan
firewall.@redirect[0].dest=wan
firewall.@redirect[0].src_dip=192.168.100.1
firewall.@redirect[0].name=DHCPMessages
firewall.@redirect[0].proto=udp
firewall.@redirect[0].dest_port=67
```

30.4.3.2 Source NAT for DHCP forwarding over IPSec using package options

```
root@VA_router:~# uci export firewall
package firewall
……
config redirect
        option target 'SNAT'
        option src 'lan'
        option dest 'wan'
        option src_dip '192.168.100.1'
        option name 'DHCPMessages'
        option proto 'udp'
        option dest_port '67'
```

30.5 DHCP forwarding diagnostics

30.5.1 Tracing DHCP packets

To trace DHCP packets on any interface on the router, enter:

```
root@VA_router:~# tcpdump -i any -n -p port 67 &
root@VA_router:~# tcpdump: verbose output suppressed, use -v or -vv for
full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 65535
bytes
16:39:20.666070 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request
from 00:e0:c8:13:02:3d, length 360
16:39:20.666166 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request
from 00:e0:c8:13:02:3d, length 360
```

To stop tracing enter **fg** (to bring tracing task to foreground), and then **<CTRL-C>** to stop the trace.

```
root@VA_router:~# fg
tcpdump -i any -n -p port 67
^C
33 packets captured
33 packets received by filter
0 packets dropped by kernel
```

```
16:39:20.666166 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request
from 00:e0:c8:13:02:3d, length 360
```

30.5.2 ARP table status

To show the current ARP table of the router, enter **arp**

```
root@VA_router:~# arp
? (10.67.253.141) at 30:30:41:30:43:36 [ether]  on eth8
? (10.47.48.1) at 0a:44:b2:06 [ether]  on gre-gre1
```

31 Configuring Dynamic DNS

31.1 Overview

Dynamic DNS (DDNS) functionality on a Virtual Access router will dynamically perform DDNS updates to a server so it can associate an IP address with a correctly associated DNS name. Users can then contact a machine, router, device and so on with a DNS name rather than a dynamic IP address.

An account is required with the provider, and one or more domain names are associated with that account. A dynamic DNS client on the router monitors the public IP address associated with an interface and whenever the IP address changes, the client notifies the DNS provider to update the corresponding domain name.

When the DNS provider responds to queries for the domain name, it sets a low lifetime, typically a minute or two at most, on the response so that it is not cached. Updates to the domain name are thus visible throughout the whole internet with little delay.

Note: most providers impose restrictions on how updates are handled: updating when no change of address occurred is considered abusive and may result in an account being blocked. Sometimes, addresses must be refreshed periodically, for example, once a month, to show that they are still in active use.

31.2 Configuration packages used

Package	Sections
ddns	service

31.3 Configuring Dynamic DNS using the web interface

In the top menu, select **Services -> Dynamic DNS**. The Dynamic DNS Configuration page appears.

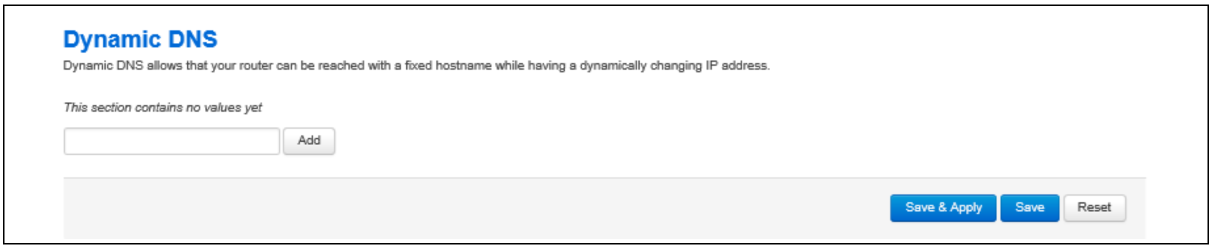

Figure 154: The Dynamic DNS configuration page

Enter a text name that will be used for the dynamic DNS section in the configuration. Select **Add**. The Dynamic DNS configuration options appear.

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31.3.1 Dynamic DNS settings

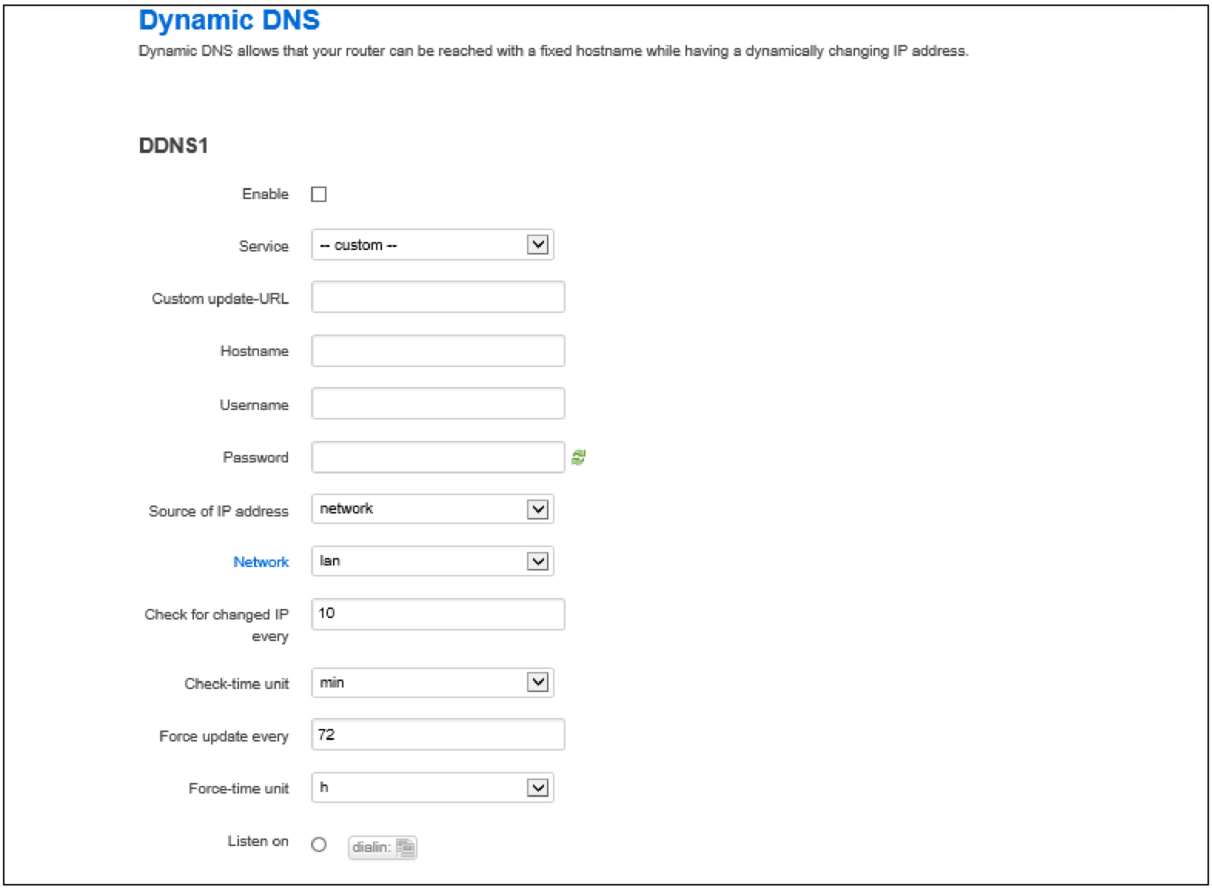

Figure 155: The dynamic DNS main settings page

Web Field/UCI/Package Option	Description
Web: Enable UCI: ddns.<name>.enabled Opt: enabled	Enables a dynamic DNS entry on the router. 0 Disabled. 1 Enabled
Web: Service UCI: ddns.<name>.service_name Opt: service_name	Defines the dynamic DNS provider.
Web: Customer update-URL UCI: ddns.<name>.update_url Opt: update_url	Defines the customer DNS provider. Displayed when the service is set to custom in the web interface.
Web: Hostname UCI: ddns.<name>.domain Opt: domain	Defines the fully qualified domain name associated with this entry. This is the name to update with the new IP address as needed.
Web: Username UCI: ddns.<name>.username Opt: username	Defines the username to use for authenticating domain updates with the selected provider.
Web: Password UCI: ddns.<name>.password Opt: password	Defines the password to use for authenticating domain name updates with the selected provider.
Web: Source of IP address UCI: ddns.<name>.ip_source Opt: ip_source	Defines the type of interface whose IP needs to be updated. network IP is associated with a network configuration. interface IP is associated with an interface. web IP is associated with a URL.

Web: Network UCI: ddns.<name>.ip_network Opt: ip_network	Defines the network whose IP needs to be updated. Displayed when the Source of IP address option is set to network. All the configured network interfaces will be shown.
Web: Interface UCI: ddns.<name>.ip_interface Opt: ip_interface	Defines the interface whose IP needs to be updated. Displayed when the Source of IP address option is set to interface. All the configured interfaces will be shown.
Web: URL UCI: ddns.<name>.ip_url Opt: ip_url	Defines the URL where the IP downloaded from. Displayed when the Source of IP address option is set to URL.
Web: Check for changed IP every UCI: ddns.<name>.check_interval Opt: check_interval	Defines how often to check for an IP change. Used in conjunction with check_unit. 10 | Range |
Web: Check-time unit UCI: ddns.<name>.check_unit Opt: check_unit	Defines the time unit to use for check for an IP change. Used in conjunction with check_interval. Minutes | hours |
Web: Force update every UCI: ddns.<name>.force_interval Opt: force_interval	Defines how often to force an IP update to the provider. Used in conjunction with force_unit. 72 | Disabled. Range | Enabled
Web: Force-time unit UCI: ddns.<name>.force_unit Opt: force_unit	Defines the time unit to use for check for an IP change. Used in conjunction with force_interval. Minutes | Hours |
Web: Listen on UCI: ddns.<name>.interface Opt: interface	Defines the interface for ddns monitoring. Typically, this will be the same as the interface whose IP is being updated – as defined ip_network or ip_interface. All configured interfaces will be displayed.

Table 101: Information table for dynamic DNS settings

31.4 Dynamic DNS using UCI

Dynamic DNS uses the ddns package **/etc/config/ddns**

31.4.1 UCI commands for DDNS

```
root@VA_router:~# uci show ddns
ddns.ddns1=service
ddns.ddns1.enabled=1
ddns.ddns1.service_name=dyndns.org
ddns.ddns1.domain=fqdn_of_interface
ddns.ddns1.username=testusername
ddns.ddns1.password=testpassword
ddns.ddns1.ip_source=network
ddns.ddns1.ip_network=dsl0
ddns.ddns1.check_interval=10
```

```
ddns.ddns1.check_unit=minutes
ddns.ddns1.force_interval=72
ddns.ddns1.force_unit=hours
ddns.ddns1.interface=dsl0
Package options for DDNS
root@VA_router:~# uci export ddns
package ddns

config service 'ddns1'
        option enabled '1'
        option service_name 'dyndns.org'
        option domain 'fqdn_of_interface'
        option username 'test'
        option password 'test'
        option ip_source 'network'
        option ip_network 'dsl0'
        option check_interval '10'
        option check_unit 'minutes'
        option force_interval '72'
        option force_unit 'hours'
        option interface 'dsl0'
```

32 Configuring hostnames

32.1 Overview

Hostnames are human-readable names that identify a device connected to a network. There are several different ways in which hostnames can be configured and used on the router.

- Local host file records
- PTR records
- Static DHCP leases

32.2 Local host file records

The hosts file is an operating system file that maps hostnames to IP addresses. It is used preferentially to other name resolution methods such as DNS.

The hosts file contains lines of text consisting of an IP address in the first text field followed by one or more host names. Each field is separated by white space; tabs are often preferred for historical reasons, but spaces are also used. Comment lines may be included; they are indicated by an octothorpe (#) in the first position of such lines. Entirely blank lines in the file are ignored.

By default, the router's local host file contains:

```
127.0.0.1 localhost

::1 ip6-localhost ip6-loopback
```

The local host file is stored at **/etc/hosts**

32.2.1 Configuration packages used

Package	Sections
network	host

32.2.2 Configuring local host files entries using the web interface

In the top menu, select **Network -> Interfaces**. The Interfaces configuration page appears.

Browse to **Host Records** section at the bottom of the page.

Figure 156: The host records add page

Select **Add**. Enter a hostname and IP address and select **Save & Apply**.

Figure 157: The host records configuration page

Web Field/UCI/Package Option	Description
Web: Hostname UCI: network.host.hostname Opt: hostname	Defines the hostname.
Web: IP-Address UCI: network.host.addr Opt: addr	Defines the IP address associated with the hostname.

Table 102: Information table for host records settings

32.2.3 Local host records using command line

Local host records are configured in the host section of the network package **/etc/config/network**.

You can configure multiple hosts.

By default, all host instances are named host and are identified by `@host` then the host position in the package as a number. For example, for the first host in the package using UCI:

```
network.@host[0]=host
network.@host[0].hostname=Device1
```

Or using package options:

```
config host
       option hostname 'Device1'
```

32.2.3.1 Local host records using uci

```
root@VA_router:~# uci show network
……
network.@host[0]=host
network.@host[0].hostname=Device1
network.@host[0].addr=1.1.1.1
```

32.2.3.2 Local host records using package option

```
root@VA_router:~# uci export network
package network
……
config host
        option hostname 'Device1'
        option addr '1.1.1.1'
```

32.2.4 Local host records diagnostics

32.2.4.1 Hosts file

Local host records are written to the local hosts file stored at **/etc/hosts**. To view the local hosts file, enter:

```
root@VA_router:~# cat /etc/hosts
127.0.0.1 localhost
::1 ip6-localhost ip6-loopback
1.1.1.1 Device1
```

32.3 PTR records

PTR records are used for reverse DNS.

The primary purpose for DNS is to map domains to IP addresses. A pointer record works in the opposite way; it associates an IP address with a domain name.

32.3.1 Configuration packages used

Package	Sections
dhcp	domain

32.3.2 Configuring PTR records using the web interface

In the top menu, select **Network -> Hostnames**. The Hostnames configuration page appears.

Figure 158: The hostnames add page

Select **Add**. Enter a hostname and IP address for the PTR record and select **Save & Apply**.

Figure 159: The hostnames configuration page

Web Field/UCI/Package Option	Description
Web: Hostname UCI: dhcp.domain.name Opt: name	Defines the domain name for the PTR record.
Web: IP-Address UCI: dhcp.domain.ip Opt: ip	Defines the IP address associated with the domain name.

Table 103: Information table for hostnames settings

32.3.3 PTR records using command line

PTR records are configured in the **domain** section of the dhcp package. **/etc/config/dhcp.**

Multiple **domains** can be configured.

By default, all domain instances are named domain and are identified by `@domain` then the domain position in the package as a number. For example, for the first domain in the package using UCI:

```
dhcp.@domain[0]=domain
dhcp.@domain[0].name=Domain1
```

Or using package options:

```
config domain
        option name 'Domain1'
```

32.3.3.1 PTR records using uci

```
root@VA_router:~# uci show dhcp
……
dhcp.@domain[0]=domain
dhcp.@domain[0].name=Domain1
dhcp.@domain[0].ip=2.2.2.2
```

32.3.3.2 PTR records using package option

```
root@VA_router:~# uci export dhcp
package dhcp
……
config domain
        option name 'Domain1'
        option ip '2.2.2.2'
```

32.3.4 PTR records diagnostics

32.3.4.1 PTR records table

To view PTR records, enter:

```
root@VA_router:~# pgrep -fl dnsmasq
4724 /usr/sbin/dnsmasq -K -D -y -Z -b -E -s lan -S /lan/ -l
/tmp/dhcp.leases -r /tmp/resolv.conf.auto --stop-dns-rebind --rebind-
localhost-ok -A /Device1.lan/1.1.1.1 --ptr-record=1.1.1.1.in-
addr.arpa,Device1.lan -A /Device2.lan/2.2.2.2 --ptr-record=2.2.2.2.in-
addr.arpa,Device2.lan
```

32.4 Static leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients based on their MAC (hardware) address.

They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served.

32.4.1 Configuration packages used

Package	Sections
dhcp	host

32.4.2 Configuring static leases using the web interface

In the top menu, select **Network -> DHCP and DNS**. The DHCP and DNS configuration page appears.

Browse to **Static leases** section.

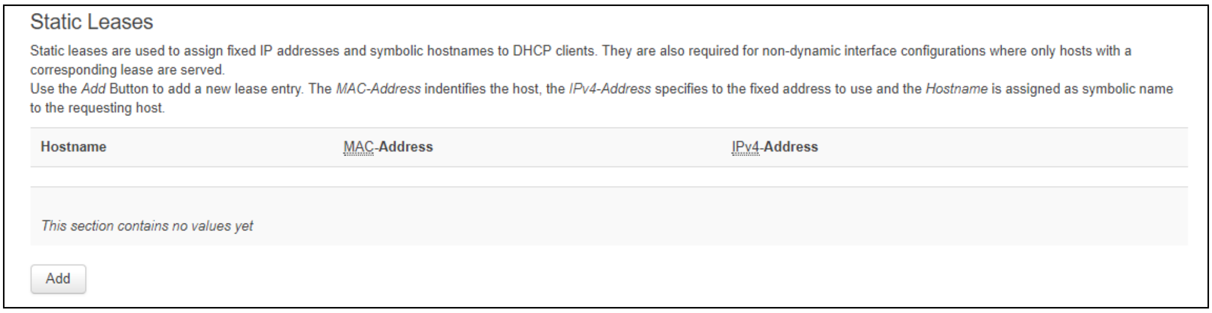

Figure 160: The static leases add page

Select **Add**. Enter a hostname, MAC address and IP address for the static lease. Select **Save & Apply**.

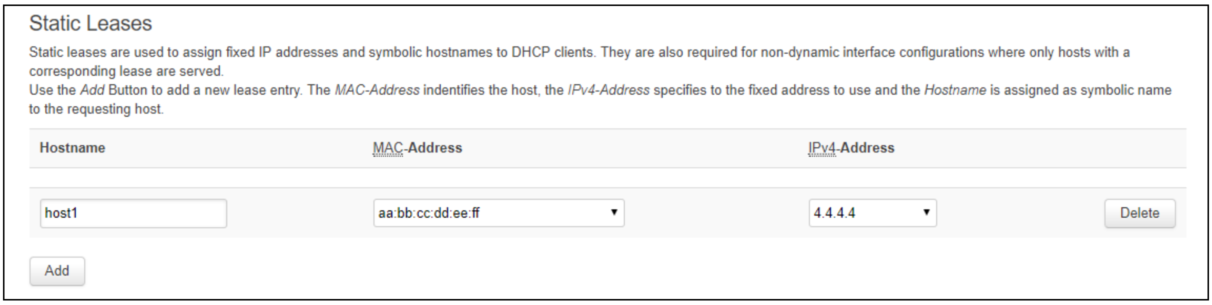

Figure 161: The static leases configuration page

Web Field/UCI/Package Option	Description
Web: Hostname UCI: dhcp.host.name Opt: name	Defines the symbolic hostname to assign.
Web: MAC-Address UCI: dhcp.host.mac Opt: mac	Defines the MAC address for this host. MAC addresses should be entered in the format `aa:bb:cc:dd:ee:ff`
Web: IPv4-Address UCI: dhcp.host.ip Opt: ip	Defines the IP address to be used for this host.

Table 104: Information table for static leases settings

32.4.3 Static leases using command line

Static leases are configured in the **host** section of the dhcp package **/etc/config/dhcp.**

Multiple **hosts** can be configured.

By default, all dhcp host instances are named host. It is identified by `@host` then the host position in the package as a number. For example, for the first host in the package using UCI:

```
dhcp.@host[0]=host

dhcp.@host[0].name=Host1
```

Or using package options:

```
config host
        option name 'Host1'
```

32.4.3.1 Static leases using uci

```
root@VA_router:~# uci show dhcp
……
dhcp.@host[0]=host
dhcp.@host[0].name=Host1
dhcp.@host[0].mac=aa:bb:cc:dd:ee:ff
dhcp.@host[0].ip=4.4.4.4
```

32.4.3.2 Static leases using package option

```
root@VA_router:~# uci export dhcp
package dhcp
……
config host
        option name 'Host1'
        option mac 'aa:bb:cc:dd:ee:ff'
        option ip '4.4.4.4'
```

33 Configuring firewall

The firewall itself is not required. It is a set of scripts which configure Netfilter. If preferred, you can use Netfilter directly to achieve the desired firewall behaviour.

Note: the UCI firewall exists to simplify configuring Netfilter for many scenarios, without requiring the knowledge to deal with the complexity of Netfilter.

The firewall configuration consists of several zones covering one or more interfaces. Permitted traffic flow between the zones is controlled by forwardings. Each zone can include multiple rules and redirects (port forwarding rules).

The Netfilter system is a chained processing filter where packets pass through various rules. The first rule that matches is executed often leading to another rule-chain until a packet hits either ACCEPT or DROP/REJECT.

Accepted packets pass through the firewall. Dropped packets are prohibited from passing. Rejected packets are also prohibited but an ICMP message is returned to the source host.

A minimal firewall configuration for a router usually consists of one 'defaults' section, at least two 'zones' (LAN and WAN) and one forwarding to allow traffic from LAN to WAN. Other sections that exist are 'redirects', 'rules' and 'includes'.

33.1 Configuration package used

Package	Sections
firewall	

33.2 Configuring firewall using the web interface

In the top menu, select **Network -> Firewall**. The Firewall page appears. It is divided into three sections:

Section	Description
General Settings	Defines the firewall zones, both global and specific.
Port Forwards	Port Forwards are also known as Redirects. This section creates the redirects using DNAT (Destination Network Address Translation) with Netfilter.
Traffic Rules	Defines rules to allow or restrict access to specific ports, hosts or protocols.

33.2.1 Firewall: General Settings section

The General settings page is divided into two sections:

Section	Description
General Settings	Defines the global firewall settings that do not belong to any specific zones.
Zones	The zones section groups one or more interfaces and serves as a source or destination for forwardings, rules and redirects. Masquerading (NAT) of outgoing traffic is controlled on a per-zone basis.

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The General Settings page, or defaults section declares global firewall settings that do not belong to any specific zones. These default rules take effect last and more specific rules take effect first.

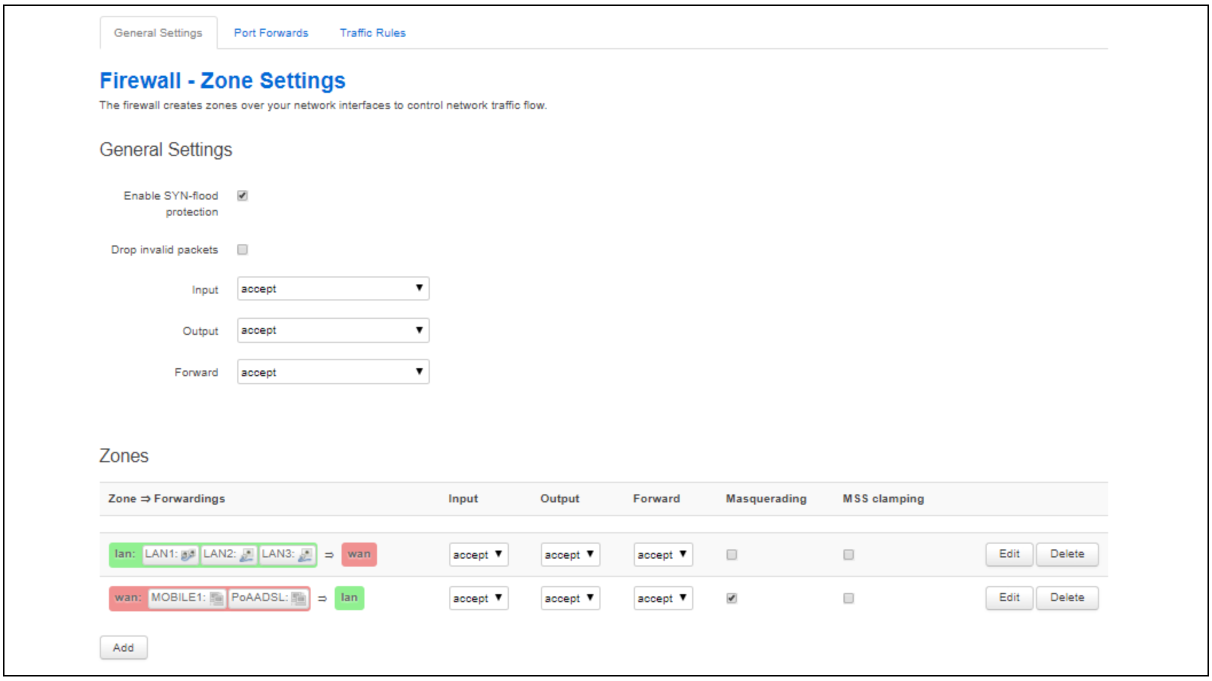

Figure 162: The firewall zone general settings page

Web Field/UCI/Package Option	Description	
Web: Enable SYN-flood protection UCI: firewall.defaults.syn_flood Opt: syn_flood	Enables SYN flood protection.	
	0	Disabled.
	1	Enabled.
Web: Drop invalid packets UCI: firewall.defaults.drop_invalid Opt: drop_invalid	Drops packets not matching any active connection.	
	0	Disabled.
	1	Enabled.
Web: Input UCI: firewall.defaults.input Opt: input	Default policy for the Input chain.	
	Accept	Accepted packets pass through the firewall.
	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.
	Drop	Dropped packets are blocked by the firewall.
Web: Output UCI: firewall.defaults.output Opt: output	Default policy for the Output chain.	
	Accept	Accepted packets pass through the firewall.
	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.
	Drop	Dropped packets are blocked by the firewall.
Web: Forward UCI: firewall.defaults.forward Opt: forward	Default policy for the Forward chain.	
	Accept	Accepted packets pass through the firewall.
	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.
	Drop	Dropped packets are blocked by the firewall.

Table 105: Information table for general zone general settings page

33.2.1.1 Firewall zones

The Zones section groups one or more interfaces and serves as a source or destination for forwardings, rules and redirects. Masquerading (NAT) of outgoing traffic is controlled on a per-zone basis. To view a zone's settings, click **Edit**.

The number of concurrent dynamic/static NAT entries of any kind (NAT/PAT/DNAT/SNAT) is not limited in any way by software; the only hardware limitation is the amount of RAM installed on the device.

33.2.1.2 Firewall zone: general settings

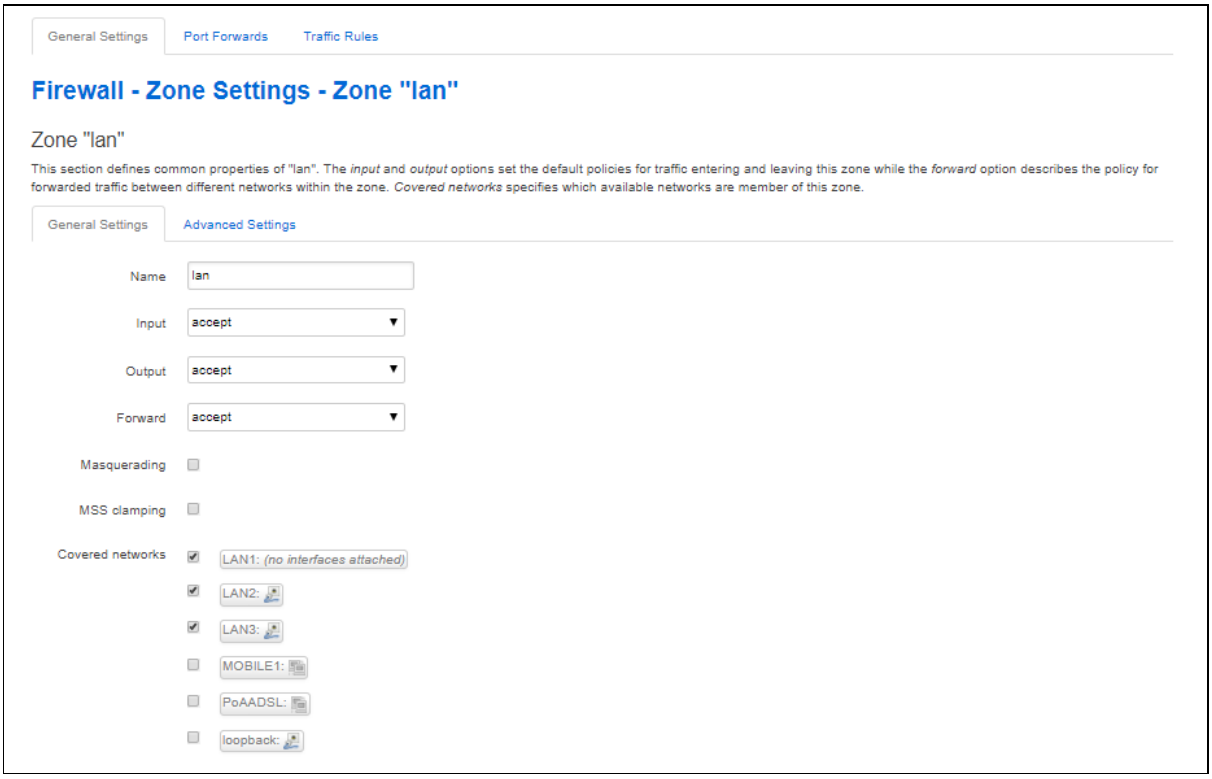

Figure 163: The firewall zone general settings

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: name
UCI: firewall.<zone label>.name
Opt: name</td><td>Sets the unique zone name. Maximum of 11 characters allowed. Note: the zone label is obtained by using the 'uci show firewall' command and is of the format '@zone[x]' where x is an integer starting at 0.</td></tr>
<tr><td>Web: Input
UCI: firewall.<zone label>.input
Opt: input</td><td>Default policy for incoming zone traffic. Incoming traffic is traffic entering the router through an interface selected in the 'Covered Networks' option for this zone.
<table>
<tr><td>Accept</td><td>Accepted packets pass through the firewall.</td></tr>
<tr><td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr>
<tr><td>Drop</td><td>Dropped packets are blocked by the firewall.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Web: Output
UCI: firewall.<zone label>.output
Opt: output</td><td>Default policy for outgoing zone traffic. Outgoing traffic is traffic leaving the router through an interface selected in the 'Covered Networks' option for this zone.<table><tr><td>Accept</td><td>Accepted packets pass through the firewall.</td></tr><tr><td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr><tr><td>Drop</td><td>Dropped packets are blocked by the firewall.</td></tr></table></td></tr>
<tr><td>Web: Forward
UCI: firewall.<zone label>.forward
Opt: forward</td><td>Default policy for internal zone traffic between interfaces. Forward rules for a zone describe what happens to traffic passing between different interfaces within that zone.<table><tr><td>Accept</td><td>Accepted packets pass through the firewall.</td></tr><tr><td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr><tr><td>Drop</td><td>Dropped packets are blocked by the firewall.</td></tr></table></td></tr>
<tr><td>Web: Masquerading
UCI: firewall.<zone label>.masq
Opt: masq</td><td>Specifies whether outgoing zone traffic should be masqueraded (NATTED). This is typically enabled on the wan zone.</td></tr>
<tr><td>Web: MSS Clamping
UCI: firewall.<zone label>.mtu_fix
Opt: mtu_fix</td><td>Enables MSS clamping for outgoing zone traffic. Subnets are allowed.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Covered networks
UCI: firewall.<zone label>.network
Opt: network</td><td>Defines a list of interfaces attached to this zone, if omitted, the value of name is used by default.
Note: use the uci list syntax to edit this setting through UCI.</td></tr>
</table>

Table 106: Information table for firewall zone general settings

33.2.1.3 Firewall zone: advanced settings

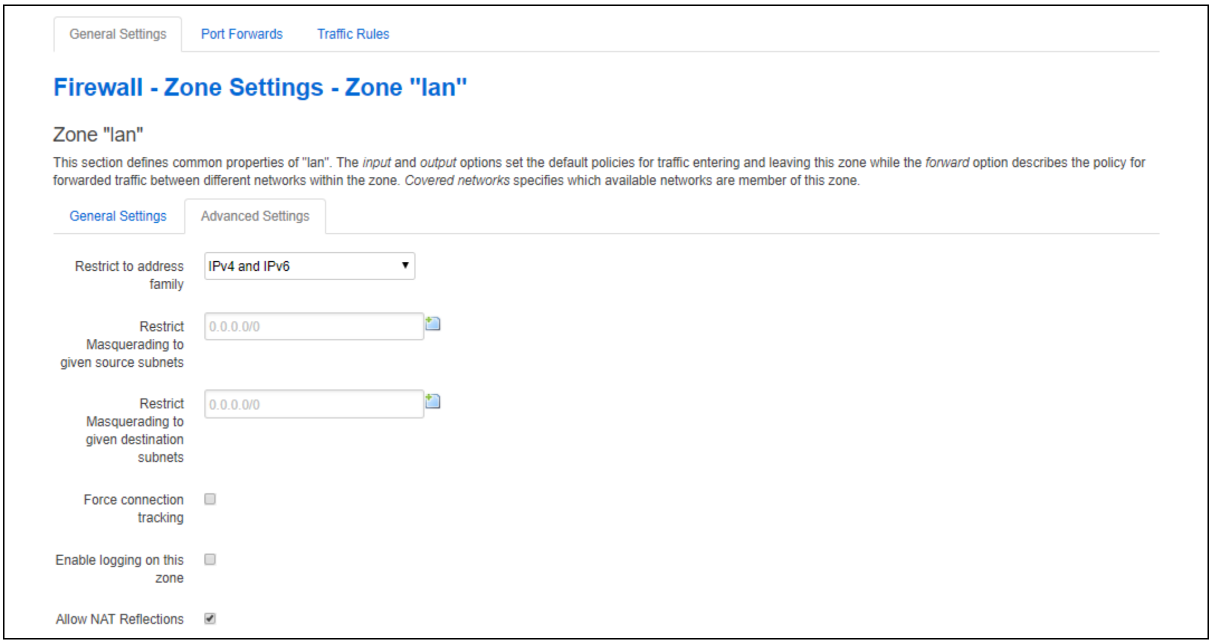

Figure 164: Firewall zone advanced settings

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Restrict to address family
UCI: firewall.<zone label>.family
Opt: family</td><td>Restricts zone to IPv4, IPv6 or both IPv4 and IPv6.<table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>IPv4 and IPv6</td><td>Any address family</td><td>any</td></tr><tr><td>IPv4 only</td><td>IPv4 only</td><td>ipv4</td></tr><tr><td>IPv6 only</td><td>IPv6 only</td><td>ipv6</td></tr></table></td></tr>
<tr><td>Web: Restrict Masquerading to given source subnets.
UCI: firewall.<zone label>.masq_src
Opt: masq_src</td><td>Limits masquerading to the given source subnets. Negation is possible by prefixing the subnet with ‘!’. Multiple subnets are allowed.</td></tr>
<tr><td>Web: Restrict Masquerading to given destination subnets.
UCI: firewall.<zone label>.masq_dest
Opt: masq_dest</td><td>Limits masquerading to the given destination subnets. Negation is possible by prefixing the subnet with ‘!’. Multiple subnets are allowed. Multiple IP addresses/subnets should be separated by a space, for example: option masq_dest ‘1.1.1.1 2.2.2.0/24’.</td></tr>
<tr><td>Web: Force connection tracking
UCI: firewall.<zone label>.conntrack
Opt: conntrack</td><td>Forces connection tracking for this zone.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>If masquerading is used. Otherwise, default is 0.</td></tr></table></td></tr>
<tr><td>Web: Enable logging on this zone
UCI: firewall.<zone label>.log
Opt: log</td><td>Creates log rules for rejected and dropped traffic in this zone.</td></tr>
<tr><td>Web: Allow NAT reflections
UCI: firewall.<zone label>.reflection
Opt: reflection</td><td>Enable/disable all NAT reflections for this zone.
Note: for configs with a large number of firewall rules, disabling NAT reflection will speed up load of firewall rules on interface start.<table><tr><td>0</td><td>Disable reflection.</td></tr><tr><td>1</td><td>Enable reflection.</td></tr></table></td></tr>
</table>

Web: n/a UCI: firewall.<zone label>.log_limit Opt: log_limit	Limits the amount of log messages per interval.

Table 107: Information table for firewall zone advanced settings

33.2.1.4 Inter-zone forwarding

This section controls the traffic flow between zones. Selecting a source or destination zone generates a forwarding rule. Only one direction is covered by any forwarding rule. Hence for bidirectional traffic flow between two zones then two rules are required, with source and destination alternated.

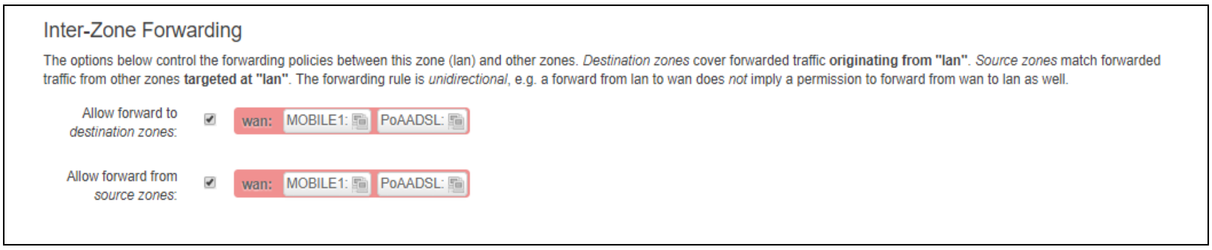

Figure 165: The inter-zone forwarding section

Web Field/UCI/Package Option	Description
Web: Allow forward to destination zones UCI: firewall.<forwarding label>.dest Opt: dest	Allows forward to other zones. Enter the current zone as the source. Enabling this option puts two entries into the firewall file: destination and source.
UCI firewall.<forwarding label>.src Opt: src	
Web: Allow forward from source zones UCI: firewall.<forwarding label>.dest Opt: dest	Allows forward from other zones. Enter the current zone as the destination. Enabling this option puts two entries into the firewall file: destination and source.
UCI: firewall.<forwarding label>.src Opt: src	

Table 108: Information table for inter-zone forwarding settings

Note: the rules generated for forwarding traffic between zones relay connection tracking to be enabled on at least one of the source or destination zones. This can be enabled through the conntrack option or through masq.

33.2.2 Firewall port forwards

Port forwards are also known as redirects. This section creates the redirects using DNAT (Destination Network Address Translation) with Netfilter. The redirects are from the firewall zone labelled as wan to the firewall zone labelled as lan. These zones can refer to multiple external and internal interfaces as defined in the Firewall Zone settings.

To edit an existing port forward select **edit**.

To add a new port forward select **add**.

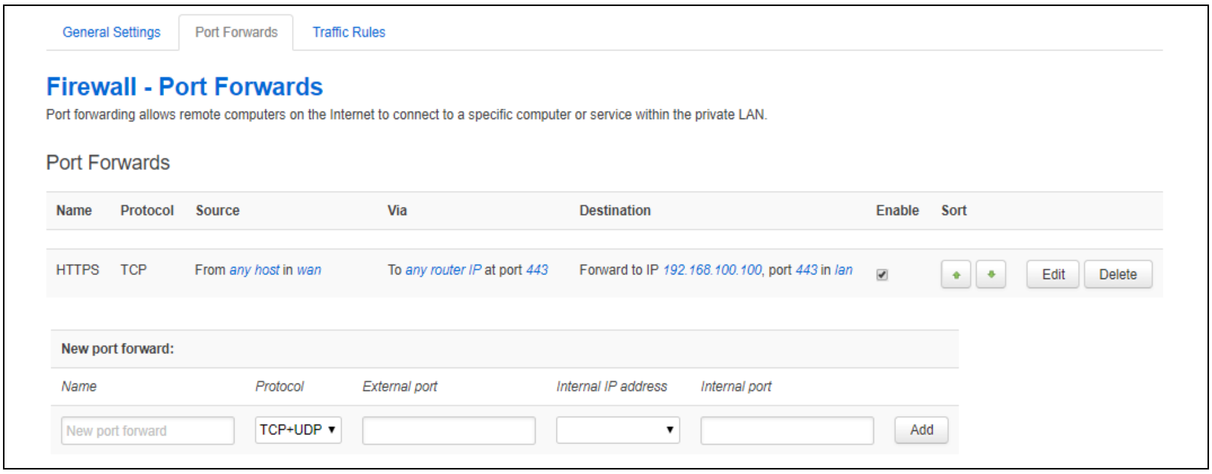

Figure 166: The firewall port forward page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: name
UCI: firewall.<redirect label>.name
Opt: name</td><td>Sets the port forwarding name. For Web UI generated redirects the <redirect label> takes the form of @redirect[x], where x is an integer starting from 0.</td></tr>
<tr><td>Web: Protocol
UCI: firewall.<redirect label>.proto
Opt: proto</td><td>Defines layer 4 protocol to match incoming traffic.<table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>tcp+udp</td><td>Match either TCP or UDP packets.</td><td>tcp udp</td></tr><tr><td>tcp</td><td>Match TCP packets only.</td><td>tcp</td></tr><tr><td>udp</td><td>Match UDP packets only.</td><td>udp</td></tr></table></td></tr>
<tr><td>Web: External port
UCI: firewall.<redirect label>.src_dport
Opt: src_dport</td><td>Specifies the incoming TCP/UDP port or port range to match. This is the incoming destination port specified by the external host. Port ranges specified as start:stop, for example, 2001:2020.<table><tr><td>Blank</td><td>Match traffic to any port.</td></tr><tr><td>Range</td><td>1 - 65535</td></tr></table></td></tr>
<tr><td>Web: Internal IP address
UCI: firewall.<redirect label>.dest_ip
Opt: dest_ip</td><td>Specifies the internal (LAN) IP address for the traffic to be redirected to.</td></tr>
<tr><td>Web: Internal port
UCI: firewall.<redirect label>.dest_port
Opt: dest_port</td><td>Specifies the destination tcp/udp port for the redirect traffic.</td></tr>
</table>

Table 109: Information table for firewall port forward settings

The defined redirects can be sorted into a specific order to be applied. More specific rules should be placed first.

After the redirect is created and saved, to make changes, click **Edit**. This will provide further options to change the source/destination zones; specify source MAC addresses and enable NAT loopback (reflection).

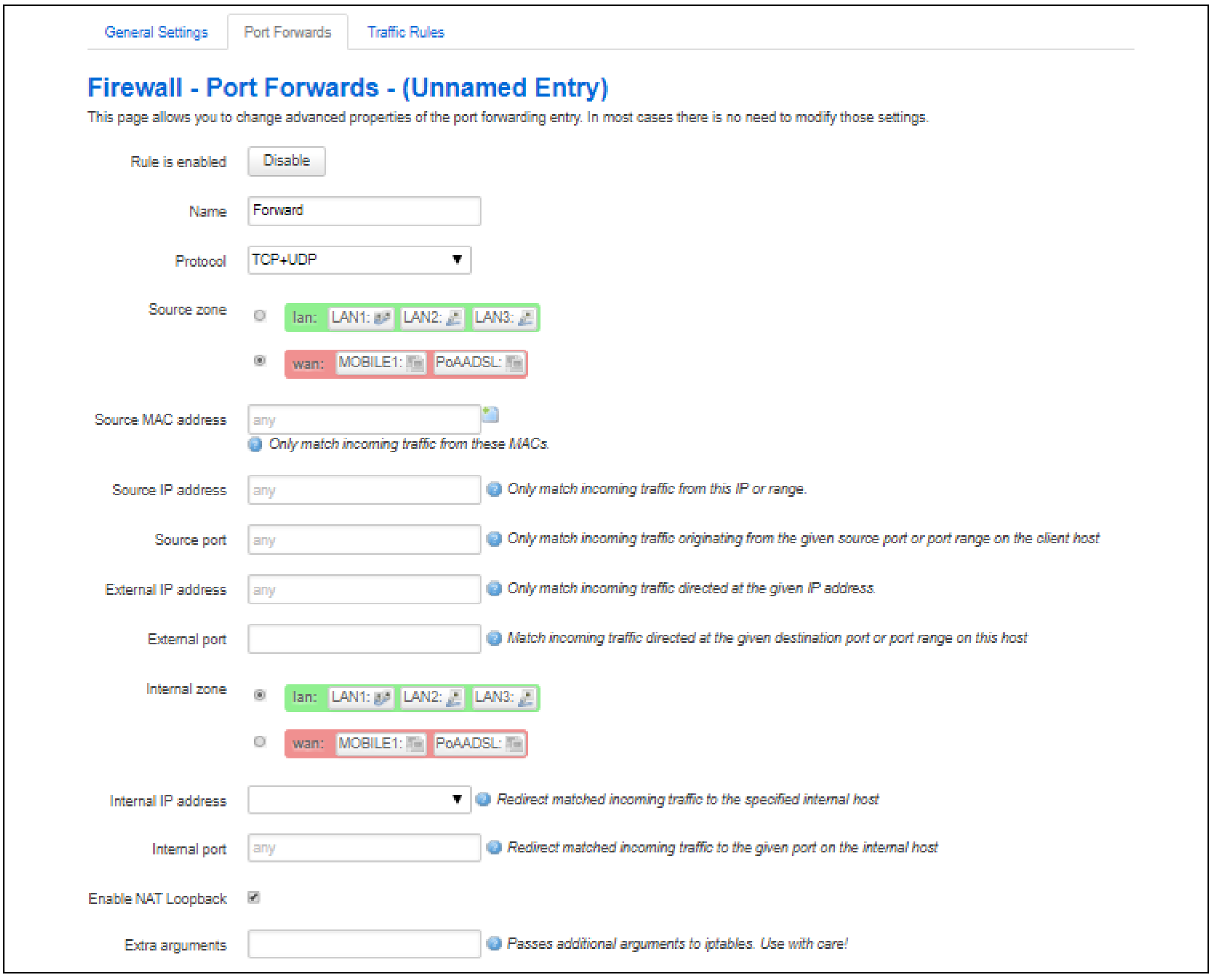

Figure 167: The firewall port forwards edits page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Rule is enabled
UCI: firewall.<redirect label>.enabled
Opt: enabled</td><td>Specifies if this redirect should be enabled or disabled.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: name
UCI: firewall.<redirect label>.name
Opt: name</td><td>Sets the port forwarding name. For Web UI generated redirects the <redirect label> takes the form of @redirect[x], where x is an integer starting from 0.</td></tr>
<tr><td>Web: Protocol
UCI: firewall.<redirect label>.proto
Opt: proto</td><td>Defines layer 4 protocol to match incoming traffic.<table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>tcp+udp</td><td>Match either TCP or UDP packets.</td><td>tcp udp</td></tr><tr><td>tcp</td><td>Match TCP packets only.</td><td>tcp</td></tr><tr><td>udp</td><td>Match UDP packets only.</td><td>udp</td></tr></table></td></tr>
<tr><td>Web: Source zone
UCI: firewall.<redirect label>.src
Opt: src</td><td>Specifies the traffic source zone. It must refer to one of the defined zone names. When using the web interface, this is set to WAN initially.</td></tr>
</table>

<table>
<tr><td>Web: Source MAC address
UCI: firewall.<redirect label>.src_mac
Opt: list src_mac</td><td>Defines the list of source MAC addresses that this redirect will match.
Format: aa:bb:cc:dd:ee:ff
Multiple RIP interfaces are entered using uci set and uci add_list commands. Example:
uci set firewall.@redirect[0].src_mac=aa:bb:cc:dd:ee:ff
uci add_list firewall.@redirect[0].src_mac=12:34:56:78:90:12
or using a list of options via package options
list network 'aa:bb:cc:dd:ee:ff'
list network '12:34:56:78:90:12'</td></tr>
<tr><td>Web: Source IP address
UCI: firewall.<redirect label>.src_ip
Opt: src_ip</td><td>Defines a source IP address that this redirect will match.<table><tr><td>Blank</td><td>Match traffic from any source IP.</td></tr><tr><td>Range</td><td>A.B.C.D/mask.</td></tr></table></td></tr>
<tr><td>Web: Source port
UCI: firewall.<redirect label>.src_port
Opt: src_port</td><td>Defines a source IP port that this redirect will match. You can enter multiple ports, using a space separator.
*For example: option src_port '22 23'
*see note below on use with options src_dport and dest_port<table><tr><td>Blank</td><td>Match traffic from any source port.</td></tr><tr><td>Range</td><td>1 - 65535</td></tr></table></td></tr>
<tr><td>Web: External port
UCI: firewall.<redirect label>.src_dport
Opt: src_dport</td><td>Specifies the incoming TCP/UDP port or port range to match. This is the incoming destination port specified by the external host. Port ranges specified in format start:stop, for example, 2001:2020.
You can enter multiple ports, using a space separator.
*For example: option src_dport '22 23'
*see note below on use with options src_port and dest_port<table><tr><td>Blank</td><td>Match traffic to any port.</td></tr><tr><td>Range</td><td>1 – 65535</td></tr></table></td></tr>
<tr><td>Web: Internal zone
UCI: firewall.<redirect label>.dest
Opt: dest</td><td>Specifies the traffic destination zone, must refer to one of the defined zone names.</td></tr>
<tr><td>Web: Internal IP address
UCI: firewall.<redirect label>.dest_ip
Opt: dest_ip</td><td>Specifies the internal (LAN) IP address for the traffic to be redirected to.</td></tr>
<tr><td>Web: Internal port
UCI: firewall.<redirect label>.dest_port
Opt: dest_port</td><td>Specifies the destination tcp/udp port for the redirect traffic. You can enter multiple ports, using a space separator.
*For example: option dest_port '22 23'
*See note below table on use with options src_port and src_dport.</td></tr>
<tr><td>Web: Enable NAT Loopback
UCI: firewall.<redirect label>.reflection
Opt: reflection</td><td>Enable or disable NAT reflection for this redirect.<table><tr><td>0</td><td>Reflection disabled.</td></tr><tr><td>1</td><td>Reflection enabled.</td></tr></table></td></tr>
<tr><td>Web: Extra arguments
UCI: firewall.<redirect label>.extra
Opt: extra</td><td>Passes extra arguments to IP tables. This is useful to specify additional match options, like -m policy --dir in for IPSec. The arguments are entered as text strings.</td></tr>
</table>

Table 110: Information table for port forward edits fields

***Note**: redirect rule options `src_port` and `src_dport/dest_port` accept space-separated lists of ports. If `src_port` is a list, then `src_dport/dst_port` cannot be, to avoid ambiguity.

If `src_dport/dest_port` are lists of different lengths, then the missing values of the shorter list default to the corresponding port in the other list. For example, if configuration file is:

```
option src_dport '21 22 23'

option dest_port '21 22 23 24'
```

then the firmware will interpret the values as:

```
option src_dport '21 22 23 24’

option dest_port '21 22 23 24'
```

33.2.3 Firewall traffic rules

Rules can be defined to allow or restrict access to specific ports, hosts or protocols.

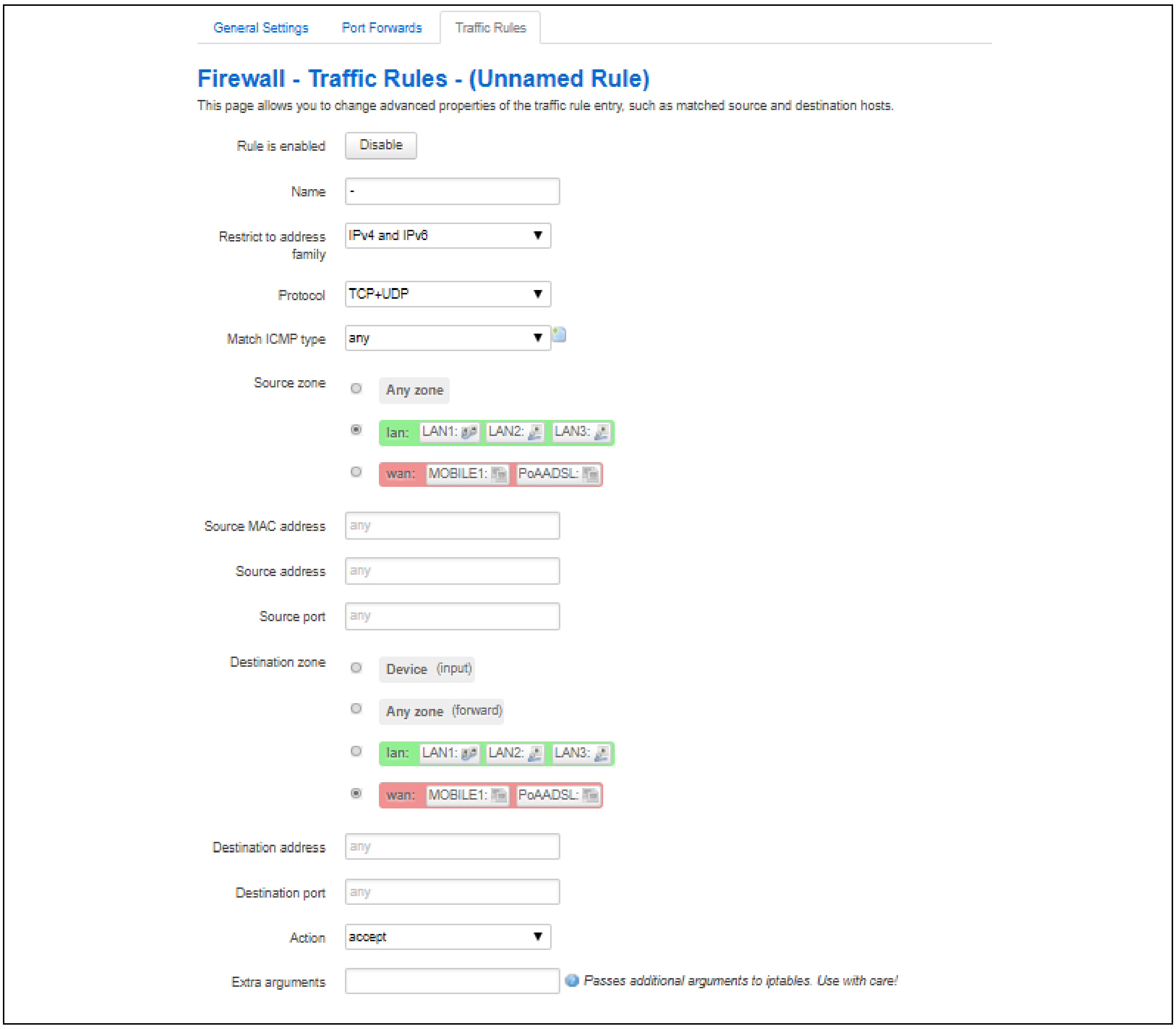

Figure 168: The firewall traffic rules page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Rule is enabled
UCI: firewall.<rule label>.enabled
Opt: enabled</td><td>Enables or disables traffic rule.<table><tr><td>0</td><td>Rule is disabled.</td></tr><tr><td>1</td><td>Rule is enabled.</td></tr></table></td></tr>
<tr><td>Web: Name
UCI: firewall.<rule label>.name
Opt: name</td><td>Select a descriptive name limited to less than 11 characters. No spaces are allowed in the naming convention.</td></tr>
<tr><td>Web: Restrict to address family
UCI: firewall.<rule label>.family
Opt: family</td><td>Restrict to protocol family.<table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>IPv4 and IPv6</td><td>Traffic rule applies to any address family</td><td>any</td></tr><tr><td>IPv4 only</td><td>IPv4 only</td><td>ipv4</td></tr><tr><td>IPv6 only</td><td>IPv6 only</td><td>Ipv6</td></tr></table></td></tr>
<tr><td>Web: Protocol
UCI: firewall.<rule label>.proto
Opt: proto</td><td>Matches incoming traffic using the given protocol.<table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>TCP+UDP</td><td>Applies rule to TCP and UDP only</td><td>tcp udp</td></tr><tr><td>TCP</td><td>Applies rule to TCP only</td><td>tcp</td></tr><tr><td>UDP</td><td>Applies rule to UDP only</td><td>udp</td></tr><tr><td>ICMP</td><td>Applies rule to ICMP only</td><td>icmp</td></tr><tr><td>custom</td><td>Specify protocol from /etc/protocols</td><td></td></tr></table></td></tr>
<tr><td>Web: Match ICMP type
UCI: firewall.<rule label>.icmp_type
Opt: icmp_type</td><td>Match specific icmp types.
This option is only valid when ICMP is selected as the protocol. ICMP types can be listed as either type names or type numbers.
Note: for a full list of valid ICMP type names, see the ICMP Options table below.</td></tr>
<tr><td>Web: Source zone
UCI: firewall.<rule label>.src
Opt: src</td><td>Specifies the traffic source zone, must refer to one of the defined zone names. For typical port forwards, this is usually WAN.</td></tr>
<tr><td>Web: Source MAC address
UCI: firewall.<rule label>.src_mac
Opt: src_mac</td><td>Matches incoming traffic from the specified MAC address.
The MAC address must be entered in the following format:
<code>aa:bb:cc:dd:ee:ff:</code>
To match only the first portion of the MAC address append <code>/prefix</code> to the option value, where <code>prefix</code> defines the bits from the start of the MAC to match on.
Example:
<code>option src_mac 00:E0:C8:12:34:56/24</code>
will match on all packets with prefix 00:E0:C8.</td></tr>
<tr><td>Web: Source address
UCI: firewall.<rule label>.src_ip
Opt: src_ip</td><td>Matches incoming traffic from the specified source IP address.</td></tr>
<tr><td>Web: Source port
UCI: firewall.<rule label>.src_port
Opt: src_port</td><td>Matches incoming traffic originating from the given source port or port range on the client host.</td></tr>
<tr><td>Web: Destination zone
UCI: firewall.<rule label>.dest
Opt: dest</td><td>Specifies the traffic destination zone. Must refer to one of the defined zone names.</td></tr>
<tr><td>Web: Destination address
UCI: firewall.<rule label>.dest_ip
Opt: dest_ip</td><td>For DNAT, redirects matched incoming traffic to the specified internal host.
For SNAT, matches traffic directed at the given address.</td></tr>
</table>

<table>
<tr><td>Web: Destination port
UCI: firewall.<rule label>.dest_port
Opt: dest_port</td><td>For DNAT, redirects matched incoming traffic to the given port on the internal host.
For SNAT, matches traffic directed at the given ports.</td></tr>
<tr><td>Web: Action
UCI: firewall.<rule label>.target
Opt: target</td><td>Action to take when rule is matched.
<table>
<tr><th>Option</th><th>Description</th><th>UCI</th></tr>
<tr><td>drop</td><td>Drop matching traffic</td><td>DROP</td></tr>
<tr><td>accept</td><td>Allow matching traffic</td><td>ACCEPT</td></tr>
<tr><td>reject</td><td>Reject matching traffic</td><td>REJECT</td></tr>
<tr><td>don’t track</td><td>Disable connection tracking for the rule. See the ‘Connection tracking’ section below for more information.</td><td>NOTRACK</td></tr>
</table></td></tr>
<tr><td>Web: Extra arguments
UCI: firewall.<rule label>.extra
Opt: extra</td><td>Passes extra arguments to IP tables. This is useful to specify additional match options, like -m policy --dir in for IPSec.</td></tr>
<tr><td>Web: n/a
UCI: firewall.<rule label>.reflection
Opt: reflection</td><td>Disables NAT reflection for this redirect if set to 0. Applicable to DNAT targets.</td></tr>
<tr><td>Web: n/a
UCI: firewall.<rule label>.limit
Opt: limit</td><td>Sets maximum average matching rate; specified as a number, with an optional /second, /minute, /hour or /day suffix. Example: 3/hour.</td></tr>
<tr><td>Web: n/a
UCI: firewall.<rule label>.limit_burst
Opt: limit_burst</td><td>Sets maximum initial number of packets to match. This number gets recharged by one every time the limit specified above is not reached, up to this number.</td></tr>
<tr><td>Web: n/a
UCI: firewall.<rule label>.recent
Opt: recent</td><td>Sets number of allowed connections within specified time. This command takes two values e.g. recent=2 120 will allow 2 connections within 120 seconds.</td></tr>
</table>

Table 111: Information table for firewall traffic rules

ICMP Options	**ICMP Options**	**ICMP Options**	**ICMP Options**
address-mask-reply	host-redirect	pong	time-exceeded
address-mask-request	host-unknown	port-unreachable	timestamp-reply
any	host-unreachable	precedence-cutoff	timestamp-request
communication-prohibited	ip-header-bad	protocol-unreachable	TOS-host-redirect
destination-unreachable	network-prohibited	redirect	TOS-host-unreachable
echo-reply	network-redirect	required-option-missing	TOS-network-redirect
echo-request	network-unknown	router-advertisement	TOS-network-unreachable
fragmentation-needed	network-unreachable	router-solicitation	ttl-exceeded
host-precedence-violation	parameter-problem	source-quench	ttl-zero-during-reassembly
host-prohibited	ping	source-route-failed	ttl-zero-during-transit

Table 112: Information table for match ICMP type drop-down menu

33.3 Configuring firewall using UCI

Firewall is configured under the firewall package /etc/config/firewall.

There are six config sections: defaults, zone, forwarding, redirect, rule and include.

You can configure multiple zone, forwarding and redirect sections.

33.3.1 Firewall general settings

To set general (default) settings, enter:

```
uci add firewall defaults

uci set firewall.@defaults[0].syn_flood=1

uci set firewall.@defaults[0].drop_invalid=1

uci set firewall.@defaults[0].input=ACCEPT

uci set firewall.@defaults[0].output=ACCEPT

uci set firewall.@defaults[0].forward=ACCEPT
```

Note: this command is only required if there is no defaults section.

33.3.2 Firewall zone settings

By default, all firewall zone instances are named zone, instances are identified by `@zone` then the zone position in the package as a number. For example, for the first zone in the package using UCI, enter:

```
firewall.@zone[0]=zone

firewall.@zone[0].name=lan
```

Or using package options:

```
config zone

      option name 'lan'
```

To set up a firewall zone, enter:

```
uci add firewall zone

uci set firewall.@zone[1].name=lan

uci set firewall.@zone[1].input=ACCEPT

uci set firewall.@zone[1].output=ACCEPT

uci set firewall.@zone[1].forward=ACCEPT

uci set firewall.@zone[1].network=lan1 wifi_client

uci set firewall.@zone[1].family=any

uci set firewall.@zone[1].masq_src=10.0.0.0/24

uci set firewall.@zone[1].masq_dest=20.0.0.0/24
```

```
uci set firewall.@zone[1].conntrack=1
uci set firewall.@zone[1].masq=1
uci set firewall.@zone[1].mtu_fix=1
uci set firewall.@zone[1].log=1
uci set firewall.@zone[1].log_limit=5
```

33.3.3 Inter-zone forwarding

By default, all inter-zone instances are named 'forwarding'; instances are identified by `@forwarding` then the forwarding position in the package as a number. For example, for the first forwarding in the package using UCI, enter:

```
firewall.@forwarding[0]=forwarding
firewall.@forwarding[0].src=lan
```

Or using package options:

```
config forwarding
      option src 'lan'
```

To enable forwarding of traffic from WAN to LAN, enter:

```
uci add firewall forwarding
uci set firewall.@forwarding[1].dest=wan
uci set firewall.@forwarding[1].src=lan
```

33.3.4 Firewall port forwards

By default, all port forward instances are named 'redirect'; instances are identified by `@redirect` then the redirect position in the package as a number. For example, for the first redirect in the package using UCI, enter:

```
firewall.@redirect[0]=redirect
firewall.@redirect[0].name=Forward
```

Or using package options:

```
config redirect
      option name 'Forward'
```

To set port forwarding rules, enter:

```
uci add firewall redirect
uci set firewall.@redirect[1].name=Forward
```

```
uci set firewall.@redirect[1].proto=tcp
uci set firewall.@redirect[1].src=wan   #  <- zone names
uci set firewall.@redirect[1].dest=lan   # <- zone names
uci set firewall.@redirect[1].src_dport=2001
uci set firewall.@redirect[1].dest_ip=192.168.0.100
uci set firewall.@redirect[1].dest_port=2005
uci set firewall.@redirect[1].enabled=1
```

33.3.5 Firewall traffic rules

By default, all traffic rule instances are named rule, instances are identified by `@rule` then the rule position in the package as a number. For example, for the first rule in the package using UCI, enter:

```
firewall.@rule[0]=rule
firewall.@rule[0].enabled=1
```

Or using package options:

```
config rule
      option enabled '1'
```

To set traffic rules, enter:

```
uci add firewall rule
uci set firewall.@rule[1].enabled=1
uci set firewall.@rule[1].name=Allow_ICMP
uci set firewall.@rule[1].family=any
uci set firewall.@rule[1].proto=ICMP
uci set firewall.@rule[1].icmp_type=any
uci set firewall.@rule[1].src=wan
uci set firewall.@rule[1].src_mac=ff:ff:ff:ff:ff:ff
uci set firewall.@rule[1].src_port=
uci set firewall.@rule[1].dest=lan
uci set firewall.@rule[1].dest_port=
uci set firewall.@rule[1].dest_ip=192.168.100.1
uci set firewall.@rule[1].target=ACCEPT
uci set firewall.@rule[1].extra=
uci set firewall.@rule[1].src_ip=8.8.8.8
uci set firewall.@rule[1].src_dip=9.9.9.9
```

```
uci set firewall.@rule[1].src_dport=68
uci set firewall.@rule[1].reflection=1
uci set firewall.@rule[1].limit=3/second
uci set firewall.@rule[1].limit_burst=30
```

33.3.5.1 Custom firewall scripts: includes

It is possible to include custom firewall scripts by specifying one or more include sections in the firewall configuration.

There is only one possible parameter for includes:

Parameter	Description
path	Specifies a shell script to execute on boot or firewall restarts.

Custom scripts are executed as shell scripts and are expected to contain iptables commands.

33.4 IPv6 notes

As described above, the option family is used for distinguishing between IPv4, IPv6 and both protocols. However, the family is inferred automatically if a specific IP address family is used. For example, if IPv6 addresses are used then the rule is automatically treated as IPv6 only rule.

```
config rule
        option src wan
        option src_ip fdca:f00:ba3::/64
        option target ACCEPT
```

Similarly, the following rule is automatically treated as IPv4 only.

```
config rule
        option src wan
        option dest_ip 88.77.66.55
        option target REJECT
```

Rules without IP addresses are automatically added to iptables and ip6tables, unless overridden by the family option. Redirect rules (port forwards) are always IPv4 since there is no IPv6 DNAT support at present.

33.5 Implications of DROP vs. REJECT

The decision whether to drop or to reject traffic should be done on a case-by-case basis. Many people see dropping traffic as a security advantage over rejecting it because it exposes less information to a hypothetical attacker. While dropping slightly increases security, it can also complicate the debugging of network issues or cause unwanted side-effects on client programs.

If traffic is rejected, the router will respond with an icmp error message ("destination port unreachable") causing the connection attempt to fail immediately. This also means that for each connection attempt a certain amount of response traffic is generated. This can actually harm if the firewall is attacked with many simultaneous connection attempts, the resulting backfire of icmp responses can clog up all available upload and make the connection unusable (DoS).

When connection attempts are dropped the client is not aware of the blocking and will continue to re-transmit its packets until the connection eventually times out. Depending on the way the client software is implemented, this could result in frozen or hanging programs that need to wait until a timeout occurs before they're able to continue.

DROP

- less information is exposed
- less attack surface
- client software may not cope well with it (hangs until connection times out)
- may complicate network debugging (where was traffic dropped and why)

REJECT

- may expose information (like the IP at which traffic was actually blocked)
- client software can recover faster from rejected connection attempts
- network debugging easier (routing and firewall issues clearly distinguishable)

33.6 Connection tracking

By default, the firewall will disable connection tracking for a zone if no masquerading is enabled. This is achieved by generating NOTRACK firewall rules matching all traffic passing via interfaces referenced by the firewall zone. The purpose of NOTRACK is to speed up routing and save memory by circumventing resource intensive connection tracking in cases where it is not needed. You can check if connection tracking is disabled by issuing iptables -t raw -S, it will list all rules, check for NOTRACK target.

NOTRACK will render certain iptables extensions unusable, for example the MASQUERADE target or the state match will not work.

If connection tracking is required, for example by custom rules in /etc/firewall.user, you must enable the conntrack option in the corresponding zone to disable NOTRACK. It should appear as option 'conntrack' '1' in the right zone in /etc/config/firewall.

33.7 Firewall examples

33.7.1 Opening ports

The default configuration accepts all LAN traffic, but blocks all incoming WAN traffic on ports not currently used for connections or NAT. To open a port for a service, add a rule section:

```
config rule
        option src              wan
        option dest_port        22
        option target           ACCEPT
        option proto            tcp
```

This example enables machines on the internet to use SSH to access your router.

33.7.2 Forwarding ports (destination NAT/DNAT)

This example forwards http, but not HTTPS, traffic to the web server running on 192.168.1.10:

```
config redirect
        option src       wan
        option src_dport 80
        option proto     tcp
        option dest_ip   192.168.1.10
```

The next example forwards one arbitrary port that you define to a box running SSH behind the firewall in a more secure manner because it is not using default port 22.

```
config 'redirect'
        option 'name' 'ssh'
        option 'src' 'wan'
        option 'proto' 'tcpudp'
        option 'src_dport' '5555'
        option 'dest_ip' '192.168.1.100'
        option 'dest_port' '22'
        option 'target' 'DNAT'
        option 'dest' 'lan'
```

33.7.3 Source NAT (SNAT)

Source NAT changes an outgoing packet destined for the system so that it looks as though the system is the source of the packet.

Define source NAT for UDP and TCP traffic directed to port 123 originating from the host with the IP address 10.55.34.85. The source address is rewritten to 63.240.161.99.

```
config redirect
        option src              lan
        option dest             wan
        option src_ip           10.55.34.85
        option src_dip          63.240.161.99
        option dest_port        123
        option target           SNAT
```

When used alone, Source NAT is used to restrict a computer's access to the internet, but allows it to access a few services by manually forwarding what appear to be a few local services; for example, NTP to the internet. While DNAT hides the local network from the internet, SNAT hides the internet from the local network.

Source NAT and destination NAT are combined and used dynamically in IP masquerading to make computers with private (192.168.x.x, etc.) IP addresses appear on the internet with the system's public WAN IP address.

33.7.4 True destination port forwarding

This usage is similar to SNAT, but as the destination IP address is not changed, machines on the destination network need to be aware that they will receive and answer requests from a public IP address that is not necessarily theirs. Port forwarding in this fashion is typically used for load balancing.

```
config redirect
        option src              wan
        option src_dport        80
        option dest             lan
        option dest_port        80
        option proto            tcp
```

33.7.5 Block access to a specific host

The following rule blocks all connection attempts to the specified host address.

```
config rule
        option src              lan
        option dest             wan
```

```
        option dest_ip          123.45.67.89
        option target           REJECT
```

33.7.6 Block access to the internet using MAC

The following rule blocks all connection attempts from the client to the internet.

```
config rule
        option src              lan
        option dest             wan
        option src_mac          00:00:00:00:00:00
        option target           REJECT
```

33.7.7 Block access to the internet for specific IP on certain times

The following rule blocks all connection attempts to the internet from 192.168.1.27 on weekdays between 21:00pm and 09:00am.

```
config rule
        option src          lan
        option dest         wan
        option src_ip       192.168.1.27
        option extra        '-m time --weekdays Mon,Tue,Wed,Thu,Fri --
timestart 21:00 --timestop 09:00'
        option target       REJECT
```

33.7.8 Restricted forwarding rule

The example below creates a forward rule rejecting traffic from LAN to WAN on the ports 1000-1100.

```
config rule
        option src              lan
        option dest             wan
        option dest_port        1000-1100
        option proto            tcpudp
        option target           REJECT
```

33.7.9 Denial of service protection rule

The example below shows a sample configuration of SSH DoS attack where if more than two SSH connections are attempted within 120 seconds, every further connection will be dropped. You can configure this for any port number.

```
config rule 'sshattack'
```

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```
        option src 'lan'
        option dest_port '22'
        option proto 'tcp'
        option recent '2 120'
        option target 'DROP'
```

33.7.10 IP spoofing prevention mechanism

Configure IP spoofing protection on a per interface basis in the /etc/config/network configuration file. The example below shows the ipv4_rp_filter option enabled on the Vlan12 interface in the network file. When reverse path filtering mechanism is enabled, the router will check whether a receiving packet source address is routable.

If it is routable through the interface from which it came, then the machine will accept the packet.

If it is not routable through the interface from which it came, then the machine will drop that packet.

```
config interface 'Vlan12'
        option type 'bridge'
        option proto 'static'
        option monitored '0'
        option ipaddr '10.1.28.122'
        option netmask '255.255.0.0'
        option ifname 'eth1 eth3.12'
        option ipv4_rp_filter '1'
```

33.7.11 Simple DMZ rule

The following rule redirects all WAN ports for all protocols to the internal host 192.168.1.2.

```
config redirect
      option src              wan
      option proto            all
      option dest_ip          192.168.1.2
```

33.7.12 Transparent proxy rule (external)

The following rule redirects all outgoing HTTP traffic from LAN through an external proxy at 192.168.1.100 listening on port 3128. It assumes the router LAN address to be 192.168.1.1 - this is needed to masquerade redirected traffic towards the proxy.

```
config redirect
        option src              lan
```

```
        option proto            tcp
        option src_ip           !192.168.1.100
        option src_dport        80
        option dest_ip          192.168.1.100
        option dest_port        3128
        option target           DNAT

config redirect
        option dest             lan
        option proto            tcp
        option src_dip          192.168.1.1
        option dest_ip          192.168.1.100
        option dest_port        3128
        option target           SNAT
```

33.7.13 Transparent proxy rule (same host)

The rule below redirects all outgoing HTTP traffic from LAN through a proxy server listening at port 3128 on the router itself.

```
config redirect
      option src              lan
      option proto            tcp
      option src_dport        80
      option dest_port        3128
```

33.7.14 IPSec passthrough

This example enables proper forwarding of IPSec traffic through the WAN.

```
# AH protocol
config rule
        option src              wan
        option dest             lan
        option proto            ah
        option target           ACCEPT
# ESP protocol
config rule
        option src              wan
        option dest             lan
```

```
        option proto            esp
        option target           ACCEPT
```

For some configurations you also have to open port 500/UDP.

```
# ISAKMP protocol
config rule
        option src              wan
        option dest             lan
        option proto            udp
        option src_port         500
        option dest_port        500
        option target           ACCEPT
```

33.7.15 Manual iptables rules

You can specify traditional iptables rules, in the standard iptables UNIX command form, in an external file and included in the firewall config file. It is possible to use this process to include multiple files.

```
config include
       option path /etc/firewall.user

config include
       option path /etc/firewall.vpn
```

The syntax for the includes is Linux standard and therefore different from UCIs.

33.7.16 Firewall management

After a configuration change, to rebuild firewall rules, enter:

```
root@VA_router:/# /etc/init.d/firewall restart
```

Executing the following command will flush all rules and set the policies to ACCEPT on all standard chains:

```
root@VA_router:/# /etc/init.d/firewall stop
```

To manually start the firewall, enter:

```
root@VA_router:/# /etc/init.d/firewall start
```

To permanently disable the firewall, enter:

```
root@VA_router:/# /etc/init.d/firewall disable
```

Note: disable does not flush the rules, so you might be required to issue a stop before.

To enable the firewall again, enter:

```
root@VA_router:/# /etc/init.d/firewall enable
```

33.7.17 Debug generated rule set

It is possible to observe the iptables commands generated by the firewall programme. This is useful to track down iptables errors during firewall restarts or to verify the outcome of certain UCI rules.

To see the rules as they are executed, run the `fw` command with the FW_TRACE environment variable set to **1**:

```
root@VA_router:/# FW_TRACE=1 fw reload
```

To direct the output to a file for later inspection, enter:

```
root@VA_router:/# FW_TRACE=1 fw reload 2>/tmp/iptables.lo
```

34 Configuring IPSec

Internet Protocol Security (IPSec) is a protocol suite used to secure communications at IP level. Use IPSec to secure communications between two hosts or between two networks. Virtual Access routers implement IPSec using strongSwan software.

If you need to create an IPSec template for DMVPN, read the chapter 'Dynamic Multipoint Virtual Private Network (DMVPN)'.

The number of IPSec tunnels supported by Virtual Access' routers is not limited in any way by software; the only hardware limitation is the amount of RAM installed on the device.

34.1 Configuration package used

Package	Sections
strongswan	general connection secret

34.2 Configuring IPSec using the web interface

To configure IPSec using the web interface, in the top menu, select **Services -> IPSec**. The strongSwan IPSec VPN page appears. There are three sections:

Common Settings	Control the overall behaviour of strongSwan. This behaviour is common across all tunnels.
Connection Settings Secret Settings	Together, these sections define the required parameters for a two-way IKEv1 tunnel.

34.2.1 Configure common settings

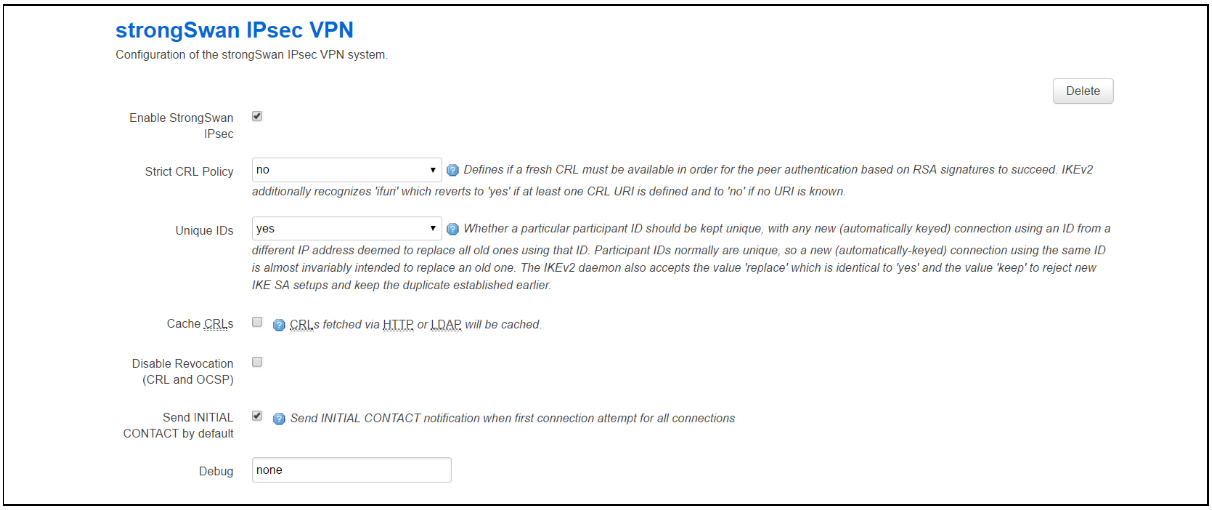

Figure 169: The common settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enable strongswan
UCI: strongswan.general.enable
Opt: enabled</td><td>Enables or disables IPSec.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Strict CRL Policy
UCI: strongswan.general.strictcrlpolicy
Opt: strictcrlpolicy</td><td>Defines if a fresh CRL must be available for the peer authentication based on RSA signatures to succeed.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr><tr><td>ifuri</td><td>The IKEv2 application additionally recognises the <code>ifuri</code> option which reverts to ‘yes’ if at least one CRL URI is defined and to ‘no’ if no URI is known.</td></tr></table></td></tr>
<tr><td>Web: Unique IDs
UCI: strongswan.general.uniqueids
Opt: uniqueids</td><td>Defines whether a particular participant ID should be kept unique, with any new, automatically keyed, connection using an ID from a different IP address deemed to replace all old ones using that ID.
Participant IDs normally are unique, so a new, automatically-keyed, connection using the same ID is almost invariably intended to replace an old one.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr><tr><td>replace</td><td>Identical to Yes.</td></tr><tr><td>keep</td><td>Rejects new IKE SA and keeps the duplicate established earlier.</td></tr></table></td></tr>
<tr><td>Web: Cache CRLs
UCI: strongswan.general.cachecrls
Opt: cachecrls</td><td>Certificate Revocation Lists (CRLs) fetched via HTTP or LDAP will be cached in /etc/ipsec.d/crls/ under a unique file name derived from the certification authority's public key.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Disable Revocation
UCI: strongswan.general.revocation_disabled
Opt: revocation_disabled</td><td>Defines whether disable CRL and OCSP checking for revoked certificates.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Send INITIAL CONTACT by default
UCI: strongswan.general.initial_contact
Opt: initial_contact</td><td>Defines whether the first attempt to contact a remote peer by this strongswan instance sets the initial_contact flag, which should cause compliant peers to automatically bring down any previous sessions. This can also be enabled or disabled per connection.<table><tr><td>0</td><td>Does not set initial contact flag.</td></tr><tr><td>1</td><td>Sets initial contact flag on first attempt.</td></tr></table></td></tr>
<tr><td>Web: Debug
UCI: strongswan.general.debug
Opt: debug</td><td>Enables debugging. This option is used for trouble shooting issues. It is not suitable for a production environment.<table><tr><td>None</td><td>Debug disabled.</td></tr><tr><td>Control</td><td>Debug enabled. Shows generic control flow with errors and very basic auditing logs.</td></tr><tr><td>All</td><td>Debug enabled. Most verbose logging also includes sensitive information such as keys.</td></tr></table></td></tr>
</table>

Table 113: Information table for IPSec common settings

34.2.2 Common settings: configure connection

Figure 170: The configure connection page

Web Field/UCI/Package Option	Description
Web: Enabled UCI: strongswan.@connection[X].enabled Opt: enable	Enables or disables an IPSec connection. 0 – Disabled. 1 – Enabled.
Web: Aggressive UCI: strongswan.@connection[X].aggressive Opt: aggressive	Enables or disables IKE aggressive mode. **Note**: using aggressive mode along with PSK authentication is a less secure method than main mode and should be avoided. 0 – Disabled. 1 – Enabled.
Web: Name UCI: strongswan.@connection[X].name Opt: name	Specifies a name for the tunnel.
Web: Autostart Action UCI: strongswan.@connection[X].auto Opt: auto	Specifies when the tunnel is initiated. start – On start up. route – When traffic routes this way. add – Loads a connection without starting it. ignore – Ignores the connection. always – Actively retries to establish the tunnel if it went down.
Web: Connection Type UCI: strongswan.@connection[X].type Opt: type	Defines the type of IPSec connection. tunnel – Connection uses tunnel mode. transport – Connection uses transport mode. pass – Connection does not perform any IPSec processing. drop – Connection drops all the packets.

Table 114: Information table for connection settings

34.2.3 Common settings: IP addressing

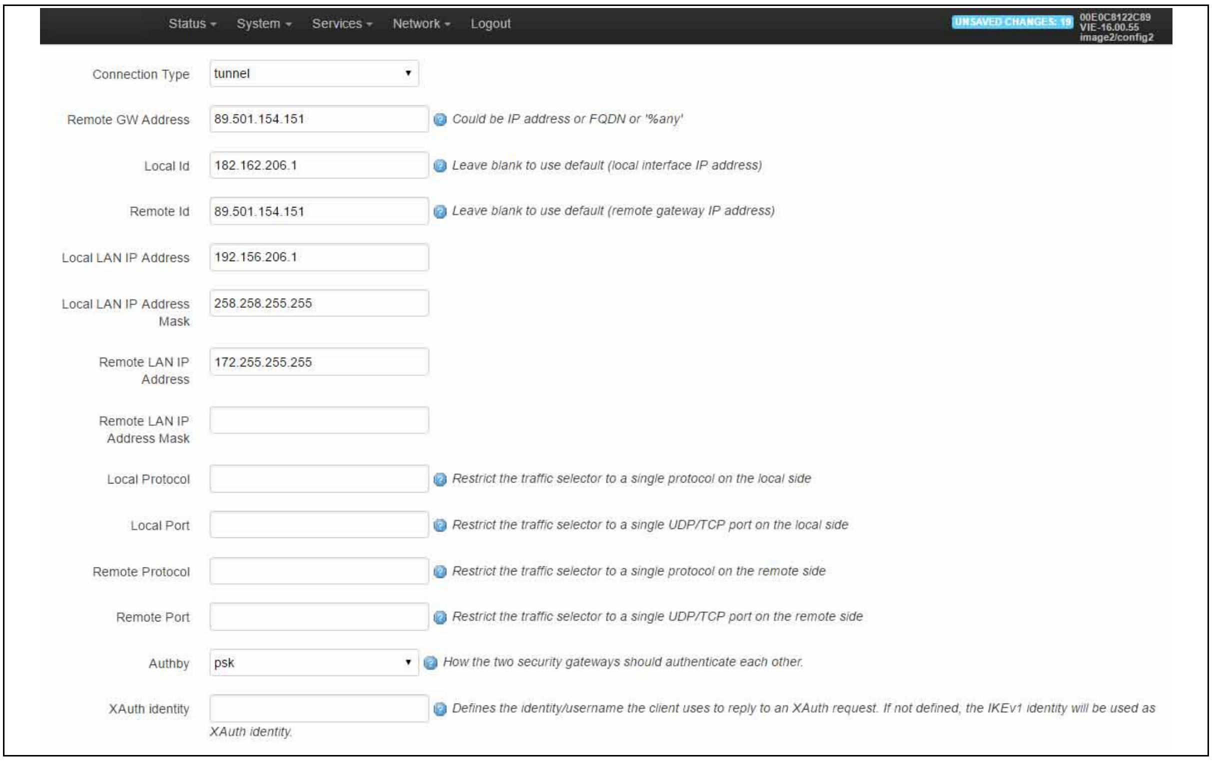

Figure 171: The IP addressing settings

Web Field/UCI/Package Option	Description
Web: Remote GW Address UCI: strongswan.@connection[X]. remoteaddress Opt: remoteaddress	Sets the public IP address of the remote peer.
Web: Local ID UCI: strongswan.@connection[X].localid Opt: localid	Defines the local peer identifier.
Web: Remote ID UCI: strongswan.@connection[X].remoteid Opt:remoteid	Defines the remote peer identifier.
Web: Local LAN IP Address UCI: strongswan.@connection[X]. locallan Opt: locallan	Defines the local IP of LAN.
Web: Local LAN IP Address Mask UCI: strongswan.@connection[X]. locallanmask Opt: locallanmask	Defines the subnet of local LAN.
Web: Remote LAN IP Address UCI: strongswan.@connection[X]. remotelan Opt:remotelan	Defines the IP address of LAN serviced by remote peer.
Web: Remote LAN IP Address Mask UCI: strongswan.@connection[X]. remotelanmask Opt:remotelanmask	Defines the Subnet of remote LAN.

<table>
<tr><td>Web: Local Protocol
UCI: strongswan.@connection[X].localproto
Opt: localproto</td><td>Restricts the connection to a single protocol on the local side.</td></tr>
<tr><td>Web: Local Port
UCI: strongswan.@connection[X].localport
Opt: localport</td><td>Restricts the connection to a single port on the local side.</td></tr>
<tr><td>Web: Remote Protocol
UCI: strongswan.@connection[X].remoteproto
Opt:remoteproto</td><td>Restricts the connection to a single protocol on the remote side.</td></tr>
<tr><td>Web: Remote Port
UCI: strongswan.@connection[X].remoteport
Opt: remoteport</td><td>Restricts the connection to a single port on the remote side.</td></tr>
<tr><td>Web: Authby
UCI: strongswan.@connection[X].authby
Opt: authby</td><td>Defines how the two secure gateways should authenticate.
Note: using aggressive mode along with PSK authentication is unsecure and should be avoided.
<table>
<tr><td>Pubkey</td><td>For public key signatures.</td></tr>
<tr><td>Rsasig</td><td>For RSA digital signatures.</td></tr>
<tr><td>ecdsasig</td><td>For elliptic curve DSA signatures.</td></tr>
<tr><td>Psk</td><td>Using a preshared key.</td></tr>
<tr><td>xauthrsasig</td><td>Enables eXtended Authentication (XAuth) with addition to RSA signatures.</td></tr>
<tr><td>xauthpsk</td><td>Using extended authentication and preshared key.</td></tr>
<tr><td>never</td><td>Can be used if negotiation is never to be attempted or accepted (shunt connections).</td></tr>
</table></td></tr>
</table>

Table 115: Information table for IP addressing settings

34.2.4 Common settings: IPSec settings

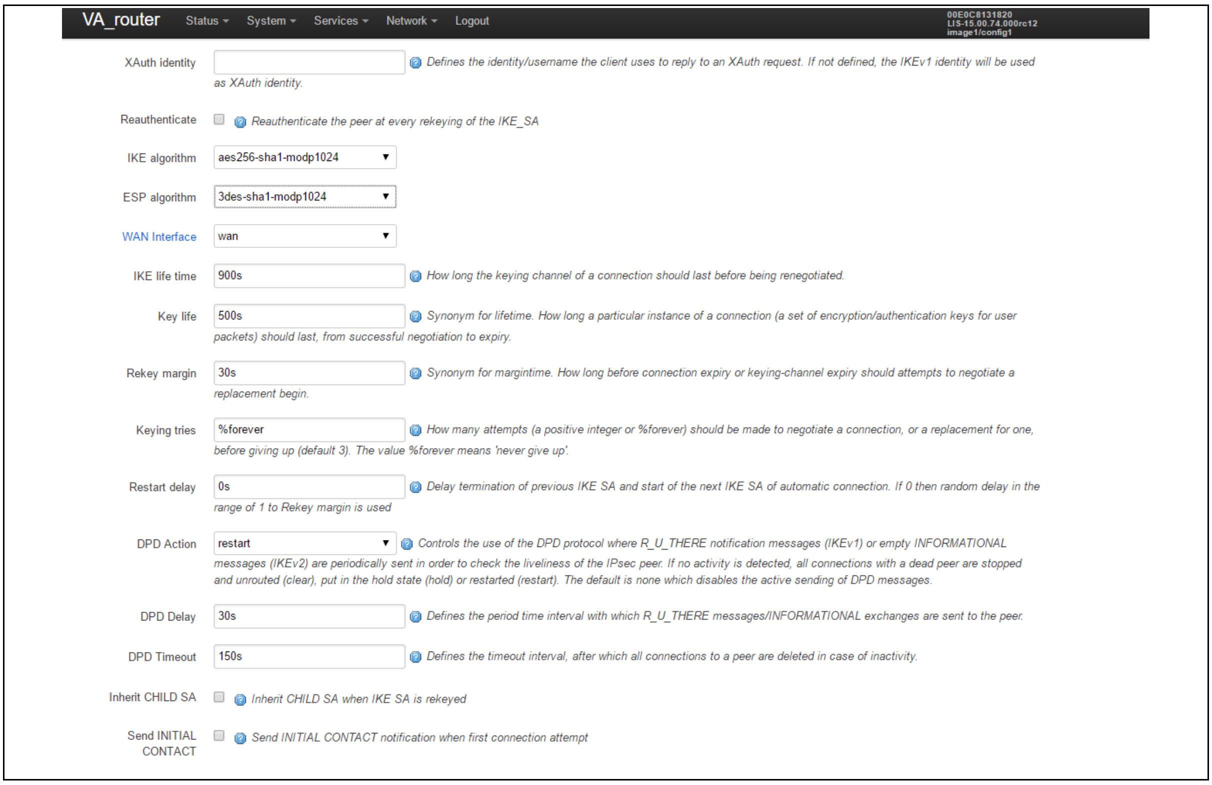

Figure 172: The IPSec connections settings

Web Field/UCI/Package Option	Description
Web: XAuth Identity UCI: strongswan.@connection[X].xauth_identity Opt: xauth_identity	Defines Xauth ID.
Web: IKE Algorithm UCI: strongswan.@connection[X].ike Opt: ike	Specifies the IKE algorithm to use. The format is: encAlgo | authAlgo | DHGroup encAlgo: 3des aes128 aes256 serpent twofish blowfish authAlgo: md5 sha sha2 DHGroup: modp1024 modp1536 modp2048 modp3072 modp4096 modp6144 modp8192 For example, a valid IKE algorithm is aes128-sha-modp1536.

Web: ESP algorithm UCI: strongswan.@connection[X].esp Opt: esp	Specifies the esp algorithm to use. The format is: encAlgo | authAlgo | DHGroup encAlgo: 3des aes128 aes256 serpent twofish blowfish authAlgo: md5 sha sha2 DHGroup: modp1024 modp1536 modp2048 modp3072 modp4096 modp6144 modp8192 For example, a valid encryption algorithm is: aes128-sha-modp1536. If no DH group is defined then PFS is disabled.
Web: WAN Interface UCI: strongswan.@connection[X].waniface Opt: waniface	This is a space-separated list of the WAN interfaces the router will use to establish a tunnel with the secure gateway. On the web, a list of the interface names is automatically generated. If you want to specify more than one interface use the "custom" value. Example: if you have a 3G WAN interface called 'wan' and a WAN ADSL interface called 'dsl' and wanted to use one of these interfaces for this IPSec connection, you would use: 'wan adsl'.
Web: IKE Life Time UCI: strongswan.@connection[X].ikelifetime Opt:ikelifetime	Specifies how long the keyring channel of a connection (ISAKMP or IKE SA) should last before being renegotiated. 3h | Timespec | 1d, 3h, 25m, 10s.
Web: Key Life UCI: strongswan.@connection[X].keylife Opt: keylife	Specifies how long a particular instance of a connection (a set of encryption/authentication keys for user packets) should last, from successful negotiation to expiry. Normally, the connection is renegotiated (via the keying channel) before it expires (see rekeymargin). 1h | Timespec | 1d, 1h, 25m, 10s.
Web: Rekey Margin UCI: strongswan.@connection[X].rekeymargin Opt: rekeymargin	Specifies how long before connection expiry or keying-channel expiry should attempt to negotiate a replacement begin. Relevant only locally, other end need not agree on it. 9m | Timespec | 1d, 2h, 9m, 10s.

Web: Restart Delay UCI: strongswan.@connection[X].restartdelay Opt: restartdelay	Defines specific delay when re-establishing a connection. Previously if `close_action=restart`, then the new option `restartdelay` controls how many seconds it waits before attempting to re-establish the tunnel to allow the headend some time to tidy up. If not set, it defaults to zero, which means that the previous behaviour of choosing a random time interval in the range 0..`RekeyMargin` seconds takes effect. Relevant only locally, other end need not agree on it. 0 | Timespec | 1d, 2h, 9m, 10s.
Web: Keying Tries UCI: strongswan.@connection[X].keyringtries Opt: keyringtries	Specifies how many attempts, for example, a positive integer or %forever, should be made to negotiate a connection, or a replacement for one, before giving up. The value %forever means 'never give up'. Relevant only locally, the other end need not agree on it.
Web: DPD Action UCI: strongswan.@connection[X].dpdaction Opt: dpdaction	Defines DPD (Dead Peer Detection) action. None | Disables DPD. Clear | Clear down the tunnel if peer does not respond. Reconnect when traffic brings the tunnel up. Hold | Clear down the tunnel and bring up as soon as the peer is available. Restart | Restarts DPD when no activity is detected.
Web: DPD Delay UCI: strongswan.@connection[X].dpddelay Opt: dpddelay	Defines the period time interval with which R_U_THERE messages and INFORMATIONAL exchanges are sent to the peer. These are only sent if no other traffic is received. 30s | Timespec | 1d, 2h, 25m, 10s.
Web: DPD Timeout UCI: strongswan.@connection[X].dpdtimeout Opt: dpdtimeout	Defines the timeout interval, after which all connections to a peer are deleted in case of inactivity. 150s | Timespec | 1d, 2h, 25m, 10s.
Web: Inherit CHILD SA UCI: strongswan.@connection[X].inherit_child Opt: inherit_child	Defines whether the existing phase two IPSEC SA is maintained through IKE rekey for this tunnel. This is normally set to match the behaviour on the IPSEC headend. 0 | Delete the existing IPSEC SA on IKE rekey 1 | Maintain the existing IPSEC SA on IKE rekey
Web: Send INITIAL CONTACT UCI: strongswan.@connection[X].initial_contact Opt: initial_contact	Defines whether the first attempt to contact a remote peer by this strongswan instance sets the initial_contact flag which should cause compliant peers to automatically bring down any previous sessions. 0 | Do not set initial contact flag. 1 | Set initial contact flag on first attempt.

Table 116: Information table for IPSec connections settings

34.2.5 Configure secret settings

Each tunnel requires settings to configure how the local end point of the tunnel proves its identity to the remote end point.

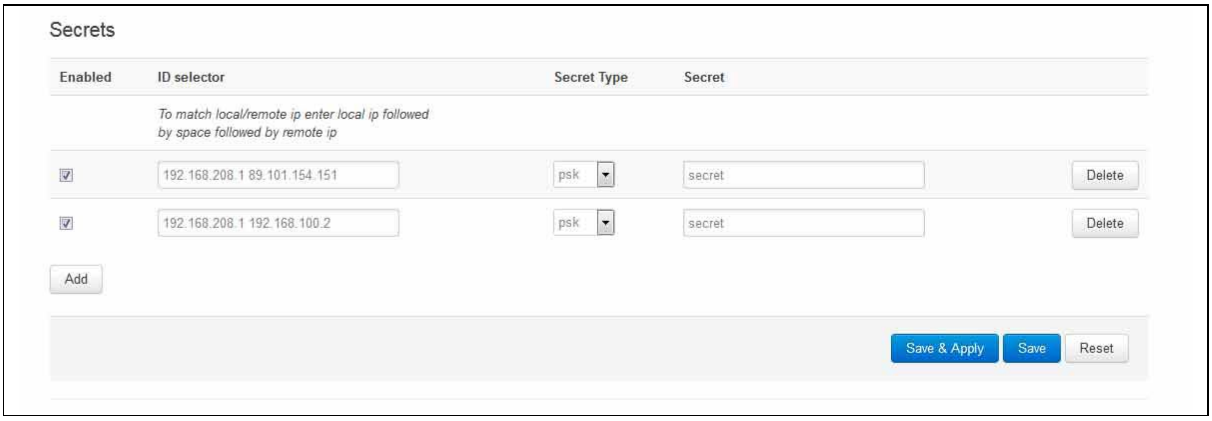

Figure 173: IPSec secrets settings

Web Field/UCI/Package Option	Description
Web: Enabled UCI: strongswan.@secret[X].enabled Opt: enabled	Defines whether this set of credentials is to be used or not. 0: Disabled. 1: Enabled.
Web: ID selector UCI: strongswan.@secret[X].idtype Opt: idtype	Defines whether IP address or userfqdn is used.
Web: ID selector UCI: strongswan.@secret[X].localaddress Opt: localaddress	Defines the local address this secret applies to.
Web: ID selector UCI: strongswan.@secret[X].remoteaddress Opt: remoteaddress	Defines the remote address this secret applies to.
Web: N/A UCI: strongswan.@secret[X].userfqnd Opt: userfqnd	FQDN or Xauth name used of Extended Authentication. This must match xauth_identity from the configuration connection section.
Web: Secret Type UCI: strongswan.@secret[X].secrettype Opt: secrettype	Specifies the authentication mechanism to be used by the two peers. Psk: Preshared secret Pubkey: Public key signatures Rsasig: RSA digital signatures Ecdsasig: Elliptic Curve DSA signatures Xauth: Extended authentication
Web: Secret UCI: strongswan.@secret[X].secret Opt: secret	Defines the secret.

Table 117: Information table for IPSec secrets settings

34.3 Configuring IPSec using UCI

34.3.1 Common settings

```
# Commands
touch /etc/config/strongswan
uci set strongswan.general=general
uci set strongswan.general.enabled=yes
uci set strongswan.general.strictcrlpolicy=no
uci set strongswan.general.uniqueids=yes
uci set strongswan.general.cachecrls=no
uci set strongswan.general.debug=none
uci set strongswan.general.initial_contact=0
uci commit
```

This will create the following output:

```
config general 'general'
        option enabled 'yes'
        option strictcrlpolicy 'no'
        option uniqueids 'yes'
        option cachecrls 'no'
        option debug 'none'
        option initial_contact ‘0’
```

34.3.2 Connection settings

Note: Xauth is not supported in IKEv2.

```
touch /etc/config/strongswan
uci add strongswan connection
uci set strongswan.@connection[0].ikelifetime=3h
uci set strongswan.@connection[0].keylife=1h
uci set strongswan.@connection[0].rekeymargin=9m
uci set strongswan.@connection[0].keyingtries=3
uci set strongswan.@connection[0].restartdelay=0
uci set strongswan.@connection[0].dpdaction=none
uci set strongswan.@connection[0].dpddelay=30s
uci set strongswan.@connection[0].dpdtimeout=150s
uci set strongswan.@connection[0].enabled=yes
```

```
uci set strongswan.@connection[0].name=3G_Backup
uci set strongswan.@connection[0].auto=start
uci set strongswan.@connection[0].type=tunnel
uci set strongswan.@connection[0].remoteaddress=100.100.100.100
uci set strongswan.@connection[0].localid=192.168.209.1
uci set strongswan.@connection[0].remoteid=100.100.100.100
uci set strongswan.@connection[0].locallan=192.168.209.1
uci set strongswan.@connection[0].locallanmask=255.255.255.255
uci set strongswan.@connection[0].remotelan=172.19.101.3
uci set strongswan.@connection[0].remotelanmask=255.255.255.255
uci set strongswan.@connection[0].authby=xauthpsk
uci set strongswan.@connection[0].xauth_identity=testxauth
uci set strongswan.@connection[0].ike=3des-md5-modp1024
uci set strongswan.@connection[0].esp=3des-md5
uci set strongswan.@connection[0].waniface=wan
uci set strongswan.@connection[0].inherit_child=0
uci set strongswan.@connection[0].initial_contact=0
uci commit
```

This will create the following output:

```
config connection
        option ikelifetime '3h'
        option keylife '1h'
        option rekeymargin '9m'
        option keyingtries '3'
        option restartdelay ‘0’
        option dpdaction ‘none’
        option dpddelay '30s'
        option dpdtimeout '150s'
        option enabled 'yes'
        option name '3G_Backup'
        option auto 'start'
        option type 'tunnel'
        option remoteaddress '100.100.100.100 '
        option localid '192.168.209.1'
        option remoteid '100.100.100.100 '
        option locallan '192.168.209.1'
```

```
        option locallanmask '255.255.255.255'
        option remotelan '172.19.101.3'
        option remotelanmask '255.255.255.255'
        option authby 'xauthpsk'
        option xauth_identity 'testxauth'
        option ike '3des-md5-modp1024'
        option esp '3des-md5'
        option waniface 'wan'
        option inherit_child ‘0’
        option initial_contact ‘0’
```

34.3.3 Shunt connection

If the remote LAN network is 0.0.0.0/0 then all traffic generated on the local LAN will be sent via the IPSec tunnel. This includes the traffic destined to the router's IP address. To avoid this situation, you must include an additional config connection section.

```
# Commands
touch /etc/config/strongswan
uci add strongswan connection
uci set strongswan.@connection[1].name=local
uci set strongswan.@connection[1].enabled=yes
uci set strongswan.@connection[1].locallan=10.1.1.1
uci set strongswan.@connection[1].locallanmask=255.255.255.255
uci set strongswan.@connection[1].remotelan=10.1.1.0
uci set strongswan.@connection[1].remotelanmask=255.255.255.0
uci set strongswan.@connection[1].type=pass
uci set strongswan.@connection[1].auto=route
uci commit
```

This will create the following output:

```
config connection
        option name 'local'
        option enabled 'yes'
        option locallan '10.1.1.1'
        option locallanmask '255.255.255.255'
        option remotelan '10.1.1.0'
        option remotelanmask '255.255.255.0'
        option type 'pass'
        option auto 'route'
```

Traffic originated on `remotelan` and destined to `locallan` address is excluded from VPN IPSec policy.

34.3.4 Secret settings

Each tunnel also requires settings for how the local end point of the tunnel proves its identity to the remote end point.

A sample secret section, which could be used with the connection section in 'Connection Settings', is shown below.

```
# Commands to add a secret for psk auth
touch /etc/config/strongswan
uci add strongswan secret
uci set strongswan.@secret[0].enabled=yes
uci set strongswan.@secret[0].localaddress=192.168.209.1
uci set strongswan.@secret[0].remoteaddress= 100.100.100.100
uci set strongswan.@secret[0].secrettype=psk
uci set strongswan.@secret[0].secret=secret
uci commit
```

This will create the following output:

```
config secret
        option enabled 'yes'
        option localaddress '192.168.209.1'
        option remoteaddress '100.100.100.100 '
        option secrettype 'psk'
        option secret 'secret'
```

If xauth is defined as the authentication method then you must include an additional config secret section, as shown in the example below.

```
# Commands to add a secret for xauth auth
touch /etc/config/strongswan
uci add strongswan secret
uci set strongswan.@secret[1].enabled=yes
uci set strongswan.@secret[1].idtype=userfqdn
uci set strongswan.@secret[1].userfqdn=testxauth
uci set strongswan.@secret[1].remoteaddress=100.100.100.100
uci set strongswan.@secret[1].secret=xauth
uci set strongswan.@secret[1].secrettype=XAUTH
uci commit
```

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This will create the following output:

```
config secret
        option enabled 'yes'
        option idtype 'userfqdn'
        option userfqdn 'testxauth'
        option remoteaddress '100.100.100.100'
        option secret 'xauth'
        option secrettype 'XAUTH'
```

34.4 Configuring an IPSec template for DMVPN via the web interface

To configure IPSec using the web interface, in the top menu, select **Services -> IPSec**. The strongSwan IPSec VPN page appears. There are three sections:

Common Settings	Control the overall behaviour of strongSwan. This behaviour is common across all tunnels.
Connection Settings	Together, these sections define the required parameters for a two-way IKEv1 tunnel.
Secret Settings	

34.4.1 Configure common settings

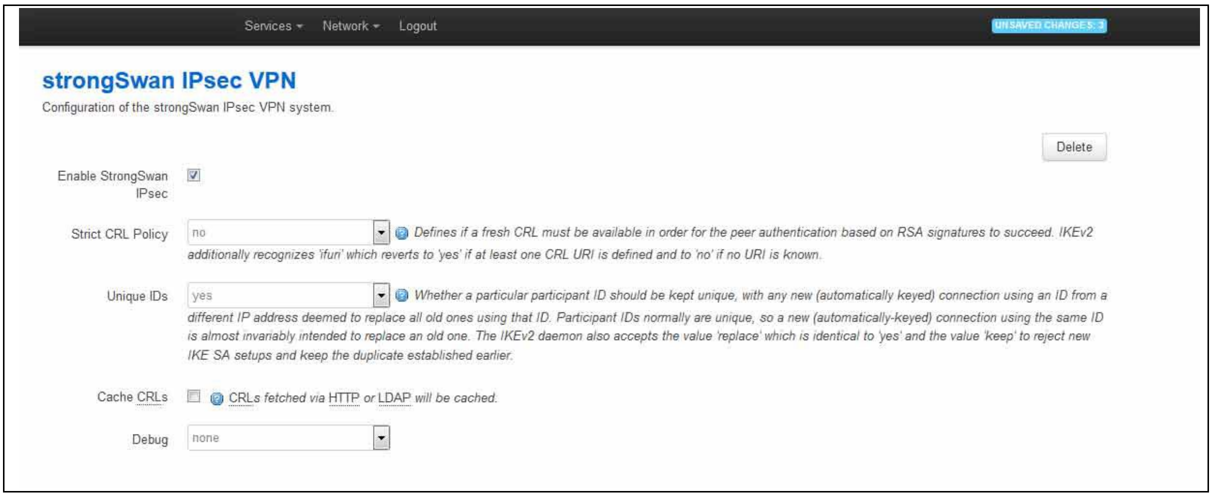

Figure 174: The common settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">Web: Enable strongswan
UCI: strongswan.general.enable
Opt: enabled</td><td colspan="2">Enables or disables IPSec.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td rowspan="4">Web: Strict CRL Policy
UCI: strongswan.general.strictcrlpolicy
Opt: strictcrlpolicy</td><td colspan="2">Defines if a fresh CRL must be available for the peer authentication based on RSA signatures to succeed.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td>ifuri</td><td>The IKEv2 application additionally recognizes the <code>ifuri</code> option which reverts to ‘yes’ if at least one CRL URI is defined and to ‘no’ if no URI is known.</td></tr>
<tr><td rowspan="5">Web: Unique IDs
UCI: strongswan.general.uniqueids
Opt: uniqueids</td><td colspan="2">Defines whether a particular participant ID should be kept unique, with any new, automatically keyed, connection using an ID from a different IP address deemed to replace all old ones using that ID.
Participant IDs normally are unique, so a new, automatically keyed, connection using the same ID is almost invariably intended to replace an old one.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td>replace</td><td>Identical to Yes</td></tr>
<tr><td>keep</td><td>Rejects new IKE SA and keep the duplicate established earlier</td></tr>
<tr><td rowspan="3">Web: Cache CRLs
UCI: strongswan.general.cachecrls
Opt: cachecrls</td><td colspan="2">Certificate Revocation Lists (CRLs) fetched via HTTP or LDAP will be cached in /etc/ipsec.d/crls/ under a unique file name derived from the certification authority's public key.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td rowspan="4">Web: Debug
UCI: strongswan.general.debug
Opt: debug</td><td colspan="2">Enable debugging. This option is used for trouble shooting issues. It is not suitable for a production environment.</td></tr>
<tr><td>None</td><td>Debug disabled.</td></tr>
<tr><td>Control</td><td>Debug enabled. Shows generic control flow with errors and very basic auditing logs.</td></tr>
<tr><td>All</td><td>Debug enabled. Most verbose logging also includes sensitive information such as keys.</td></tr>
</table>

Table 118: Information table for IPSec common settings

34.4.2 Configure connection settings

Scroll down to view the connection settings section.

If you want to create a DMVPN, you do not need to configure all settings as the DMVPN will automatically create them using the template. Leave the following sections blank:

- Remote GW Address
- Local ID
- Remote Id
- Local LAN IP Address
- Local LAN IP Address Mask
- Remote LAN IP Address
- Remote LAN IP Address Mask

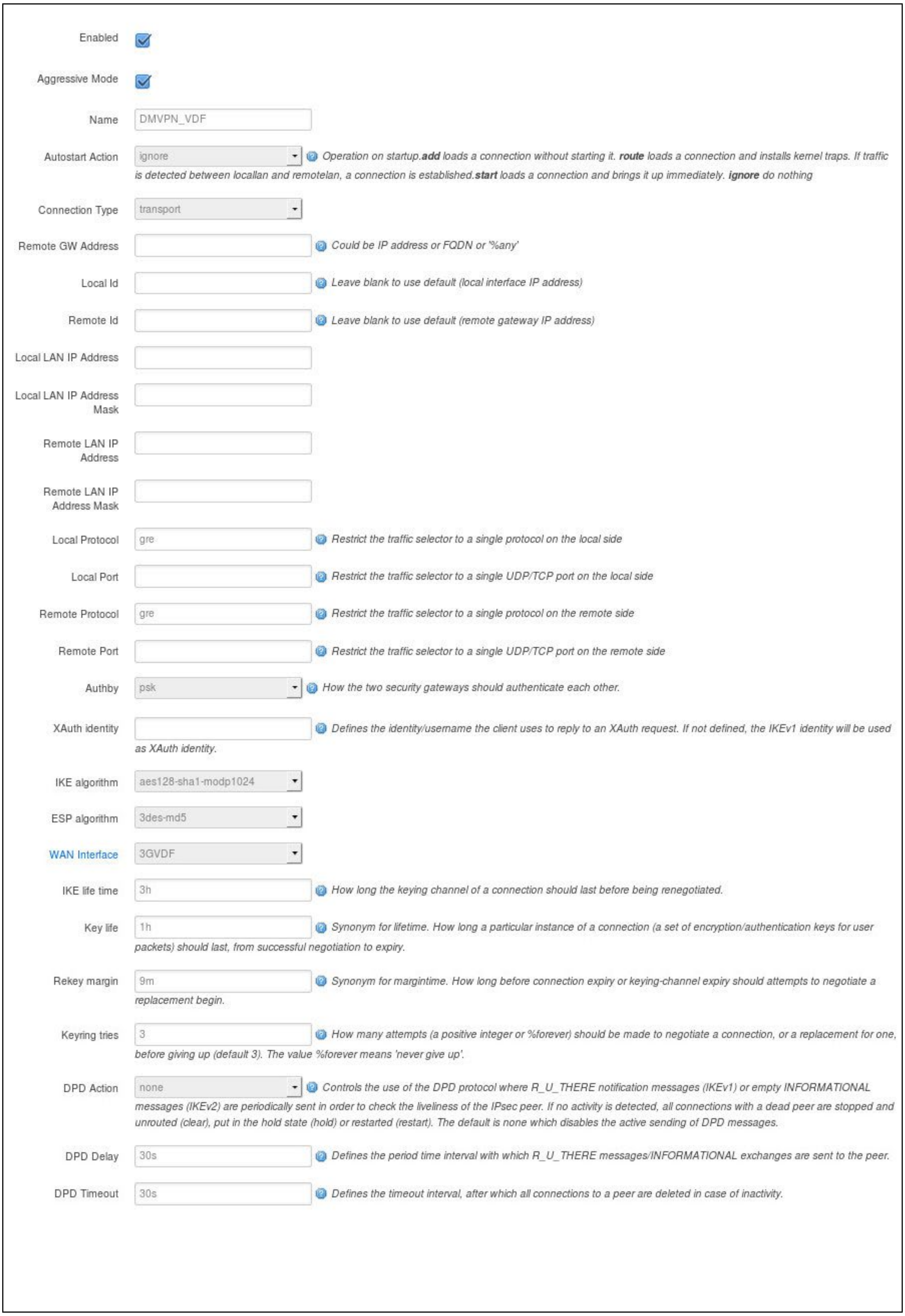

Figure 175: The connections settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">Web: Enabled
UCI: strongswan.@connection[X].enabled
Opt: enable</td><td colspan="2">Enables or disables IPSec connection.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td rowspan="3">Web: Aggressive
UCI: strongswan.@connection[X].aggressive
Opt: aggressive</td><td colspan="2">Enables or disables IKE aggressive mode.
Note: using aggressive mode along with PSK authentication is less secure method than main mode and should be avoided.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td>Web: Name
UCI: strongswan.@connection[X].name
Opt: name</td><td colspan="2">Specifies a name for the tunnel.</td></tr>
<tr><td rowspan="6">Web: Autostart Action
UCI: strongswan.@connection[X].auto
Opt: auto</td><td colspan="2">Specifies when the tunnel is initiated.</td></tr>
<tr><td>start</td><td>On start up.</td></tr>
<tr><td>route</td><td>When traffic routes this way.</td></tr>
<tr><td>add</td><td>Loads a connection without starting it.</td></tr>
<tr><td>ignore</td><td>Ignores the connection.</td></tr>
<tr><td>always</td><td>Actively retries to establish the tunnel if it went down.</td></tr>
<tr><td rowspan="5">Web: Connection Type
UCI: strongswan.@connection[X].type
Opt: type</td><td colspan="2">Defines the type of IPSec connection.</td></tr>
<tr><td>tunnel</td><td>Connection uses tunnel mode.</td></tr>
<tr><td>transport</td><td>Connection uses transport mode.</td></tr>
<tr><td>pass</td><td>Connection does not perform any IPSec processing.</td></tr>
<tr><td>drop</td><td>Connection drops all the packets.</td></tr>
<tr><td>Web: Remote GW Address
UCI: strongswan.@connection[X]. remoteaddress
Opt: remoteaddress</td><td colspan="2">Sets the public IP address of the remote peer.
Leave blank for DMVPN.</td></tr>
<tr><td>Web: Local ID
UCI: strongswan.@connection[X].localid
Opt: localid</td><td colspan="2">Defines the local peer identifier.
Leave blank for DMVPN.</td></tr>
<tr><td>Web: Remote ID
UCI: strongswan.@connection[X].remoteid
Opt:remoteid</td><td colspan="2">Defines the remote peer identifier.
Leave blank for DMVPN.</td></tr>
<tr><td>Web: Local LAN IP Address
UCI: strongswan.@connection[X]. locallan
Opt: locallan</td><td colspan="2">Defines the local IP of LAN.
Leave blank for DMVPN.</td></tr>
<tr><td>Web: Local LAN IP Address Mask
UCI: strongswan.@connection[X]. locallanmask
Opt: locallanmask</td><td colspan="2">Defines the subnet of local LAN.
Leave blank for DMVPN.</td></tr>
<tr><td>Web: Remote LAN IP Address
UCI: strongswan.@connection[X]. remotelan
Opt:remotelan</td><td colspan="2">Defines the IP address of LAN serviced by remote peer.
Leave blank for DMVPN.</td></tr>
<tr><td>Web: Remote LAN IP Address Mask
UCI: strongswan.@connection[X]. remotelanmask
Opt:remotelanmask</td><td colspan="2">Defines the Subnet of remote LAN.
Leave blank for DMVPN.</td></tr>
<tr><td>Web: Local Protocol
UCI: strongswan.@connection[X].localproto
Opt: localproto</td><td colspan="2">Restricts the connection to a single protocol on the local side.</td></tr>
</table>

Web: Local Port UCI: strongswan.@connection[X].localport Opt: localport	Restricts the connection to a single port on the local side.
Web: Remote Protocol UCI: strongswan.@connection[X].remoteproto Opt:remoteproto	Restricts the connection to a single protocol on the remote side.
Web: Remote Port UCI: strongswan.@connection[X].remoteport Opt: remoteport	Restricts the connection to a single port on the remote side.
Web: Authby UCI: strongswan.@connection[X].authby Opt: authby	Defines how the two secure gateways should authenticate. **Note**: using aggressive mode along with PSK authentication is unsecure and should be avoided. Pubkey: For public key signatures. Rsasig: For RSA digital signatures. ecdsasig: For Elliptic Curve DSA signatures. Psk: Using a preshared key. xauthrsasig: Enables eXtended Authentication (XAuth) with addition to RSA signatures. xauthpsk: Using extended authentication and preshared key. never: Can be used if negotiation is never to be attempted or accepted (shunt connections).
Web: XAuth Identity UCI: strongswan.@connection[X].xauth_identity Opt: xauth_identity	Defines Xauth ID.
Web: IKE Algorithm UCI: strongswan.@connection[X].ike Opt: ike	Specifies the IKE algorithm to use. The format is: encAlgo | authAlgo | DHGroup: encAlgo: 3des aes128 aes256 serpent twofish blowfish authAlgo: md5 sha sha2 DHGroup: modp1024 modp1536 modp2048 modp3072 modp4096 modp6144 modp8192 For example, a valid IKE algorithm is: aes128-sha-modp1536.

Web: ESP algorithm UCI: strongswan.@connection[X].esp Opt: esp	Specifies the esp algorithm to use. The format is: encAlgo | authAlgo | DHGroup encAlgo: 3des aes128 aes256 serpent twofish blowfish authAlgo: md5 sha sha2 DHGroup: modp1024 modp1536 modp2048 modp3072 modp4096 modp6144 modp8192 For example, a valid encryption algorithm is: aes128-sha-modp1536. If no DH group is defined then PFS is disabled.
Web: WAN Interface UCI: strongswan.@connection[X].waniface Opt: waniface	This is a space separated list of the WAN interfaces the router will use to establish a tunnel with the secure gateway. On the web, a list of the interface names is automatically generated. If you want to specify more than one interface use the "custom" value. Example: if you have a 3G WAN interface called 'wan' and a WAN ADSL interface called 'dsl' and wanted to use one of these interfaces for this IPSec connection, you would use: 'wan adsl'.
Web: IKE Life Time UCI: strongswan.@connection[X].ikelifetime Opt:ikelifetime	Specifies how long the keyring channel of a connection (ISAKMP or IKE SA) should last before being renegotiated. 3h | Timespec | 1d, 3h, 25m, 10s.
Web: Key Life UCI: strongswan.@connection[X].keylife Opt: keylife	Specifies how long a particular instance of a connection (a set of encryption/authentication keys for user packets) should last, from successful negotiation to expiry. Normally, the connection is renegotiated (via the keying channel) before it expires (see rekeymargin). 1h | Timespec | 1d, 1h, 25m, 10s.
Web: Rekey Margin UCI: strongswan.@connection[X].rekeymargin Opt: rekeymargin	Specifies how long before connection expiry or keying-channel expiry should attempt to negotiate a replacement begin. Relevant only locally; other end need not agree on it. 9m | Timespec | 1d, 2h, 9m, 10s.
Web: Keyring Tries UCI: strongswan.@connection[X].keyringtries Opt: keyringtries	Specifies how many attempts, for example, a positive integer or %forever, should be made to negotiate a connection, or a replacement for one, before giving up. The value %forever means 'never give up'. Relevant only locally; other end need not agree on it.

Web: DPD Action UCI: strongswan.@connection[X].dpdaction Opt: dpdaction	Defines DPD (Dead Peer Detection) action. None: Disables DPD. Clear: Clear down the tunnel if the peer does not respond. Reconnect when traffic brings the tunnel up. Hold: Clear down the tunnel and bring up as soon as the peer is available. Restart: Restarts DPD when no activity is detected.
Web: DPD Delay UCI: strongswan.@connection[X].dpddelay Opt: dpddelay	Defines the period time interval with which R_U_THERE messages and INFORMATIONAL exchanges are sent to the peer. These are only sent if no other traffic is received. 30s Timespec: 1d, 2h, 25m, 10s.
Web: DPD Timeout UCI: strongswan.@connection[X].dpdtimeout Opt: dpdtimeout	Defines the timeout interval, after which all connections to a peer are deleted in case of inactivity. 150s Timespec: 1d, 2h, 25m, 10s.

Table 119: Information table for IPSec connections settings

34.4.3 Configure secrect settings

Each tunnel requires settings to configure how the local end point of the tunnel proves its identity to the remote end point.

Figure 176: IPSec secrets settings

Web Field/UCI/Package Option	Description
Web: Enabled UCI: strongswan.@secret[X].enabled Opt: enabled	Defines whether this set of credentials is to be used or not. 0: Disabled. 1: Enabled.
Web: ID selector UCI: strongswan.@secret[X].idtype Opt: idtype	Defines whether IP address or userfqdn is used.
Web: ID selector UCI: strongswan.@secret[X].localaddress Opt: localaddress	Defines the local address this secret applies to.
Web: ID selector UCI: strongswan.@secret[X]. remoteaddress Opt: remoteaddress	Defines the remote address this secret applies to.

Web: N/A UCI: strongswan.@secret[X].userfqnd Opt: userfqnd	FQDN or Xauth name used of Extended Authentication. This must match xauth_identity from the configuration connection section.
Web: Secret Type UCI: strongswan.@secret[X].secrettype Opt: secrettype	Specifies the authentication mechanism to be used by the two peers. Psk: Preshared secret Pubkey: Public key signatures Rsasig: RSA digital signatures Ecdsasig: Elliptic Curve DSA signatures Xauth: Extended authentication
Web: Secret UCI: strongswan.@secret[X].secret Opt: secret	Defines the secret.

Table 120: Information table for IPSec secret settings

34.5 Configuring an IPSec template to use with DMVPN

The following example shows how to configure an IPSec connection template to use with DMVPN.

```
# Commands
touch /etc/config/strongswan
uci set strongswan.general=general
uci set strongswan.general.enabled=yes
uci set strongswan.general.strictcrlpolicy=no
uci set strongswan.general.uniqueids=yes
uci set strongswan.general.cachecrls=yes
uci set strongswan.general.nattraversal=yes
uci add strongswan connection
uci set strongswan.@connection[0].enabled=yes
uci set strongswan.@connection[0].name=dmvpn
uci set strongswan.@connection[0].type=transport
uci set strongswan.@connection[0].localproto=gre
uci set strongswan.@connection[0].remoteproto=gre
uci set strongswan.@connection[0].ike=aes-sha1-modp1024
uci set strongswan.@connection[0].esp=aes128-sha1
uci set strongswan.@connection[0].waniface=lan4
uci set strongswan.@connection[0].auto=ignore
uci set strongswan.@connection[0].ikelifetime=28800s
uci set strongswan.@connection[0].keylife=300s
uci set strongswan.@connection[0].rekeymargin=30s
uci set strongswan.@connection[0].keyingtries=%forever
uci set strongswan.@connection[0].dpdaction=hold
```

```
uci set strongswan.@connection[0].dpddelay=30s
uci set strongswan.@connection[0].dpdtimeout=150s
uci add strongswan secret
uci set strongswan.@secret[0].enabled=yes
uci set strongswan.@secret[0].secrettype=psk
uci set strongswan.@secret[0].secret=secret
```

This will create package strongswan.

```
config general 'general'
option enabled 'yes'
option strictcrlpolicy 'no'
option uniqueids 'yes'
option cachecrls 'yes'
option nattraversal 'yes'
 config connection
option enabled 'yes'
option name 'dmvpn'
option type 'transport'
option localproto 'gre'
option remoteproto 'gre'
option ike 'aes-sha1-modp1024'
option esp 'aes128-sha1'
option waniface 'lan4'
option auto 'ignore'
option ikelifetime '28800s'
option keylife '300s'
option rekeymargin '30s'
option keyingtries '%forever'
option dpdaction 'hold'
option dpddelay '30s'
option dpdtimeout '150s'
config secret
option enabled 'yes'
option secrettype 'psk'
option secret 'secret'
```

34.6 IPSec diagnostics using the web interface

34.6.1 IPSec status

In the top menu, click **Status -> IPSec**. The IPSec Connections page appears.

IPsec Connections

Name	IKE					SA			
	Status	Remote	Established	Encryption	Integrity	Status	Policy	Data In/Out	Rekey in
dmvpn_213_233_148_2	ESTABLISHED	213.233.148.2	2 hours ago	3DES_CBC	HMAC_MD5_96	INSTALLED			
dmvpn_89_101_154_151	ESTABLISHED	89.101.154.151	2 hours ago	3DES_CBC	HMAC_MD5_96	INSTALLED			

Figure 177: The IPSec connections page

In the Name column, the syntax contains the IPSec Name defined in package dmvpn and the remote IP address of the hub, or the spoke separated by an underscore; for example, dmvpn_213.233.148.2.

34.7 IPSec diagnostics using UCI

34.7.1 IPSec configuration

To view IPSec configuration via UCI, enter:

```
root@VA_router:~# uci export strongswan
```

To restart strongSwan, enter:

```
root@VA_router:~# /etc/init.d/strongswan restart
```

34.7.2 IPSec status

34.7.3 To view IPSec status, enter:

```
root@VA_router:~# ipsec statusall
Security Associations (1 up, 0 connecting):
dmvpn_89_101_154_151[1]: ESTABLISHED 2 hours ago,
10.68.234.133[10.68.234.133]...89.101.154.151[89.101.154.151]
dmvpn_89_101_154_151{1}:  REKEYING, TRANSPORT, expires in 55 seconds
dmvpn_89_101_154_151{1}:   10.68.234.133/32[gre] === 192.168./32[gre]
dmvpn_89_101_154_151{1}:  INSTALLED, TRANSPORT, ESP in UDP SPIs: cca7b970_i
d874dc90_o
dmvpn_89_101_154_151{1}:   10.68.234.133/32[gre] === 89.101.154.151/32[gre]
```

To view a list of IPSec commands, enter:

```
root@VA_router:~# ipsec -help
```

35 Configuring SCEP (Simple Certificate Enrolment Protocol)

SCEP is a method for automatically obtaining x.509 certificates for IPSec validation. This protocol is commonly used in a Private Key Infrastructure (PKI).

The SCEP method has the following steps:

- Obtain a copy of the Certificate Authority (CA) certificate and validate it.
- Generate a Certificate Signing Request (CSR) and send it securely to the CA.
- Re-enrol as necessary to obtain a new certificate prior to the expiration of the current certificate.

This section only details the SCEP portion of an IPSec configuration. For more information on configuring general IPSec, read the chapter 'Configuring IPSec'.

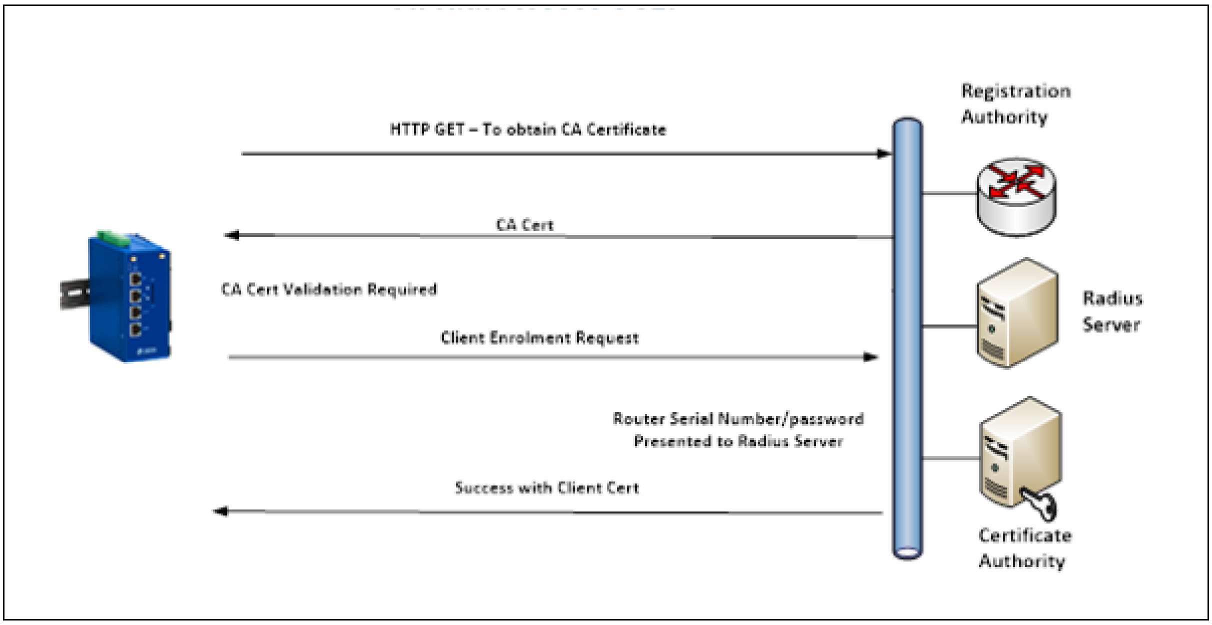

Figure 178: The SCEP process between router and PKI infrastructure

35.1 Configuration package used

Package	Sections
strongswan	scep_cert

35.2 Configuring SCEP using the web interface

To define an automatically enroled certificate, using SCEP, select **Services -> IPSec**. Scroll down to the SCEP Certificate section. Enter a name for the SCEP section and select **Add**.

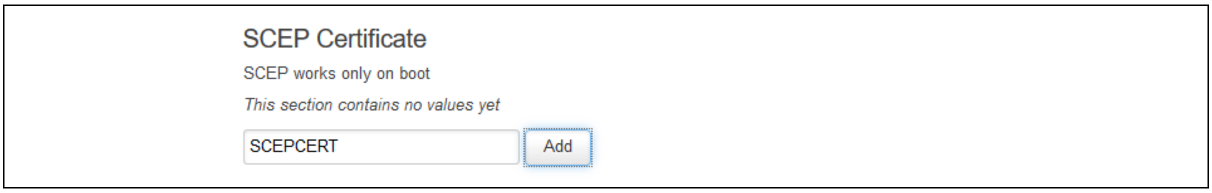

Figure 179: Creating a SCEP certificate section name

The SCEP certificate configuration section options appear.

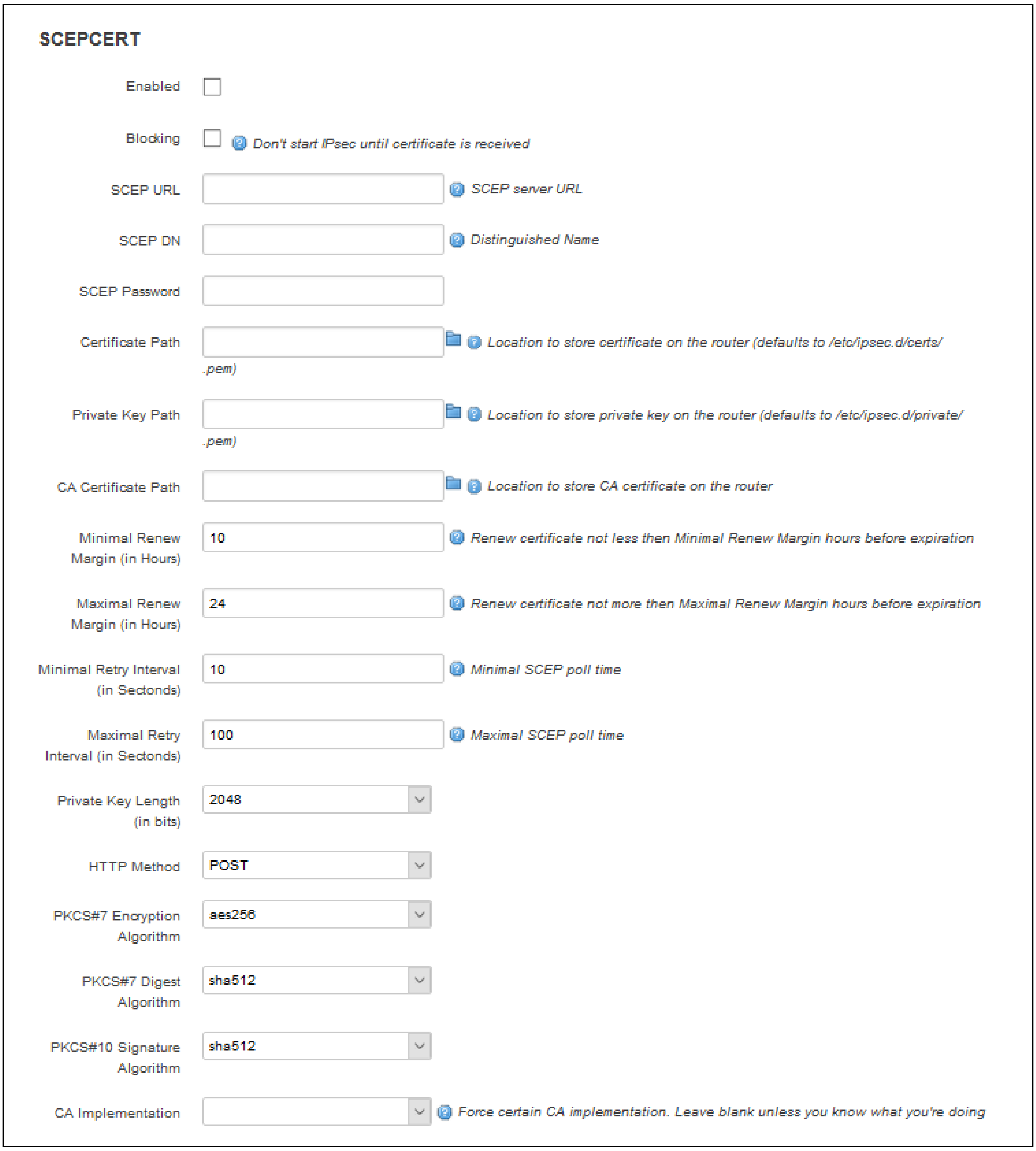

Figure 180: The SCEP certificate section

Web Field/UCI/Package Option	**Description**
Web: Enabled UCI: strongswan.@scep_cert[0].enabled Opt: enabled	Defines whether SCEP automatic enrolment is enabled. 0 — Disabled. 1 — Enabled.
Web: Blocking UCI: strongswan.@scep_cert[0].blocking Opt: blocking	Defines whether to wait until the certificate is received before starting IPSec. 0 — Wait until the certificate is received before starting IPSec. 1 — Do not wait until the certificate is received.
Web: SCEP URL UCI: strongswan.@scep_cert[0].url Opt: url	Defines the URL for the SCEP server. Range
Web: SCEP DN UCI: strongswan.@scep_cert[0].dn Opt: dn	Defines the Distinguished Name to use for new certificate. **Note**: substring `%serial` will be replaced with a router's serial number. Range
Web: SCEP Password UCI: strongswan.@scep_cert[0].scep_psk Opt: scep_psk	Defines a SCEP password. Range
Web: Certificate Path UCI: strongswan.@scep_cert[0].cert_path Opt: cert_path	Defines the filepath to store the certificate on the router (absolute of relative). Empty — /etc/ipsec.d/certs/.pem Range
Web: Private Key Path UCI: strongswan.@scep_cert[0].key_path Opt: key_path	Defines the filepath to store the private key on the router (absolute of relative). Empty — /etc/ipsec.d/private/.pem Range
Web: CA Certificate Path UCI: strongswan.@scep_cert[0].cacert Opt: cacert	Defines the filepath to store the CA certificate on the router (absolute of relative). Empty — /etc/ipsec.d/cacerts/.pem Range
Web: Minimal Renewal Margin (Hours) UCI: strongswan.@scep_cert[0].minmargin_hrs Opt: minmargin_hrs	Defines the minimum duration, in hours, from certificate expiration for renewal of certificate. **Note**: a random value between minimal and maximal renewal margin will be used. 10 — 10 hours Range
Web: Maximal Renewal Margin (Hours) UCI: strongswan.@scep_cert[0].maxmargin_hrs Opt: maxmargin_hrs	Defines the maximum duration, in hours, from certificate expiration for renewal of certificate. **Note**: the retry interval will be set to a random value between minimal and maximal renewal margin. 24 — 24 hours Range
Web: Minimal Retry Interval (Seconds) UCI: strongswan.@scep_cert[0].minretry Opt: minretry	Defines the minimal poll time, in seconds. **Note**: the retry interval will be set to a random value between minimal and maximal renewal margin. The retry interval is used when the server replies with `PENDING` status for initial request (also called `manual` mode). 10 — 10 seconds Range

<table>
<tr><td>Web: Maximal Retry Interval (Seconds)
UCI: strongswan.@scep_cert[0].maxretry
Opt: maxretry</td><td>Defines the maximal poll time, in seconds.
Note: the retry interval will be set to a random value between minimal and maximal renewal margin. The retry interval is used when the server replies with <code>PENDING</code> status for initial request (also called <code>manual</code> mode).<table><tr><td>100</td><td>100 seconds</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Private Key Length (in bits)
UCI: strongswan.@scep_cert[0].key_len
Opt: key_len</td><td>Defines the private key length.<table><tr><td>2048</td><td>2048 bits</td></tr><tr><td>4096</td><td>4096 bits</td></tr><tr><td>6144</td><td>6144 bits</td></tr><tr><td>8192</td><td>8192 bits</td></tr><tr><td>--custom--</td><td>Define custom length</td></tr></table></td></tr>
<tr><td>Web: HTTP Method
UCI: strongswan.@scep_cert[0].method
Opt: method</td><td>Defines the HTTP method used for client enrolment<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>GET</td><td>HTTP GET</td><td>get</td></tr><tr><td>POST</td><td>HTTP POST</td><td>post</td></tr></table></td></tr>
<tr><td>Web: PKCS#7 Encryption Algorithm
UCI: strongswan.@scep_cert[0].pkcs7_enc_algo
Opt: pkcs7_enc_algo</td><td>Defines the symmetric encryption algorithm to use.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>aes256</td><td></td><td>aes256</td></tr><tr><td>aes192</td><td></td><td>aes192</td></tr><tr><td>aes128</td><td></td><td>aes128</td></tr><tr><td>3des</td><td></td><td>3des</td></tr></table></td></tr>
<tr><td>Web: PKCS#7 Digest Algorithm
UCI: strongswan.@scep_cert[0].pkcs7_dgst_algo
Opt: pkcs7_dgst_algo</td><td>Defines the hash algorithm for pkcs7 digest calculation.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>sha512</td><td></td><td>sha512</td></tr><tr><td>sha384</td><td></td><td>sha384</td></tr><tr><td>sha256</td><td></td><td>sha256</td></tr><tr><td>sha1</td><td></td><td>sha1</td></tr><tr><td>md5</td><td></td><td>md5</td></tr></table></td></tr>
<tr><td>Web: PKCS#7 Signature Algorithm
UCI: strongswan.@scep_cert[0].pkcs10_sig_algo
Opt: pkcs10_sig_algo</td><td>Defines the hash algorithm for pkcs10 signature.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>sha512</td><td></td><td>sha512</td></tr><tr><td>sha384</td><td></td><td>sha384</td></tr><tr><td>sha256</td><td></td><td>sha256</td></tr><tr><td>sha1</td><td></td><td>sha1</td></tr><tr><td>md5</td><td></td><td>md5</td></tr></table></td></tr>
<tr><td>Web: CA Implementation
UCI: strongswan.@scep_cert[0].caimpl
Opt: caimpl</td><td>Defines the SCEP server implementation.<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Empty</td><td>Automatically deducted from URL.</td><td></td></tr><tr><td>Microsoft CA</td><td>Microsoft CA</td><td>ms</td></tr><tr><td>EJB CA</td><td>Enterprise Java Beans Certificate Authority.</td><td>ejbca</td></tr></table></td></tr>
</table>

Table 121: Information table for SCEP certificate settings

35.2.1 Configuring SCEP certificate using the command line

SCEP is configured using the **scep_cert** configuration section in the strongswan package **/etc/config/strongswan**.

You can configure multiple SCEP configuration sections.

By default, all SCEP certificate instances are named 'scep_cert'. The SCEP certificate instance is identified by `@scep_cert` then the SCEP certificate position in the package as a number. For example, for the first SCEP certificate in the package using UCI, enter:

```
strongswan.@scep_cert[0]=scep_cert
strongswan.@scep_cert[0].enabled=1
```

Or using package options, enter:

```
config scep_cert
        option enabled '1'
```

However, to better identify it, we recommend giving the SCEP certificate instance a name. For example, a SCEP certificate named 'SCEPCERT' will be `strongswan.SCEPCERT`.

To define a named SCEP certificate instance using UCI, enter:

```
strongswan.SCEPCERT=scep_cert
strongswan.SCEPCERT.enabled=1
```

To define a named SCEP certificate instance using package options, enter:

```
config scep_cert 'SCEPCERT'
        option 'enabled' '1'
```

35.2.1.1 SCEP certificate using UCI

```
root@VA_router:~# uci show strongswan
package strongswan
……
strongswan.SCEPCERT=scep_cert
strongswan.SCEPCERT.enabled=1
strongswan.SCEPCERT.url=url
strongswan.SCEPCERT.dn=dn
strongswan.SCEPCERT.scep_psk=password
strongswan.SCEPCERT.cert_path=/etc/ipsec.d/certs/
strongswan.SCEPCERT.key_path=/etc/ipsec.d/private/
strongswan.SCEPCERT.cacert=/etc/ipsec.d/cacerts/
strongswan.SCEPCERT.minmargin_hrs=10
strongswan.SCEPCERT.maxmargin_hrs=240
strongswan.SCEPCERT.minretry=10
strongswan.SCEPCERT.maxretry=100
```

```
strongswan.SCEPCERT.key_len=2048
strongswan.SCEPCERT.method=get
strongswan.SCEPCERT.pkcs7_enc_algo=aes256
strongswan.SCEPCERT.pkcs7_dgst_algo=sha512
strongswan.SCEPCERT.pkcs10_sig_algo=sha512
strongswan.SCEPCERT.caimpl=ms
```

35.2.1.2 SCEP certificate using package options

```
root@VA_router:~# uci export strongswan
package strongswan
……
config scep_cert 'SCEPCERT'
        option enabled '1'
        option url 'url'
        option dn 'dn'
        option scep_psk 'password'
        option cert_path '/etc/ipsec.d/certs/'
        option key_path '/etc/ipsec.d/private/'
        option cacert '/etc/ipsec.d/cacerts/'
        option minmargin_hrs '10'
        option maxmargin_hrs '240'
        option minretry '10'
        option maxretry '100'
        option key_len '2048'
        option method 'get'
        option pkcs7_enc_algo 'aes256'
        option pkcs7_dgst_algo 'sha512'
        option pkcs10_sig_algo 'sha512'
        option caimpl 'ms'
```

35.3 SCEP certificate diagnostics

35.3.1 Syslog

SCEP certificate status can be monitored via the system log. An example of SCEP syslog messages can be seen below

```
Aug 14 04:51:01 user.notice 00E0C81604BE ipsec: ca cert
'/etc/ipsec.d/cacerts/vaebjtest' expired or not yet downloaded
Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]:   loaded
plugins: curl aes des sha1 sha2 md5 random x509 pkcs1 pkcs7 pem openssl gmp
Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]: building
CRED_CONTAINER - PKCS7 failed, tried 2 builders
Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]: unable to
parse PKCS#7, assuming plain CA cert
Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]:   written ca
cert file '/etc/ipsec.d/cacerts/vaebjtest' (1200 bytes)
Aug 14 04:51:01 authpriv.info 00E0C81604BE ipsec_starter[9172]: Starting
strongSwan 5.0.2 IPsec [starter]...
Aug 14 04:51:01 daemon.info 00E0C81604BE ipsec: 00[DMN] Starting IKE charon
daemon (strongSwan 5.0.2, Linux 3.18.11, mips)
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading ca
certificates from '/etc/ipsec.d/cacerts'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG]   loaded ca
certificate "CN=VAejbcaTestCA, O=VA, C=IE" from
'/etc/ipsec.d/cacerts/vaebjtest'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading aa
certificates from '/etc/ipsec.d/aacerts'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading ocsp signer
certificates from '/etc/ipsec.d/ocspcerts'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading attribute
certificates from '/etc/ipsec.d/acerts'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading crls from
'/etc/ipsec.d/crls'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading secrets
from '/etc/ipsec.secrets'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading secrets
from '/var/conf/ipsec.secrets'
Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG]   loaded RSA
private key from '/etc/ipsec.d/private/ejb_cert.pem'
```

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35.3.2 Strongswan process using UCI

The strongswan process has its own subset of commands.

```
root@VA_router:~# /etc/init.d/strongswan
Syntax: /etc/init.d/dsl_control [command]
```

Available commands:

```
        start   Start the service
        stop    Stop the service
        restart Restart the service
        reload  Reload configuration files (or restart if that fails)
        enable  Enable service autostart
        disable Disable service autostart
```

To restart strongswan, enter:

```
root@VA_router:~# /etc/init.d/strongswan restart
```

36 Dynamic Multipoint Virtual Private Network (DMVPN)

Dynamic Multipoint Virtual Private Network (DMVPN) is a scalable method of creating VPN IPSec networks. DMVPN is a suite of three protocols: NHRP, GRE and IPSec, used to dynamically create VPN tunnels between different endpoints in the network without having to pre-configure each device with VPN details of the rest of endpoints in the network.

36.1 Prerequisites for configuring DMVPN

Before configuring DMVPN, you must first configure:

- A GRE interface; read the previous chapter, ’Configuring GRE interfaces’.
- An IPSec connection to use as a template; read the previous chapter, ’Configuring IPSec’.

36.2 Advantages of using DMVPN

Using DMVPN eliminates the need of IPSec configuration to the physical interface. This reduces the number of lines of configuration required for a VPN development. For example, for a 1000-site deployment, DMVPN reduces the configuration effort at the hub from 3900 lines to 13.

- Adding new peers (spokes) to the VPN requires no changes at the hub.
- Better scalability of the network.
- Dynamic IP addresses can be used at the peer’s site.
- Spokes can be connected in private or public network.
- NHRP NAT extension allows spoke-to-spoke tunnels to be built, even if one or more spokes is behind a Network Address Translation (NAT) device.
- New hubs can be added to the network to improve the performances and reliability.
- Ability to carry multicast and main routing protocols traffic (RIP, OSPF, BGP).
- DMVPN can be deployed using Activator: the Virtual Access automated provisioning system.
- Simplifies branch communications by enabling direct branch to branch connectivity.
- Simplifies configuration on the spoke routers. The same IPSec template configuration is used to create spoke-to-hub and spoke-to-spoke VPN IPSec tunnel.
- Improves business resiliency by preventing disruption of business-critical applications and services by incorporating routing with standards-based IPSec technology.

36.3 DMVPN scenarios

36.3.1 Scenario 1

Spoke1, spoke2 and a hub are in the same public or private network.

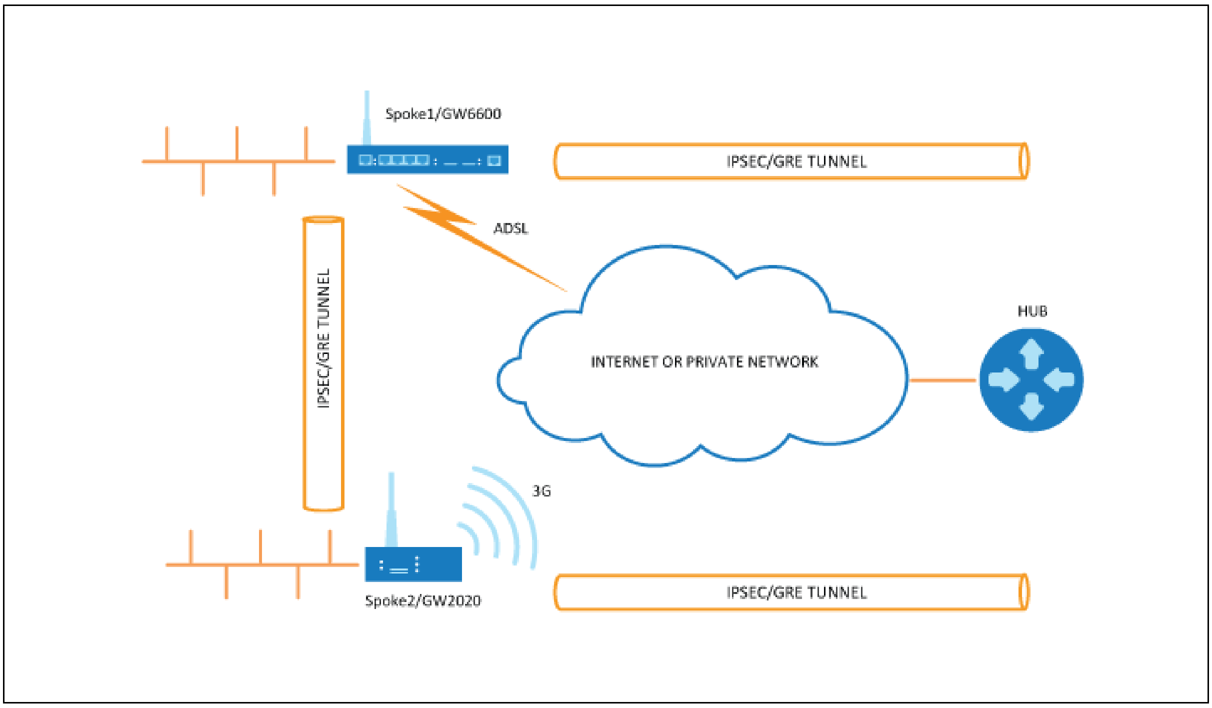

Figure 181: Network diagram for DMVPN spoke to spoke

- Spoke1 and spoke2 connect on their WAN interface: ADSL, 3G and initiate main mode IPSec in transport mode to the hub.
- After an IPSec tunnel is established, spokes register their NHRP membership with the hub.
- GRE tunnels come up.
- Hub caches the GRE tunnel and real IP addresses of each spoke.
- When spoke1 wants to talk to spoke2, it sends an NHRP resolution request to the hub.
- The hub checks its cache table and forwards that request to spoke2.
- Spoke2 caches spoke1's GRE and real IP address and sends an NHRP resolution reply via the hub.
- Spoke1 receives an NHRP resolution reply and updates its NHRP table with spoke2 information. Then it initiates VPN IPSec connection to spoke2.
- When an IPSec tunnel is established, spoke1 and spoke2 can send traffic directly to each other.

36.3.2 Scenario 2

Spoke1 is in a private (NAT-ed) network, spoke2 and hub are in public network.

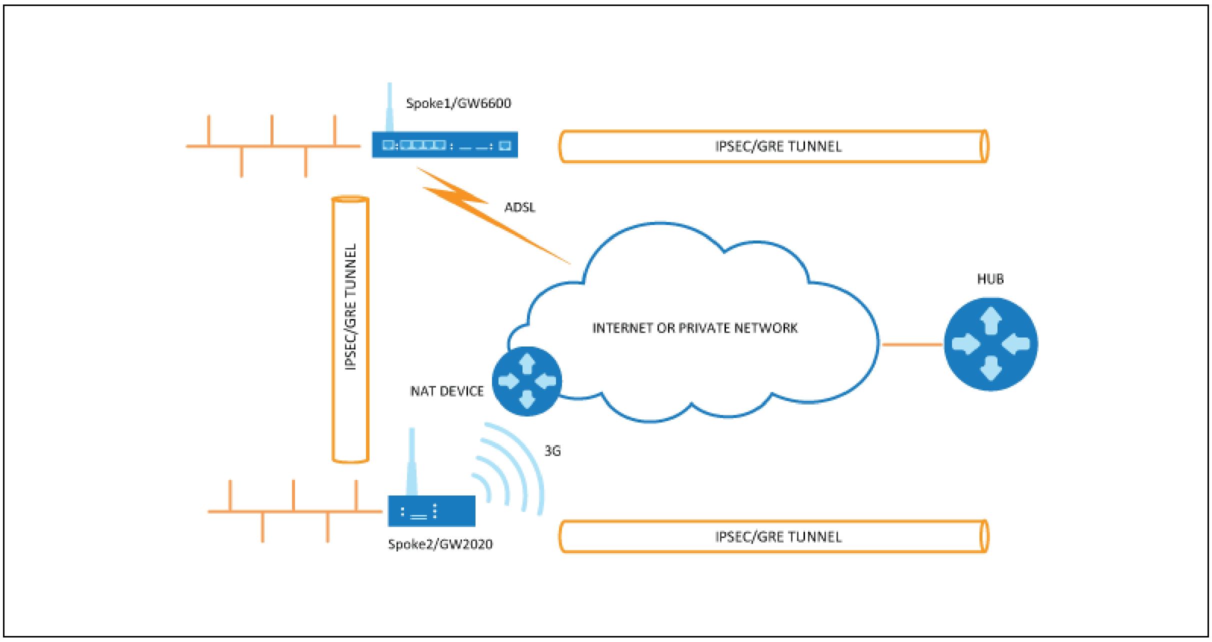

Figure 182: Network diagram for DMVPN spoke behind NAT

- Spoke1 sends an NHRP registration request to the hub.
- Hub receives this request and compares the source tunnel address of the spoke with the source of the packet.
- Hub sends an NHRP registration reply with a NAT extension to spoke1.
- The NAT extension informs spoke1 that it is behind the NAT-ed device.
- Spoke1 registers its pre- and post-NAT address.
- When spoke1 wants to talk to spoke2, it sends an NHRP resolution request to the hub.
- Hub checks its cache table and forwards that request to spoke2.
- Spoke2 caches spoke1’s GRE pre- and post-NAT IP address and sends an NHRP resolution reply via the hub.
- Spoke1 receives the NHRP resolution reply and updates its NHRP table with spoke2 information. It initiates a VPN IPSec connection to spoke2.
- When the IPSec tunnel is established, spoke1 and spoke2 can send traffic directly to each other.

Note: if an IPSec tunnel fails to be established between the spokes then packets between the spokes are sent via the hub.

36.4 Configuration packages used

Package	Sections
network	For configuring GRE tunnels.
strongswan	For enabling and configuring the IPSec connection template
dmvpn	

36.5 Configuring DMVPN using the web interface

The DMVPN section contains fields required to configure the parameters relative to the DMVPN Hub. These are used for DMVPN tunnels, such as GRE tunnels, GRE tunnel remote IP, DMVPN Hub IP and password.

36.5.1 DMVPN general settings

In the top menu, select **Network -> DMVPN**. The DMVPN page appears. There are two sections: General and DMVPN Hub Settings.

Figure 183: The DMVPN general section

Web Field/UCI/Package Option	Description
Web: Enable DMVPN UCI: dmvpn.common.enabled Opt: enable	Enables DMVPN. 0 — Disabled. 1 — Enabled.
Web: IPSec template connection UCI: dmvpn.common.ipsec_template_name Opt: ipsec_template_name	Selects the IPSec connection, defined in strongSwan, to be used as a template.

Table 122: Information table for DMVPN general settings

36.5.2 DMVPN hub settings

Figure 184: The DMVPN hub settings

Web Field/UCI/Package Option	Description
Web: GRE Interface UCI: dmvpn.@interface[X].gre_interface Opt: gre_interface	Specifies which GRE interface will be used with this DMVPN configuration.
Web: GRE Remote Endpoint IP Address UCI: dmvpn.@interface[X].gre_endpoint_ip Opt: gre_endpoint_ip	Configures the GRE IP address of the hub.
Web: GRE Remote Endpoint Mask Length UCI: dmvpn.@interface[X].gre_endpoint_mask_length Opt: gre_endpoint_mask_length	Configures the length of the mask of the GRE interface on the hub. For example, if the mask is 255.255.0.0 the length will be 16.
Web: DMVPN Hub IP Address UCI: dmvpn.@interface[X].nhs_ip Opt: nhs_ip	Configures the physical IP address for the DMVPN hub.
Web: NHRP Authentication UCI: dmvpn.@interface[X].cisco_auth Opt: cisco_auth	Enables authentication on NHRP. The password will be applied in plaintext to the outgoing NHRP packets. Maximum length is 8 characters.
Web: NHRP Holding Time UCI: dmvpn.@interface[X].holding_time Opt: holding_time	Timeout for cached NHRP requests.
Web: Use As Default Route UCI : dmvpn.@interface[X].defaultroute Opt: defaultroute	Adds a default route into tunnel interface. 0 Disabled. 1 Enabled.
Web: Default Route Metric UCI: dmvpn.@interface[X].defaultroutemetric Opt: defaultroutemetric	Metric to use for the default route.
Web: LED state indication UCI: dmvpn.@interface[X].led Opt: led	LED to use for indicating if the VPN is up.

Table 123: Information table for DMVPN hub settings

36.5.3 Configuring an IPSec template for DMVPN using the web interface

Configuring an IPSec template is covered in the chapter 'Configuring IPSec'.

36.6 DMVPN diagnostics

In the top menu, click **Status -> IPSec**. The IPSec Connections page appears.

IPsec Connections

Name	IKE					SA			
	Status	Remote	Established	Encryption	Integrity	Status	Policy	Data In/Out	Rekey in
dmvpn_213_233_148_2	ESTABLISHED	213.233.148.2	2 hours ago	3DES_CBC	HMAC_MD5_96	INSTALLED			
dmvpn_89_101_154_151	ESTABLISHED	89.101.154.151	2 hours ago	3DES_CBC	HMAC_MD5_96	INSTALLED			

Figure 185: The IPSec connections page

In the Name column, the syntax contains the IPSec name defined in package dmvpn and the remote IP address of the hub, or the spoke separated by an underscore; for example, dmvpn_213.233.148.2.

To check the status of DMVPN, in the top menu, click **Status -> DMVPN**.

NBMA peers

NBMA Address	Interface	Address	Type
213.233.148.2	GRE	11.11.11.3/32	spoke
89.101.154.151	GRE	11.11.11.1/29	hub

Powered by LuCI Trunk (trunk+svn8382) VIE-16.00.28 image1 config2

Figure 186: The NBMA peers page

To check DMVPN status, enter:

```
:~# opennhrpctl show
Status: ok
Interface: gre-GRE
Type: local
Protocol-Address: 11.11.11.7/32
Alias-Address: 11.11.11.3
Flags: up
Interface: gre-GRE
Type: local
Protocol-Address: 11.11.11.3/32
Flags: up
Interface: gre-GRE
Type: cached
Protocol-Address: 11.11.11.2/32
NBMA-Address: 178.237.115.129
NBMA-NAT-OA-Address: 172.20.38.129
```

```
Flags: used up
Expires-In: 0:18

Interface: gre-GRE
Type: static
Protocol-Address: 11.11.11.1/29
NBMA-Address: 89.101.154.151
Flags: up
```

Interface	Description	
Type	incomplete	Resolution request sent.
	negative	Negative cached.
	cached	Received/relayed resolution reply.
	shortcut_route	Received/relayed resolution for route.
	dynamic	NHC resolution.
	dynamic_nhs	Dynamic NHS from dns-map.
	static	Static mapping from config file.
	dynamic_map	Static dns-map from config file.
	local_route	Non-local destination, with local route.
	local_addr	Local destination (IP or off-NBMA subnet).
Protocol Address	Tunnel IP address	
NBMA-Address	Pre-NAT IP address if NBMA-NAT-OA-Address is present or real address if NAT is not present.	
NBMA-NAT-OA-Address	Post NAT IP address. This field is present when address is translated in the network.	
Flags	up	Can send all packets (registration ok).
	unique	Peer is unique.
	used	Peer is kernel ARP table.
	lower-up	openhrp script executed successfully.
Expires-In	Expiration time.	

Table 124: Information table for DMVPN status

You can check IPSec status using UCI commands.

```
root@VA-router:~# ipsec status
Security Associations (1 up, 0 connecting):
dmvpn_89_101_154_151[1]: ESTABLISHED 2 hours ago,
10.68.234.133[10.68.234.133]...89.101.154.151[89.101.154.151]
dmvpn_89_101_154_151{1}:  REKEYING, TRANSPORT, expires in 55 seconds
dmvpn_89_101_154_151{1}:  10.68.234.133/32[gre] === 192.168./32[gre]
dmvpn_89_101_154_151{1}:  INSTALLED, TRANSPORT, ESP in UDP SPIs: cca7b970_i
d874dc90_o
dmvpn_89_101_154_151{1}:  10.68.234.133/32[gre] === 89.101.154.151/32[gre]
```

You can check DMVPN status using UCI commands.

```
:~# opennhrpctl show
Status: ok

Interface: gre-GRE
Type: local
Protocol-Address: 11.11.11.7/32
Alias-Address: 11.11.11.3
Flags: up

Interface: gre-GRE
Type: local
Protocol-Address: 11.11.11.3/32
Flags: up
Interface: gre-GRE
Type: cached
Protocol-Address: 11.11.11.2/32
NBMA-Address: 178.237.115.129
NBMA-NAT-OA-Address: 172.20.38.129
Flags: used up
Expires-In: 0:18
Interface: gre-GRE
Type: static
Protocol-Address: 11.11.11.1/29

NBMA-Address: 89.101.154.151
Flags: up
```

37 Configuring multicasting using PIM and IGMP interfaces

37.1 Overview

IP multicast is a bandwidth-conserving technology that reduces traffic by simultaneously delivering a single stream of information to potentially thousands of corporate recipients. Applications that take advantage of multicast include video conferencing and corporate communications.

IP multicast delivers application source traffic to multiple receivers without burdening the source or the receivers while using a minimum of network bandwidth.

PIM (Protocol Independent Multicast) and IGMP (Internet Group Management Protocol) are protocols used to create multicasting networks within a regular IP network.

A multicast group is an arbitrary group of receivers that expresses an interest in receiving a particular data stream. The receivers (the designated multicast group) are interested in receiving a data stream from the source. They indicate this by sending an Internet Group Management Protocol (IGMP) host report to their closest router in the network. The routers are then responsible for delivering the data from the source to the receivers. The routers use Protocol Independent Multicast (PIM) between themselves to dynamically create a multicast distribution tree. The data stream will then be delivered only to the network segments that are in the path between the source and the receivers.

To summarise: PIM is used between routers while IGMP is used between a receiver and its router only. As a result, PIM must be enabled on all the interfaces on the route from the multicast source to the multicast client while IGMP must be enabled on the interface to the multicast client only.

37.2 Configuration package used

Package	Sections
pimd	pimd interface

37.3 Configuring PIM and IGMP using the web interface

To configure PIM through the web interface, in the top menu, select **Network -> PIM**. The PIM page appears. To access the Global Settings, click **Add**.

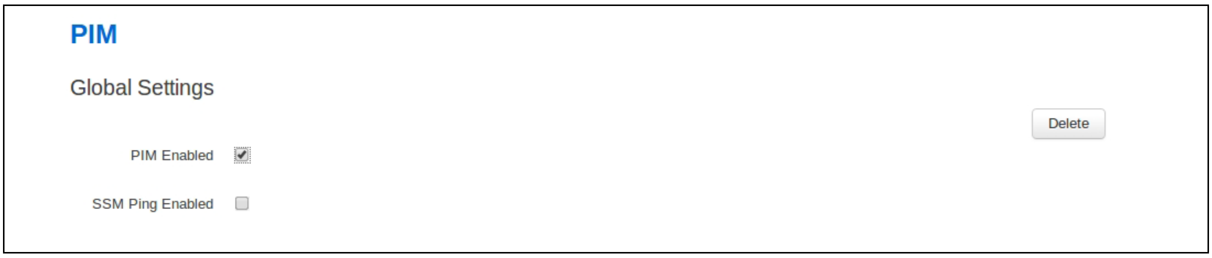

Figure 187: The global settings interface

37.3.1 Global settings

Web Field/UCI/Package Option	Description
Web: PIM Enabled UCI: pimd.pimd.enabled Opt: enabled	Globally enables PIM on the router. 0: Disabled. 1: Enabled.
Web: SSM Ping Enabled UCI: pimd.pimd.ssmpingd Opt: ssmpingd	Enables answers to SSM pings. 0: Disabled. 1: Enabled.

Table 125: Information table for PIM global settings

37.3.2 Interfaces configuration

Figure 188: The interfaces configuration section

Web Field/UCI/Package Option	Description
Web: Enabled UCI: pimd.interface[x].enabled Opt: enabled	Enables multicast management of the given interface by the PIM application. 0: Disabled. 1: Enabled.
Web: Interface UCI: pimd.interface[x].interface Opt: interface	Selects the interface to apply PIM settings to.
Web: Enable IGMP UCI: pimd.interface[x].igmp Opt: igmp	Enable IGMP on given interface. 0: Disabled. 1: Enabled. **Note**: you must enable PIM SSM and/or IGMP depending on your requirements. ICMP must be enabled on the interface to the multicast client only.
Web: Enable SSM UCI: pimd.interface[x].ssm Opt: ssm	Enable SSM on given interface. 0: Disabled. 1: Enabled.

Table 126: Information table for interface settings

To save your configuration updates, click **Save & Apply**.

37.4 Configuring PIM and IGMP using UCI

You can configure PIM and IGMP through CLI using UCI.

The configuration file is stored on **/etc/config/pimd**

To view the configuration file, enter:

```
uci export pimd
root@VA_router:/etc/config1# uci export pimd
package pimd
config routing 'pimd'
        option enabled 'yes'

config interface
        option enabled 'yes'
        option interface 'lan'
        option ssm 'yes'
        option igmp 'yes'

config interface
        option enabled 'yes'
        option interface 'wan'
        option ssm 'yes'
        option igmp 'no'

Alternatively, enter:
uci show pimd
root@VA_router:/etc/config1# uci show pimd
pimd.pimd=routing
pimd.pimd.enabled=yes
pimd.@interface[0]=interface
pimd.@interface[0].enabled=yes
pimd.@interface[0].interface=lan
pimd.@interface[0].ssm=yes
pimd.@interface[0].igmp=yes
pimd.@interface[1]=interface

pimd.@interface[1].enabled=yes
pimd.@interface[1].interface=wan
```

```
pimd.@interface[1].ssm=yes
pimd.@interface[1].igmp=no
```

To change any of the above values use `uci set` command.

38 QoS: VLAN 802.1Q PCP tagging

38.1 Configuring VLAN PCP tagging

Virtual Access routers have the capability to respect and set PCP priority values inside 802.1Q VLAN tagged frames. The following partial export of network configuration shows how to configure VLAN priorities for specific interfaces (VLANs).

```
root@VA_router:~# uci export network package network
config va_switch
        option eth0 'A E'
        option eth1 'B F'
        option eth2 'C G'
        option eth3 'D'
        option eth4 'H'

config interface 'VLAN_1'
        option type 'bridge'
        option proto 'static'
        option ipaddr '10.1.28.99'
        option netmask '255.255.0.0'
        option ifname 'eth0 eth4'

config interface 'VLAN_2'
        option type 'bridge'
        option proto 'static'
        option ipaddr '192.168.2.1'
        option netmask '255.255.255.0'
        option ifname 'eth1 eth4.2'
        option vlan_qos_map_ingress '1:1'
        option vlan_qos_map_egress '0:1'

config interface 'VLAN_3'
        option ifname 'eth2 eth4.3'
        option type 'bridge'
        option proto 'static'
        option ipaddr '192.168.3.1'
        option netmask '255.255.255.0'
```

```
        option vlan_qos_map_ingress '3:3'
        option vlan_qos_map_egress '0:3'

config interface 'VLAN_4'
        option ifname 'eth3 eth4.4'
        option type 'bridge'
        option proto 'static'
        option ipaddr '192.168.3.1'
        option netmask '255.255.255.0'
        option vlan_qos_map_ingress '5:5'
        option vlan_qos_map_egress '0:5'
```

UCI/Package Option	Description
UCI: network.<if name>.vlan_qos_map_ingress Opt: list vlan_qos_map_ingress	VLAN priority code point to socket buffer mapping. Example: network.<if name>. vlan_qos_map_ingress =1:1
UCI: network.<if name>.vlan_qos_map_egress Opt: list vlan_qos_map_egress	Socket buffer to VLAN priority code point mapping. Example: network.<if name>. vlan_qos_map_egress =0:1

The above sample configuration specifies that any frames on VLAN2, VLAN3 and VLAN4 will be processed or have their PCP value adjusted according to QoS values set.

VLAN1

- VLAN1 is an untagged VLAN so there are no 802.1Q tags on the frames.

VLAN2

- Any frames received on VLAN2 destined to VLAN2 with PCP priority of 1 will be forwarded without altering the priority; it will be still set to 1.
- Any frames received on VLAN2 destined to VLAN2 with a PCP priority set to 0 will have a priority of 1 set as they leave the router on VLAN2.

VLAN3

- Any frames received on VLAN3 destined to VLAN3 with a PCP priority of 3 will be forwarded without altering the priority; it will be still set to 3.
- Any frames received on VLAN3 destined to VLAN2 with PCP priority set to 0 will have a priority of 3 set as they leave the router on VLAN3.

VLAN4

- Any frames received on VLAN4 destined to VLAN2 with PCP priority of 5 will be forwarded without altering the priority; it will be still set to 5.
- Any frames received on VLAN4 destined to VLAN2 with PCP priority set to 0 will have a priority of 5 set as they leave the router on VLAN4.

Four queues are supported and are structured as follows:

- Queue 1: PCP values 0 and 1 - Default
- Queue 2: PCP values 2 and 3 - Normal
- Queue 3: PCP values 4 and 5 - High
- Queue 4: PCP values 6 and 7 - Express

Value 7 is the highest priority and 0 is the lowest. These queues prioritise 802.1Q tagged frames as they are received on the port, these are hardware defined.

When 802.1Q frames are received on the port they are processed according to the above queues on arrival, even if not defined in the configuration. Then if value 'vlan_qos_map_ingress' is configured you can modify the PCP priority for egress if the frame was to be forwarded on another tagged interface.

When frames are received on an untagged VLAN interface configured with 'vlan_qos_map_egress' and are destined to tagged interface, 802.1Q tag will be created with a default priority of 0 and then the priority will be set according to the PCP value specified as the frames leave port.

39 QoS: type of service

Virtual Access routers are capable of implementing quality of service configurations on a per interface basis, which allows traffic prioritisation based on type of service criteria parameters.

39.1 QoS configuration overview

A minimal QoS configuration usually consists of:

- One interface section
- Some rules allocating packets to at least two buckets
- Configuration of buckets

39.2 Configuration packages used

Package	Sections
qos	interface
	classgroup
	class
	classify

39.3 Configuring QoS using the web interface

Browse to the router's IP address and login.

Select **Network tab -> QoS**. The QoS page appears. From this page you can configure interfaces that QoS is applied to as well as classification rules.

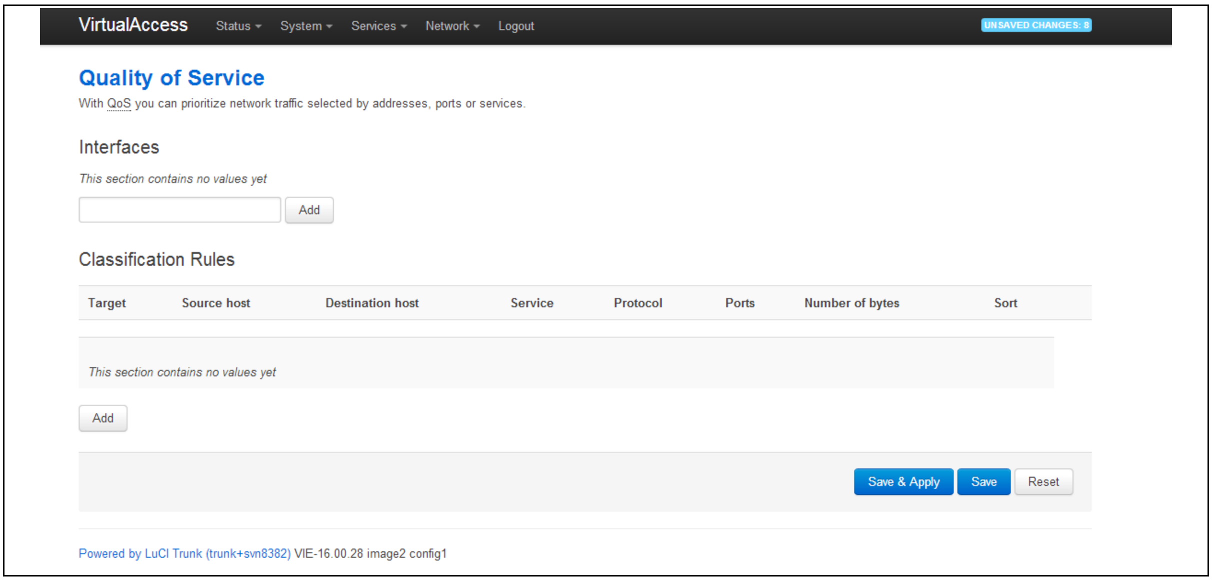

Figure 189: The quality of service page

To configure an interface, enter a relevant interface name and click **Add**. The Quality of Service page for that interface appears.

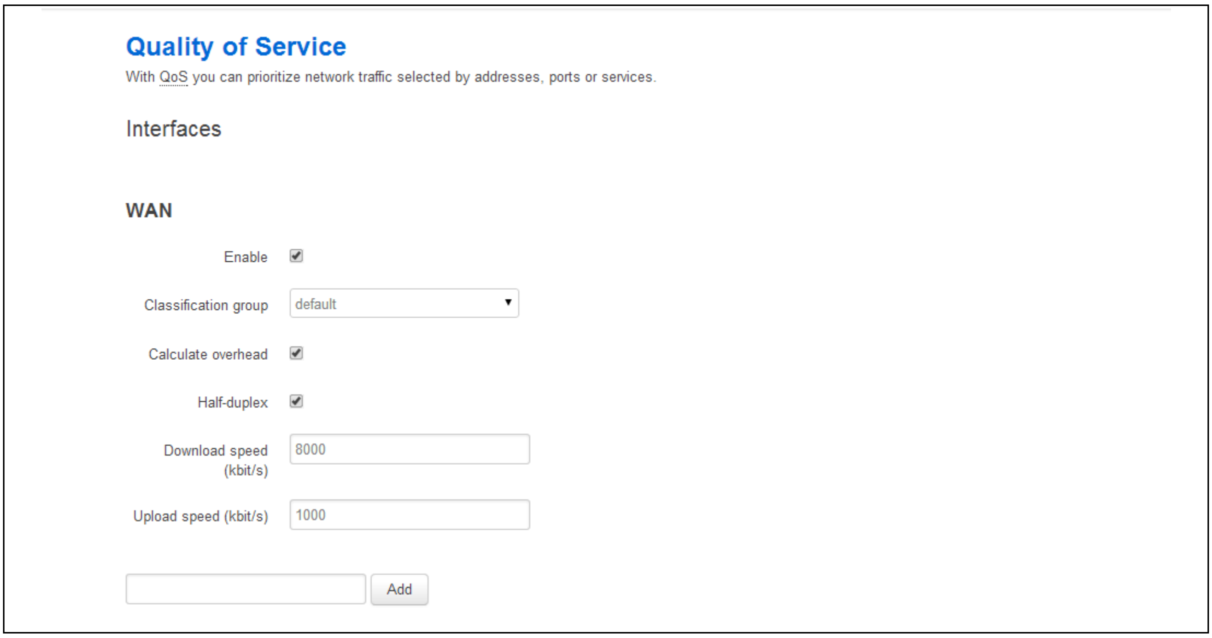

Figure 190: The quality of service page for WAN interface

Use the following parameters to configure the interface you have chosen. The name of the interfaces should match with the logical name given to the interface in the network configuration.

Web Field/UCI/Package Option	Description
Web: Enabled UCI: qos.[interface].enabled Opt: enabled	Enables or disables QoS interface. 1 Enabled. 0 Disabled.
Web: Classification group UCI: qos. [interface].classgroup Opt: classgroup	Creates a mapping before previously created classgroup and interface to which it should be assigned to.
Web: Calculate overhead UCI: qos. [interface].overhead Opt: overhead	Decreases upload and download ratio to prevent link saturation.
Web: Half-duplex UCI: qos [interface].halfduplex Opt: halfduplex	Enables or disables half-duplex operation. 1 Enabled. 0 Disabled.
Web: Download speed UCI: qos.[interface].download Opt: download	Download speed limit in kbits/sec.
Web: Upload speed UCI: qos.[interface].upload=2000 Opt:upload	Upload speed limit in kbits/sec.

Table 127: Information table for QoS page

To add classification rules, click **Add.** The Classification Rules section appears.

Configure each classification rule with the following parameters.

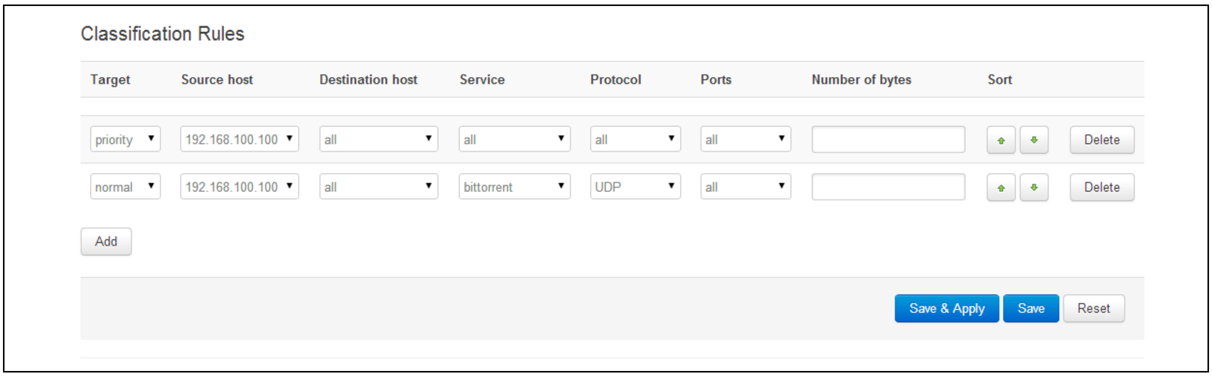

Figure 191: Parameters for classification rules

Web Field/UCI/Package Option	Description
Web: Target UCI: Opt:	Creates and configures selected target bucket. Normal Priority Low Express
Web: Source host UCI: Opt:	Source host.
Web: Destination host UCI: Opt:	Destination host.
Web: Service UCI: Opt:	Selectable service.
Web: Protocol UCI: Opt:	Protocol to classify.
Web: Ports UCI: Opt:	Upload speed kbits/sec.
Web: Number of bytes UCI: Opt:	Number of bytes for bucket.

Table 128: Information table for classification rules

39.4 Configuring QoS using UCI

You can also configure QoS using UCI. The configuration file is stored on:

/etc/config/qos

39.4.1 Interface

Defines the interface on which configured QoS settings will take place.

Each interface can have its own buffer. The interface section declares global characteristics of the connection on which the specified interface is communicating. The following options are defined within this section:

```
config interface 'ADSL'
        option classgroup 'Default'
        option enabled '1'
        option overhead '1'
        option halfduplex '0'
        option download '900'
        option upload '245'
```

Web Field/UCI/Package Option	Description
Web: Enabled UCI: qos.[interface].enabled Opt: enabled	Enables or disables QoS interface. 1 Enabled. 0 Disabled.
Web: Classification group UCI: qos. [interface].classgroup Opt: classgroup	Creates a mapping before previously created classgroup and interface to which it should be assigned to.
Web: Calculate overhead UCI: qos. [interface].overhead Opt: overhead	Decrease upload and download ratio to prevent link saturation.
Web: Half-duplex UCI: qos [interface].halfduplex Opt: halfduplex	Enables or disables half-duplex operation. 1 Enabled. 0 Disabled.
Web: Download speed UCI: qos.[interface].download Opt: download	Download speed limit in kbits/sec.
Web: Upload speed UCI: qos.[interface].upload=2000 Opt:upload	Upload speed limit in kbits/sec.

39.4.2 Classgroup

As there is more than one interface you can have more than one classgroup.

```
config classgroup 'Default'
     option classes 'Express Normal'
     option default 'Normal'
```

UCI/Package Option	Description
UCI: qos.Default=classgroup Opt: Default	Specifies name of classgroup.
UCI: qos.Default.classes=Express Normal Opt: classes	Specifies the list of names of classes which should be part of classgroup.
qos.Default.default=Normal Opt: default	Defines which class is considered default.

39.4.3 Classes

Each bucket has its own configuration.

```
config class 'Normal'
     option packetsize '1500'
     option avgrate '30'
     option priority '5'

config class 'Express'
     option packetsize '1000'
     option maxsize '800'
     option avgrate '50'
     option priority '10'
     option limitrate '10'
```

UCI/Package Option	Description
UCI: qos.Normal=class Opt: Normal	Specifies class name.
UCI: qos.Normal.packetsize=1500 Opt: packetsize	Specifies packet size for the class in bytes.
UCI: qos.Normal.avgrate=30 Opt: avgrate	Average rate for this class, value in % of bandwidth in %.
UCI: qos.Normal.priority=5 Opt: priority	Specifies priority for the class in %.
UCI: qos.Express=class Opt: Express	Specifies class name.
UCI: qos.Express.packetsize=1000 Opt: packetsize	Specifies packet size for the class in bytes.
UCI: qos.Express.maxsize=800 Opt: maxsize	Specify max packet size in bytes.
UCI: qos.Express.avgrate=50 Opt: avgrate	Average rate for this class, value in % of bandwidth in %.
UCI: qos.Express.priority=10 Opt: priority	Specifies priority for the class in %.
UCI: qos.Express.limitrate=10 Opt: limitrate	Defines to how many % of the available bandwidth this class is capped to.

39.4.4 Classify

Classifiers match the traffic for desired class.

```
config classify
        option target 'Express'
        option proto 'udp'
```

UCI/Package Option	Description
UCI: qos.@classify[0]=classify Opt: classify	Part of classify rule.
UCI: qos.@classify[0].target=Express Opt: target	Specifies target class.
UCI: qos.@classify[0].proto=udp Opt: proto	Specifies protocol.

39.5 Example QoS configurations

```
config interface 'ADSL'
      option classgroup 'Default'
      option enabled '1'
      option overhead '1'
      option download '900'
      option upload '245'

config classgroup 'Default'
     option classes 'Express Normal'
     option default 'Normal'

config class 'Normal'
     option packetsize '1500'
     option avgrate '30'
     option priority '5'

config class 'Express'
     option packetsize '1000'
     option maxsize '800'
     option avgrate '50'
     option priority '10'
     option limitrate '10'

config classify
     option target 'Express'
     option proto 'udp'
```

40 Management configuration settings

This chapter contains the configuration sections and parameters required to manage and monitor your device using Activator and Monitor.

40.1 Activator

Activator is a Virtual Access proprietary provisioning system, where specific router configurations and firmware can be stored to allow central management and provisioning. Activator has two distinct roles in provisioning firmware and configuration files to a router.

- Autoload activation of firmware and configuration files on router boot up:
    - Autoload is generally used for router installation. In this scenario the router will initiate the request for firmware and configuration files when it boots up. The router is installed with a factory config that will allow it to contact Activator. The autoload feature controls the behaviour of the router in requesting firmware and configuration files; this includes when to start the Activation process and the specific files requested. The HTTP Client (uhttpd) contains information about the Activator server and the protocol used for activation.
- Deployment of firmware to routers after installation:
    - In this scenario, Activator initiates the process. This process, known as Active Updates, allows for central automatic deployment of firmware and configuration files. It is used when configuration or firmware changes need to be pushed to live routers.

40.2 Monitor

Monitor is a Virtual Access proprietary tool, based on SNMP protocol, to monitor wide networks of deployed routers. The router is configured to send information to Monitor, which is then stored and viewed centrally via the Monitor application. This includes features such as traffic light availability status, syslog and SLA monitoring.

40.3 Configuration packages used

Package	**Sections**
autoload	main
httpclient	default
management_users	user

40.4 Autoload: boot up activation

Autoload configurations specify how the device should behave with respect to activation when it boots up. Autoload entries contain information about the specific files to be downloaded and the destination for the downloaded file. Standard autoload entry configurations to download are:

- A firmware file ($$.img)
- A configuration file ($$.ini)
- A .vas file ($$.vas). This file signals the end of the autolaod sequence to Activator

Activator identifies the device using the serial number of the router. $$ syntax is used to denote the serial number of the router when requesting a file. The requested files are written to the alternate image or config segment.

You can change the settings either directly in the configuration file or via appropriate UCI set commands. It is normal procedure for autoload to be enabled in the router's factory settings and disabled in running configurations (config 1 and 2).

Autoload may already have been set at factory config level. If you wish to enable autoload services, proceed through the following steps.

40.5 Autoload packages

Package	Sections
autoload	main

40.5.1 Create a configuration file

In the top menu, select **Services -> Autoload**. The Autoload page has two sections: Basic Settings and Entries. Click **Add** to access configuration settings for each section.

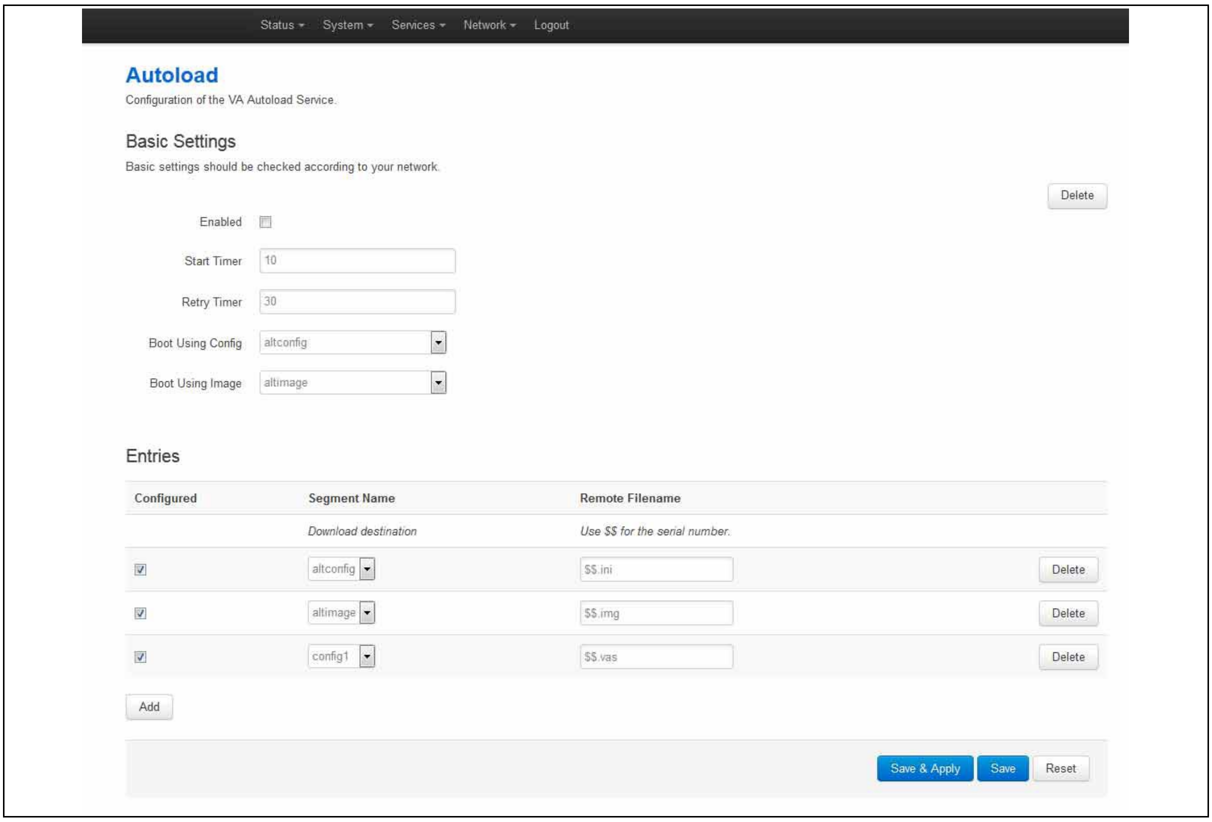

Figure 192: The autoload settings page

Web Field/UCI/Package Option	Description
Basic settings	
Web: Enabled UCI: autoload.main.enabled Opt: Enabled	Enables activation at system boot. 1 – Enabled. 0 – Disabled.
Web: Start Timer UCI: autoload.main.StartTimer Opt: StartTimer	Defines how long to wait after the boot up completes before starting activation. 10 Range – 0-300 secs
Web: Retry Timer UCI: autoload.main.RetryTimer Opt: RetryTimer	Defines how many seconds to wait between retries if a download of a particular autoload entry fails. 30 Range – 0-300 secs
Web: N/A UCI: autoload.main.NumberOfRetries Opt: Numberofretries	Defines how many retries to attempt before failing the overall activation sequence, backing off and trying the whole activation sequence again. 5 Range
Web: N/A UCI: autoload.main.BackoffTimer Opt: Backofftimer	Defines how many minutes to back off for if a download and all retires fail. After the backoff period, the entire autoload sequence will start again. 15 Range

Web: Boot Using Config UCI: autoload.main.BootUsingConfig Opt: BootUsingConfig	Specifies which configuration to boot up with after the activation sequence. Altconfig: Alternative configuration Config1: Configuration 1 Config2: Configuration 2 Factconf: Factory configuration
Web: Boot Using Image UCI: autoload.main.BootUsingImage Opt: BootUsingImage	Specifies which image to boot up with after the activation sequence completes successfully. Altimage: Alternative image Image 1: image 1 Image 2: image 2
Entries	
Web: Configured UCI: autoload.@entry[x].Configured Opt: Configured	Enables the autoload sequence to process this entry. 1: Enabled. 0: Disabled.
Web: Segment Name UCI: autoload.@entry[x].SegmentName Opt: SegmentName	Defines where the downloaded file should be stored: (config1 | config2 | altconfig | image1 | image2 | altimage). Typically only altconfig and altimage are used.
Web: RemoteFilename UCI: autoload.@entry[x].RemoteFilename Opt: RemoteFilename	Defines the name of the file to be downloaded from Activator. $$.vas: Notifies activator sequence is complete. $$ ini: Request configuration $$ img: Request firmware Note: $$.vas should always be requested last.

Table 129: Information table for autoload

40.6 Autoload using UCI

```
root@VA_router:/# uci show autoload
autoload.main=core
autoload.main.Enabled=yes
autoload.main.StartTimer=10
autoload.main.RetryTimer=30
autoload.main.NumberOfRetries=5
autoload.main.BackoffTimer=15
autoload.main.BootUsingConfig=altconfig
autoload.main.BootUsingImage=altimage
autoload.@entry[0]=entry
autoload.@entry[0].Configured=yes
autoload.@entry[0].SegmentName=altconfig
autoload.@entry[0].RemoteFilename=$$.ini
autoload.@entry[1]=entry
autoload.@entry[1].Configured=yes
autoload.@entry[1].SegmentName=altimage
autoload.@entry[1].RemoteFilename=$$.img
```

```
autoload.@entry[2]=entry
autoload.@entry[2].Configured=yes
autoload.@entry[2].SegmentName=config1
autoload.@entry[2].RemoteFilename=$$.vas
Autoload using package options
root@VA_router:/# uci export autoload
package 'autoload'

config 'core' 'main'
      option 'Enabled' "yes"
      option 'StartTimer' "10"
      option 'RetryTimer' "30"
      option 'NumberOfRetries' "5"
      option 'BackoffTimer' "15"
      option 'BootUsingConfig' "altconfig"
      option 'BootUsingImage' "altimage"

config 'entry'
      option 'Configured' "yes"
      option 'SegmentName' "altconfig"
      option 'RemoteFilename' "\$\$.ini"

config 'entry'
      option 'Configured' "yes"
      option 'SegmentName' "altimage"
      option 'RemoteFilename' "\$\$.img"

config 'entry'
      option 'Configured' "yes"
      option 'SegmentName' "config1"
      option 'RemoteFilename' "\$\$.vas"
```

40.7 HTTP Client: configuring activation using the web interface

This section contains the settings for the HTTP Client used during activation and active updates of the device.

The httpclient core section configures the basic functionality of the module used for retrieving files from Activator during the activation process.

40.7.1 HTTP Client configuraton packages

Package	Sections
Httpclient	default

40.7.2 Web configuration

To configure HTTP Client for Activator, in the top menu, click **Services -> HTTP Client**. The HTTP Client page has two sections: Basic Settings and Advanced Settings.

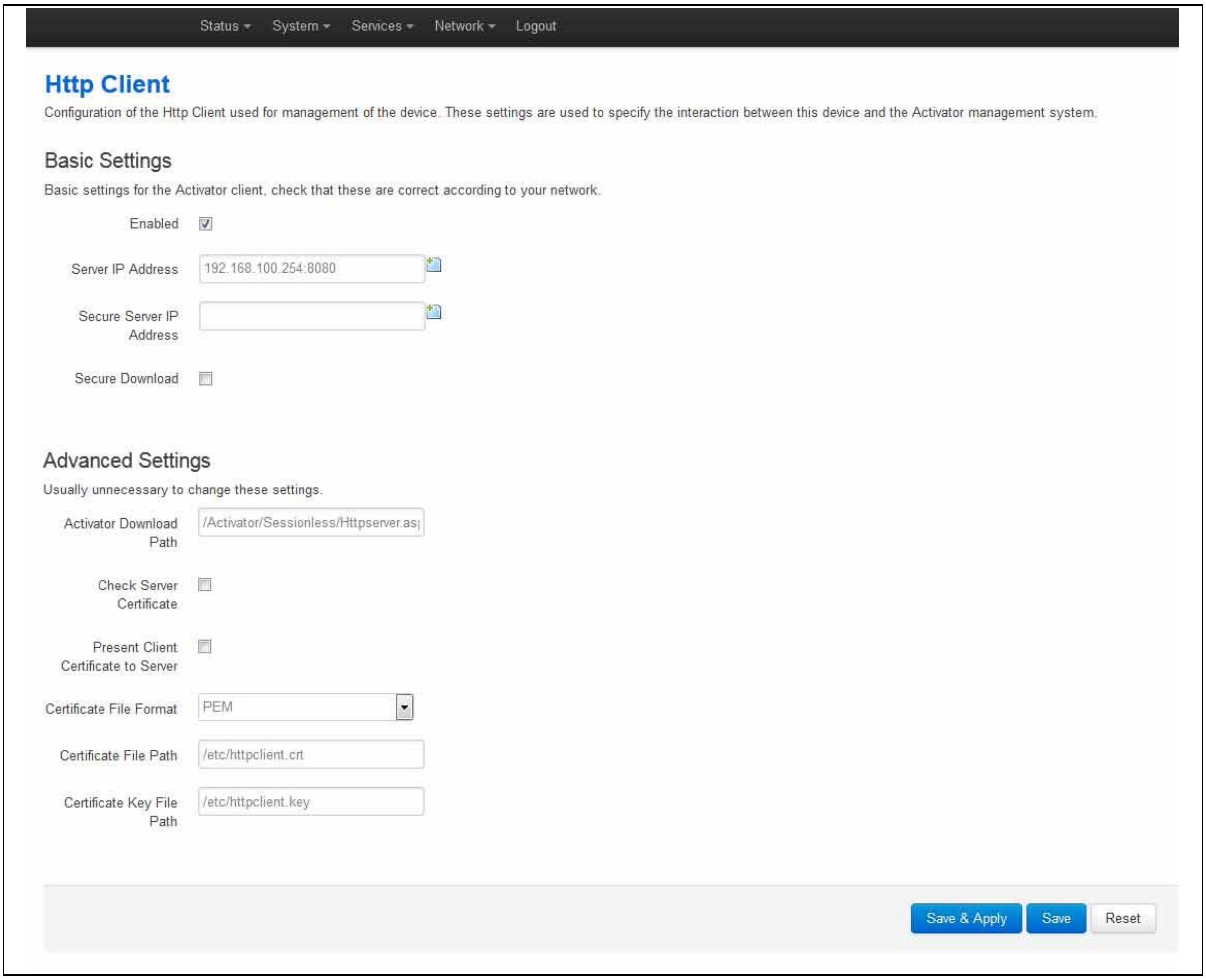

Figure 193: The HTTP client page

Web Field/UCI/Package Option	Description
Basic settings	
Web: Enabled UCI: httpclient.default.enabled Opt: Enabled	Enables the HTTP client. 1 — Enabled. 0 — Disabled.
Web: Server IP Address UCI: httpclient.default.Fileserver Opt: list Fileserver	Specifies the address of Activator that uses http port 80. This can be an IP address or FQDN. The syntax should be x.x.x.x:80 or FQDN:80. Multiple servers should be separated by a space using UCI.
Web: Secure Server IP Address UCI: httpclient.default.SecureFileServer Opt: list SecureFileServer	Specifies the address of Secure Activator that uses port 443. This can be an IP address or FQDN. The syntax should be x.x.x.x:443 or FQDN:443. Multiple servers should be separated by a space using UCI.

Web: Secure Download UCI: httpclient.default.SecureDownload Opt: SecureDownload	Enables Secure Download (port 443). 1 — Enabled. 0 — Disabled.
Advanced settings	
Web: Activator Download Path UCI: httpclient.default.ActivatorDownloadPath Opt: ActivatorDownloadPath	Specifies the URL on Activator to which the client should send requests. /Activator/Sessionless/Httpserver.asp Range
Web: Check Server Certificate UCI: httpclient.default.ValidateServerCertificateEnabled Opt: ValidateServerCertificateEnabled	Checks for the certificate's presence and validity. 1 — Enabled. 0 — Disabled.
Web: Present Client Certificate to Server UCI: httpclient.default. PresentCertificateEnabled Opt: PresentCertificateEnabled	Specifies if the client presents its certificate to the server to identify itself. 1 — Enabled. 0 — Disabled.
Web: Certificate File Format UCI: httpclient.default.CertificateFormat Opt: CertificateFormat	Specifies the value the client expects to see in the specified field in the server certificate. PEM DER
Web: Certificate File Path UCI: httpclient.default.CertificateFile Opt: CertificateFile	Defines the directory/location of the certificate. /etc/httpclient.crt Range
Web: Certificate Key File Path UCI: httpclient.default.CertificateKey Opt: CertificateKey	Specifies the directory/location of the certificate key. /etc/httpclient.key Range
Web: N/A UCI: httpclient.default.ActivatorChunkyDownloadPath Opt: ActivatorChunkyDownloadPath	Enables partial download activations and active updates. The default value is: `httpclient.default.ActivatorChunkyDownloadPath=/activator/partial/download` The URL, on Activator, to which the client should send requests for chunky image download.
Web: N/A UCI: httpclient.default.ChunkSize Opt: ChunkSize	Specifies the size of each packet payload. 100k — 100K bytes 1-infinite — Available values
Web: N/A UCI: httpclient.default.RateLimit Opt: RateLimit	Throttle activation/active updates traffic received by device to specified limit. None — By default, there is no limit. 1-infinite — Available values in kbps
Web: N/A UCI: httpclient.default.CAFile Opt: CAFile	Defines the path to the certificate authority file stored on the router.
Web: N/A UCI: httpclient.default.IgnoreServerCertificateStatus Opt: IgnoreServerCertificateStatus	Defines whether to skip the status check on the server certificate. 1 — Enabled. 0 — Disabled.

Table 130: Information table for HTTP client

40.8 Httpclient: Activator configuration using UCI

```
root@VA_router:~# uci show httpclient
httpclient.default=core
httpclient.default.Enabled=yes
httpclient.default.FileServer=10.1.83.36:80 10.1.83.37:80
httpclient.default.SecureFileServer=10.1.83.36:443 10.1.83.37:443
httpclient.default.ActivatorDownloadPath=/Activator/Sessionless/Httpserver.
asp
httpclient.default.SecureDownload=no
httpclient.default.PresentCertificateEnabled=no
httpclient.default.ValidateServerCertificateEnabled=no
httpclient.default.CertificateFile=/etc/httpclient.crt
httpclient.default.CertificateFormat=PEM
httpclient.default.CertificateKey=/etc/httpclient.key
httpclient.default.ActivatorChunkyDownloadPath=/activator/partial/download
httpclient.default.ChunkSize=100k
httpclient.default.RateLimit=2
httpclient.default.CAFile='/'
httpclient.default.IgnoreServerCertificateStatus=0
```

40.9 Httpclient: Activator configuration using package options

```
root@VA_router:~# uci export httpclient
package httpclient

config core 'default'
      option Enabled 'yes'
      list FileServer '1.1.1.1:80'
      list FileServer '1.1.1.2:80'
      listSecureFileServer '1.1.1.1:443'
      list SecureFileServer '1.1.1.2:443'
      option ActivatorDownloadPath '/Activator/Sessionless/Httpserver.asp'
      option SecureDownload 'no'
      option PresentCertificateEnabled 'no'
      option ValidateServerCertificateEnabled 'no'
      option CertificateFile '/etc/httpclient.crt'
      option CertificateFormat 'PEM'
```

```
option CertificateKey '/etc/httpclient.key'
option ActivatorChunkyDownloadPath '/activator/partial/download'
option ChunkSize '100k'
option RateLimit '2'
option CAFile '\'
option IgnoreServerCertificateStatus '0'
```

40.10 User management using UCI

User management is not currently available using the web interface. You can configure the feature using UCI or Activator.

40.10.1 User management packages

Package	Sections
management_users	Users

40.10.2 Configuring user management

You can create different users on the system by defining them in the user management configuration file. This gives users access to different services.

Web Field/UCI/Package Option	Description
General settings	
Web: n/a UCI: management_users.@user[x].enabled Opt: enable	Enables/creates the user. 0 Disabled. 1 Enabled.
Web: n/a UCI: management_users.@user[x].username Opt: username	Specifies the user's username.
Web: n/a UCI: management_users.@user[x].password Opt: password	Specifies the user's password. When entering the user password enter in plain text using the password option. After reboot the password is displayed encrypted via the CLI using the hashpassword option. UCI: `management_users.@user[x].hashpassword` Opt: hashpassword. **Note**: an SRP user password will be displayed using the srphash option.
Web: n/a UCI: management_users.@user[x].webuser Opt: webuser	Specifies web access permissions for the user. **Note**: webuser will only work if linuxuser is set to **Enabled**. 0 Disabled. 1 Enabled.
Web: n/a UCI: management_users.@user[x].chapuser Opt: chapuser	Specifies CHAP access permissions for the PPP connection. **Note**: chapuser will only work if linux user is set to **no**. 0 Disabled. 1 Enabled.
Web: n/a UCI: management_users.@user[x].papuser Opt: papuser	Specifies PAP access permissions for the PPP connection. 0 Disabled. 1 Enabled.

Web: n/a UCI: management_users.@user[x].srpuser Opt: srpuser	Specifies SRP access permissions for the PPP connection. 0 — Disabled. 1 — Enabled.
Web: n/a UCI: management_users.@user[x].smsuser Opt: smsuser	Specifies SMS access permissions for the user. 0 — Disabled. 1 — Enabled.
Web: n/a UCI: linuxuser Opt: linuxuser	Specifies linuxuser access permissions for the user. 0 — Disabled. 1 — Enabled.
Web: n/a UCI: List allowed_pages Opt: list allowed_pages	Specifies which pages the user can view. Multiple pages should be entered using a space to separate if using UCI.

Table 131: Information table for config user commands

Note:

- webuser will only work if linuxuser is set to **yes**
- chapuser will only work if linuxuser is set to **no**

When a new user is created on the system and given web access, you will no longer be able to login to the router web interface with the default root user details. The user must use their new user login details.

40.11 Configuring the management user password using UCI

The user password is displayed encrypted via the CLI using the hashpassword option.

```
root@VA_router:~# uci show management_users
management_users.@user[0].username=test
management_users.@user[0].hashpassword=$1$XVzDHHPQ$SKK4geFonctihuffMjS4U0
```

If you are changing the password via the UCI, enter the new password in plain text using the password option.

```
root@VA_router:~# uci set management_users.@user[0].password=newpassword
root@VA_router:~# uci commit
```

The new password will take effect after reboot and will now be displayed in encrypted format through the hashpassword option.

40.12 Configuring management user password using package options

The root password is displayed encrypted via CLI using the hashpassword option.

```
root@VA_router:~# uci export management_users
package management_users


config user
      option hashpassword '$1$wRYYiJOz$EeHN.GQcxXhRgNPVbqxVw
```

If you are changing the password using UCI, enter the new password in plain text using the password option.

```
package management_users


config user
      option hashpassword '$1$wRYYiJOz$EeHN.GQcxXhRgNPVbqxVw
      option password ‘newpassword’
```

The new password will take effect after reboot and will now be displayed in encrypted format via the hashpassword option.

40.13 User management using UCI

```
root@VA_router:~# uci show management_users
management_users.@user[0]=user
management_users.@user[0].enabled=1
management_users.@user[0].username=test
management_users.@user[0].hashpassword=$1$XVzDHHPQ$SKK4geFonctihuffMjS4U0
management_users.@user[0].webuser=1
management_users.@user[0].linuxuser=1
management_users.@user[0].papuser=0
management_users.@user[0].chapuser=0
management_users.@user[0].srpuser=0
management_users.@user[0].smsuser=0
```

40.14 User management using package options

```
root@VA_router:~# uci export management_users


package management_users
config user
```

```
      option enabled '1'
      option username 'test'
      option hashpassword '$1$XVzDHHPQ$SKK4geFonctihuffMjS4U0'
option webuser '1'
      option linuxuser '1'
      option papuser '0'
      option chapuser '0'
      option srpuser '0'
      option smsuser '0'
```

40.15 Configuring user access to specific web pages

To specify particular pages a user can view, add the list allowed_pages. Examples are:

```
list allowed_pages '/admin/status'
```

The user can view admin status page only.

```
List allowed_pages '/admin/system/flashops'
```

The user can view flash operation page only.

To specify monitor widgets only, enter:

```
listallowed_pages 'monitor/<widgetname>'
```

Example widget names are: dhcp, arp, 3gstats, interfaces, memory, multiwan, network, openvpn, routes, system, ipsec, dmvpn, tservd.

41 Configuring Monitor

41.1 Introduction

Virtual Access monitoring system (Monitor) is a secure portal that provides:

- Centralised monitoring of devices
- Device status
- GPS location
- Syslog reporting
- Real time diagnostics
- Email notification
- Advanced statistics
- Dashboard graph reporting

You must configure each router in the network to send the required information to Monitor. This chapter explains how to configure the different information that can be sent to Monitor, including the required router configuration for:

- Reporting device status to Monitor
- Reporting GPS location to Monitor
- Reporting syslog to Monitor
- Configuration of interface statistics collection (ISAD)

For detailed information on operating Monitor, read the 'Virtual Access Monitor User Manual'.

41.2 Reporting device status to Monitor

To allow Monitor to track the IP address and ongoing presence of a device, a keepalive heartbeat SNMP trap is sent from the router. The router is capable of sending SNMP in version 1, 2c and 3.

The SNMP keepalive heartbeat sends basic information on interface status but can also be configured to contain more detailed information such as GPS location.

The basic heartbeat configuration consists of two parts:

- enabling the heartbeat keepalive
- enabling the interface(s) to be monitored

41.2.1 Configuration package used

Package	Sections
monitor	keepalive
network	interface

41.2.2 Configuring keepalive heartbeat using the web interface

Select **Services -> Monitor**. The Monitor Keepalive & ISAD page appears.

The keepalive heartbeat is configured under the **Basic Settings** section.

A single instance keepalive can be configured to multiple monitor address using the same reference, heartbeat interval and other options. Or alternatively multiple keepalive instances can be configured with unique options.

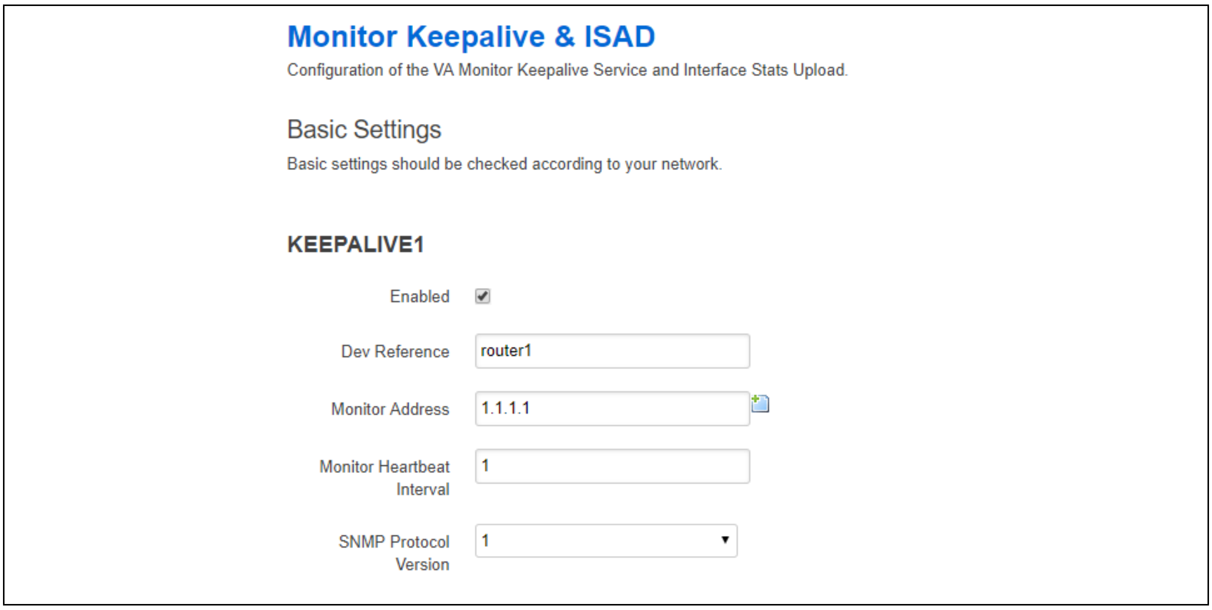

Figure 194: The Monitor & ISAD keepalive page

41.2.2.1 Basic settings

Web Field/UCI/Package Option	Description
Web: Enabled UCI: monitor.@keepalive[0].enabled Opt: Enabled	Enables Monitor to send heartbeats to the router. 0 — Disabled. 1 — Enabled.
Web: Dev Reference UCI: monitor.@keepalive[0].dev_reference Opt: dev_reference	Sets a unique identification for this device known to Monitor.
Web: Monitor Address UCI: monitor.@keepalive[0].monitor_ip Opt: list monitor_ip	Defines the IP address of Monitor. It is possible to specify multiple addresses to which SNMP heartbeat traps will be sent. To configure via UCI use a space separator. Example: `monitor.@keepalive[0].monitor_ip=1.1.1.1 2.2.2.2`
Web: Monitor Heartbeat Interval UCI: monitor.@keepalive[0].interval_min Opt: interval_min	Specifies the interval, in minutes, at which traps are sent. 1 — Trap set every 1 minute. Range
Web: SNMP Protocol Version UCI: monitor.@keepalive[0].snmp_version Opt: snmp_version	Specifies what SNMP version is sent to remote manager. 1 — snmp version 1 2c — SNMP version 2c 3 — SNMP version 3

Table 132: Information table for Monitor & ISAD basic configuration

The figure below shows options that are relevant only if you have selected SNMP version 3.

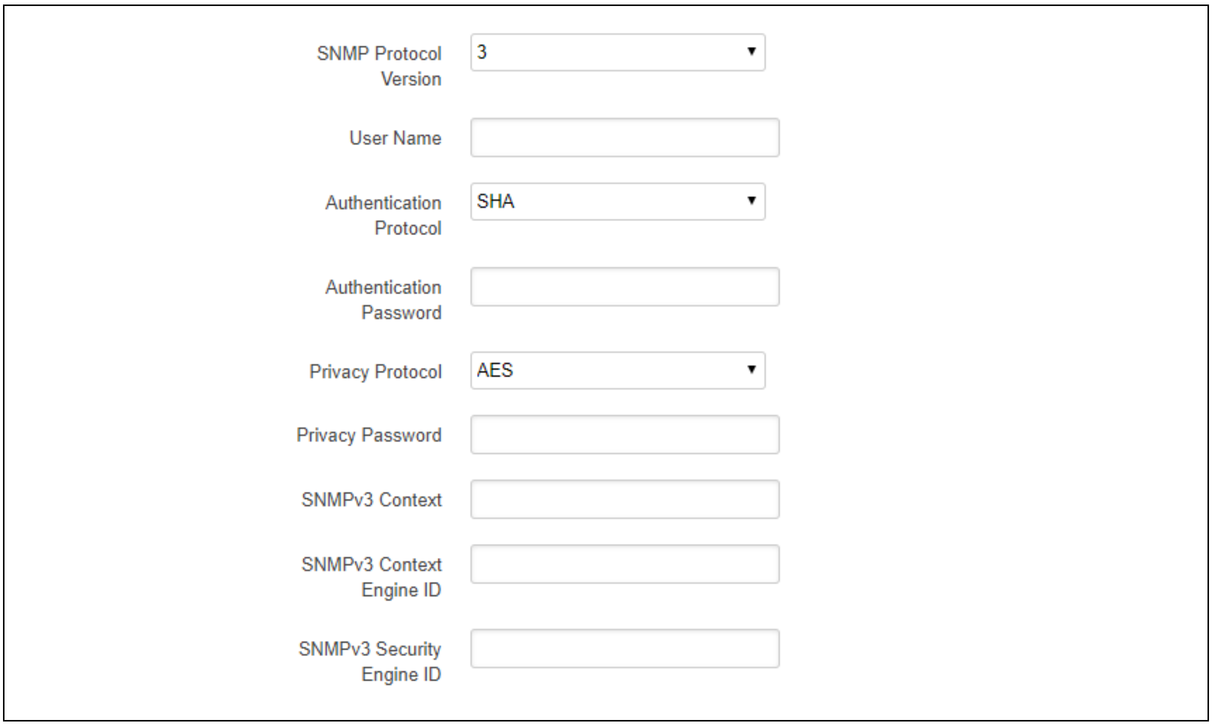

Figure 195: The Monitor & ISAD keepalive page for SNMP v3

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: User Name
UCI: monitor.@keepalive[0].snmp_uname
Opt: snmp_uname</td><td>Specifies the username.<table><tr><td>Blank</td><td>Default value</td></tr><tr><td>String</td><td></td></tr></table></td></tr>
<tr><td>Web: Authentication Password
UCI: monitor.@keepalive[0].snmp_auth_pass
Opt: snmp_auth_pass</td><td>Specifies snmpv3 authentication password.</td></tr>
<tr><td>Web: Authentication Protocol
UCI: monitor.@keepalive[0].snmp_auth_proto
Opt: snmp_auth_proto</td><td>Specifies snmpv3 authentication protocol.<table><tr><td>Blank</td><td>Default value.</td></tr><tr><td>MD5</td><td>MD5 as authentication protocol.</td></tr><tr><td>SHA</td><td>SHA as authentication protocol.</td></tr></table></td></tr>
<tr><td>Web: Privacy Protocol
UCI: monitor.@keepalive[0].snmp_priv_proto
Opt: snmp_priv_proto</td><td>Specifies snmpv3 privacy protocol.<table><tr><td>Blank</td><td>Default value.</td></tr><tr><td>AES</td><td>AES as privacy protocol.</td></tr><tr><td>DES</td><td>MD5 as privacy protocol.</td></tr></table></td></tr>
<tr><td>Web: Privacy Password
UCI: monitor.@keepalive[0].snmp_priv_pass
Opt: snmp_priv_pass</td><td>Specifies snmpv3 privacy password.</td></tr>
<tr><td>Web: SNMPv3 Context
UCI: monitor.@keepalive[0].snmp_context
Opt: snmp_context</td><td>Specifies snmpv3 context name.</td></tr>
<tr><td>Web: SNMPv3 Context Engine ID
UCI: monitor.@keepalive[0].snmp_context_eid
Opt: snmp_context_eid</td><td>Specifies snmpv3 context engine ID.</td></tr>
</table>

Web: SNMPv3 Security Engine ID UCI: monitor.@keepalive[0].snmp_sec_eid Opt: snmp_sec_eid	Specifies snmpv3 security engine ID.

Table 133: Information table for SNMP v3 reporting device commands

41.2.3 Configuring keepalive heartbeat using command line

Keepalive is configured under the monitor package.

By default, all keepalive instances are named ‘keepalive’, instances are identified by `@keepalive` then the keepalive position in the package as a number. For example, for the first keepalive in the package using UCI:

```
monitor.@keepalive[0]=keepalive
monitor.@ keepalive[0].enabled=1
```

Or using package options:

```
config keepalive
        option enabled ‘1’
```

However, to better identify, it is recommended to give the keepalive instance a name. For example, to create a keepalive instance named keepalivev1.

To define a named keepalive instance using UCI, enter:

```
monitor.keepalivev1=keepalive
monitor.keepalivev1.enable=1
```

To define a named keepalive instance using package options, enter:

```
config keepalive 'keepalivev1'
        option enabled '1'
```

41.2.4 Keepalive using UCI

```
root@VA_router:~# uci show monitor
monitor.keepalivev1=keepalive
monitor.keepalivev1enabled=1
monitor.keepalivev1.interval_min=1
monitor.keepalivev1.dev_reference=router1
monitor.keepalivev1.monitor_ip=10.1.83.36
monitor.keepalivev1.snmp_version=1
monitor.keepalivev2=keepalive
```

```
monitor.keepalivev2.enable=1
monitor.keepalivev2.interval_min=1
monitor.keepalivev2.monitor_ip=172.16.250.100
monitor.keepalivev2.dev_reference=TEST
monitor.keepalivev2.snmp_version=2c
monitor.keepalivev3=keepalive
monitor.keepalivev3.enable=1
monitor.keepalivev3.interval_min=1
monitor.keepalivev3.monitor_ip=172.16.250.101
monitor.keepalivev3.dev_reference=TEST
monitor.keepalivev3.snmp_version=3
monitor.keepalivev3.snmp_uname=TEST
monitor.keepalivev3.snmp_auth_pass=vasecret
monitor.keepalivev3.snmp_auth_proto=MD5
monitor.keepalivev3.snmp_priv_pass=vasecret
monitor.keepalivev3.snmp_priv_proto=DES
```

41.2.5 Keepalive using package options

```
root@VA_router:~# uci export monitor
package 'monitor'

config keepalive 'keepalivev1'
        option enabled '1'
        option interval_min '1'
        option dev_reference 'router1'
        option enabled 'yes'
        list monitor_ip '10.1.83.36'

config keepalive 'keepalivev2'
        option enable '1'
        option interval_min '1'
        list monitor_ip '172.16.250.100'
        option dev_reference 'TEST'
        option snmp_version '2c'

config keepalive 'keepalivev3'
```

```
        option enable '1'
        option interval_min '1'
        list monitor_ip '172.16.250.101'
        option dev_reference 'TEST'
        option snmp_version '3'
        option snmp_uname 'TEST'
        option snmp_auth_pass 'vasecret'
        option snmp_auth_proto 'MD5'
        option snmp_priv_pass 'vasecret'
        option snmp_priv_proto 'DES'
```

41.2.6 Enabling interface status in keepalive heartbeat via web interface

The keepalive heartbeat can send information on multiple interfaces. To send an interface status to Monitor, select **Network -> Interfaces**, then under the required interface select **Edit**. Under **Advanced Settings** enable the Monitor interface state option.

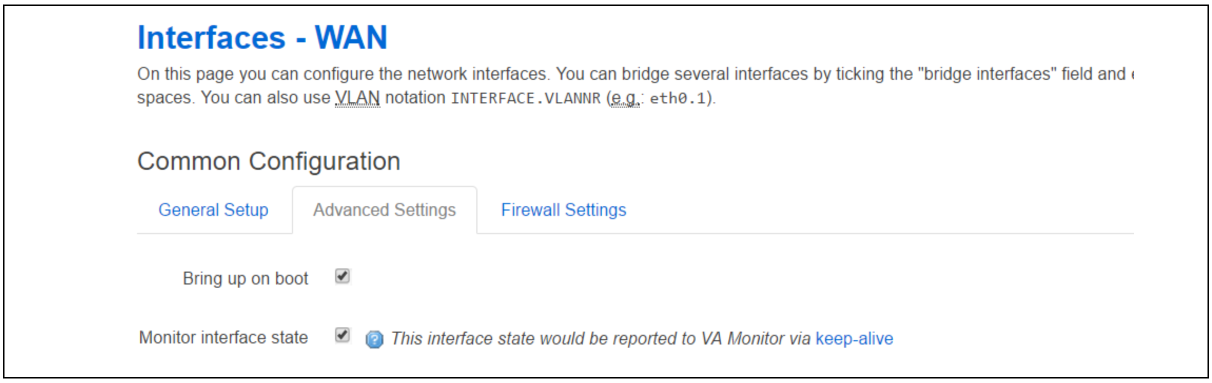

Figure 196: The interface common configuration page

Web Field/UCI/Package Option	Description
Web: Monitor interface state UCI: network.@interface[0].monitored Opt: monitored	Enables interface status to be sent in the heartbeat trap to Monitor. 0 Disabled. 1 Enabled.

Table 134: Information table for enabling interface status command

41.2.7 Enabling interface status using command line

Interface status is configured under the network package.

41.2.7.1 Enable interface status using UCI

```
root@VA_router:~# uci show network
network.@interface[0]=interface
……
network.@interface[0].monitored=1
……
```

41.2.7.2 Enable interface status using package option

```
root@VA_router:~# uci export network
package network
config interface 'WAN'
      ……
      option monitored '1'
      ……
```

41.3 Reporting GPS location to Monitor

To allow Monitor to display a router GPS location, you can configure the GPS coordinates to be sent in the heartbeat keepalive from the router.

GPS location is only available in supported hardware models.

Ensure monitor keepalive heartbeat is correctly configured as in section 41.2 above.

41.3.1 Configuration package used

Package	Sections
gpsd	gpsd

41.3.2 Configuring GPS location via the web interface

Select **Services -> GPS**. The GPS configuration page appears.

The web interface configures a gpsd section named core.

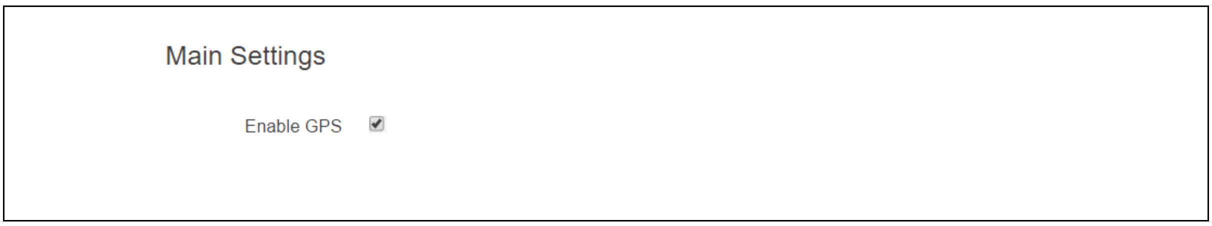

Figure 197: The GPS configuration page

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Web Field/UCI/Package Option	Description	
Web: Enable GPS UCI: monitor.core.enabled Opt: enabled	Enables GPS coordinates to be sent in the heartbeat keepalive to Monitor.	
	0	Disabled.
	1	Enabled.

Table 135: Information table for reporting GPS commands

41.3.3 Configuring GPS using command line

GPS location is configured under the gpsd package.

41.3.3.1 GPS using UCI

```
root@VA_router:~# uci show gpsd
gpsd.core=gpsd
gpsd.core.enabled=1
```

41.3.3.2 GPS using package options

```
root@VA_router:~# uci export gpsd
package gpsd
config gpsd 'core'
        option enabled '1'
```

41.3.4 GPS diagnostics

To view information on GPS coordinates via the web interface, select **Status -> GPS Information**. There are two tabs: Status and Satellite Information.

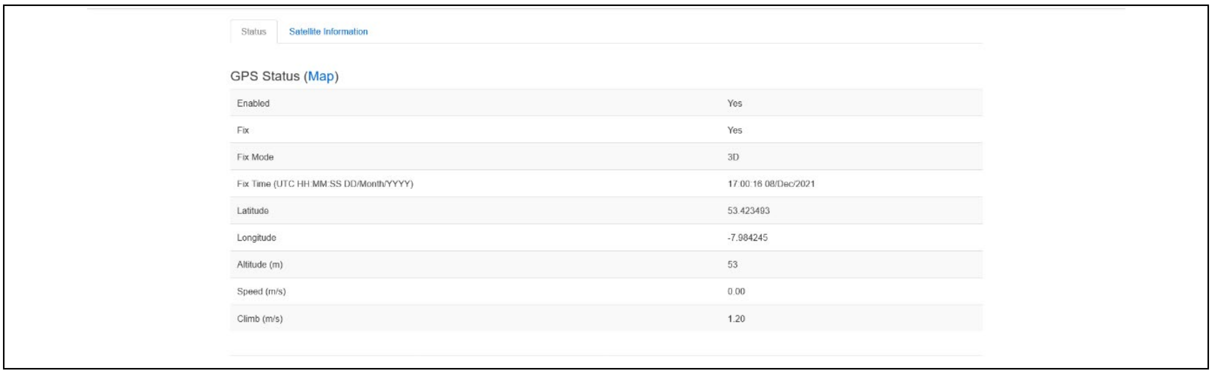

Figure 198: The GPS status page

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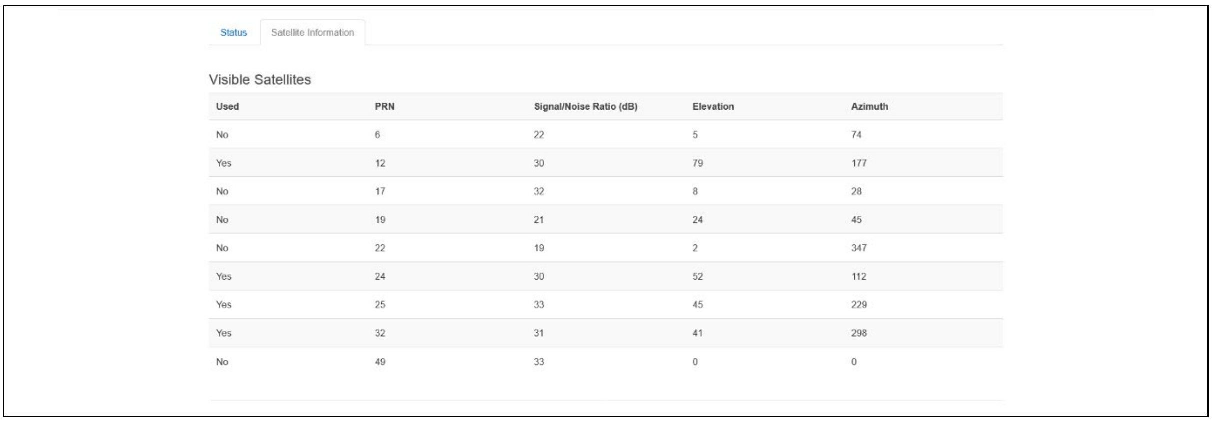

Status | Satellite Information

Visible Satellites

Used	PRN	Signal/Noise Ratio (dB)	Elevation	Azimuth
No	6	22	5	74
Yes	12	30	79	177
No	17	32	8	28
No	19	21	24	45
No	22	19	2	347
Yes	24	30	52	112
Yes	25	33	45	229
Yes	32	31	41	298
No	49	33	0	0

Figure 199: The GPS visible satellites page

To view GPS coordinates via command line, enter:

```
root@VA_router:~# gpspeek
Fix: 3D,1495467700,53.342529,-6.241236,27.700000,202.600000,0.000000,0.000000
```

41.4 Reporting syslog to Monitor

41.4.1 Configuration package used

Package	Sections
system	main

41.4.2 Configuring syslog to Monitor via the web interface

Monitor can display syslog events sent from the router. To configure the router to send syslog events, select **System -> System -> Logging** and set **External system log server** to the Monitor IP. You can also configure the syslog server port if required.

All syslog events are sent to the syslog server.

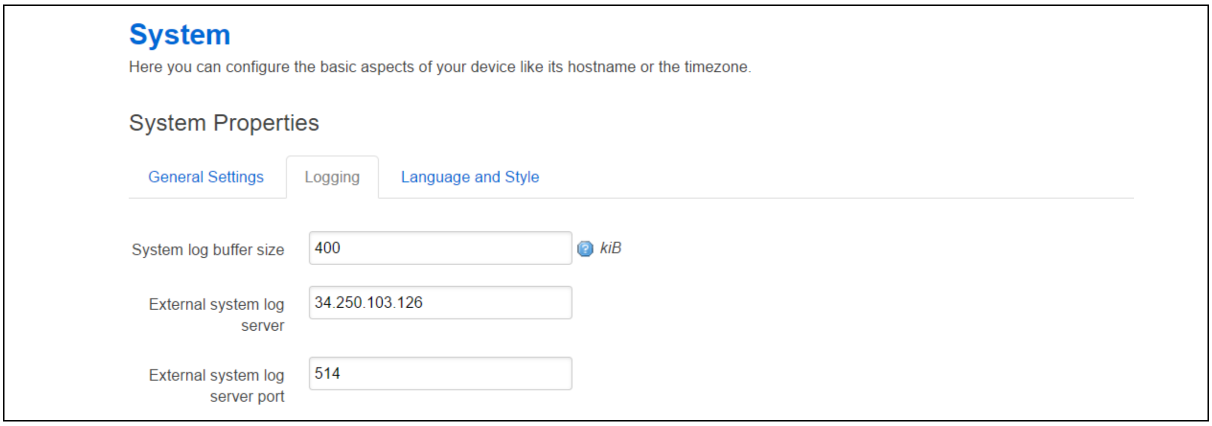

Figure 200: The system properties page

Web Field/UCI/Package Option	Description
Web: External system log server UCI: system.main.log_ip Opt: log_ip	Defines the external syslog server IP address.
Web: External system log server UCI: system.main.log_port Opt: log_port	Defines the external syslog server destination port number for syslog messages. 514 | Range |

Table 136: Information table for syslog properties commands

41.4.3 Configuring syslog events to Monitor using command line

Syslog is configured under the system package.

41.4.3.1 Syslog events to Monitor using UCI

```
root@VA_router:~# uci show system
system.main=system
……
system.main.log_ip=1.1.1.1
system.main.log_port=514
```

41.4.3.2 Syslog events to Monitor using package options

```
root@VA_router:~# uci export system
package system

config system ‘main’
……
      option log_ip ‘1.1.1.1’
      option log_port ‘514’
```

41.5 Configuring ISAD

ISAD is a system for collecting interface stats to be displayed on Monitor.

The following section explains how to configure interface statistics collection (iSAD). Statistical data is collected in bins with each bin containing interface transmit and receive packets/bytes/errors for a period. Signal strength and also temperature parameters are also stored in the bins. Bins are uploaded to Monitor periodically.

Note: ensure monitor keepalive heartbeat and interface status is correctly configured as in section 41.2 above. Interfaces should have `option monitored` enabled as part of the collection.

ISAD replaces the deprecated SLA feature.

41.5.1 Configuration package used

Package	Sections
monitor	interface_stats

41.5.2 Configuring ISAD using the web interface

Select **Services -> Monitor**. The Monitor Keepalive & ISAD page appears. ISAD is configured under the **Interface Stats** section.

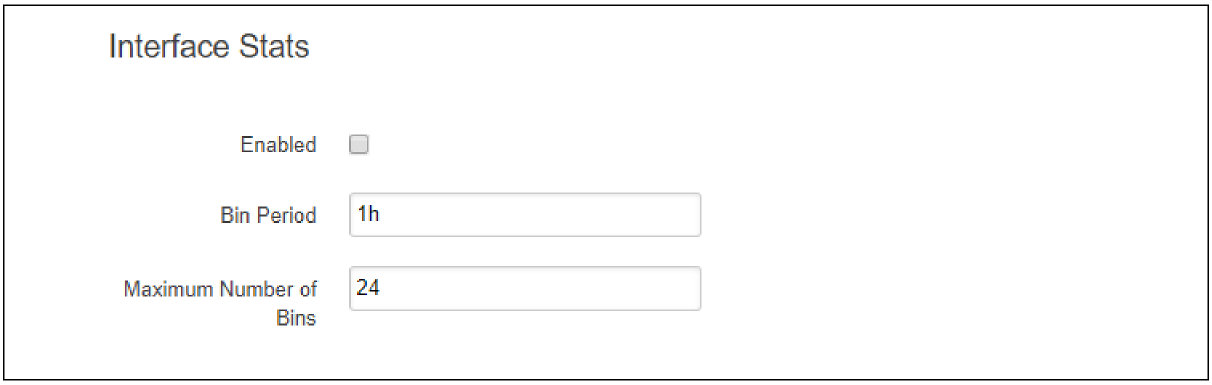

Figure 201: The Monitor keepalive & ISAD interface stats page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: monitor.stats.enabled=1
Opt: enabled</td><td>Enables ISAD.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Bin Period
UCI: monitor.stats.bin_period
Opt: time</td><td>Specifies how long to collect data for one bin.
Specifies the interval, in minutes, at which traps are sent.<table><tr><td>1h</td><td>Bin collected for 1 hour</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Maximum Number of Bins
UCI: monitor.stats.bin_cache_size
Opt: bin_cache_size</td><td>Specifies the maximum number of bins to store.<table><tr><td>Empty</td><td>24</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 137: Information table for ISAD Monitor keepalive & ISAD interface stats section

41.5.3 Configuring ISAD using the command line

ISAD is configured under the monitor package.

41.5.3.1 ISAD using UCI

```
root@VA_router:~# uci show monitor
monitor.keepalivev1=keepalive
monitor.keepalivev1.enabled=1
monitor.keepalivev1.interval_min=1
monitor.keepalivev1.dev_reference=router1
monitor.keepalivev1.monitor_ip=10.1.83.36
monitor.keepalivev1.snmp_version=1
```

```
monitor.stats=interface_stats
monitor.stats.enabled=1
monitor.stats.bin_period=1h
monitor.stats.bin_cache_size=24
```

41.5.3.2 ISAD using package options

```
root@VA_router:~# uci export monitor
package monitor

config keepalive 'keepalivev1'
        option interval_min '1'
        option enabled '1'
        list monitor_ip '10.1.83.36
        option dev_reference 'router1'

config interface_stats 'stats'
        option enabled '1'
        option bin_period '1h'
        option bin_cache_size '24'
```

41.5.4 ISAD diagnostics

41.5.4.1 Checking process

To check to see if ISAD is running, enter:

```
root@VA_router:~# pgrep -fl isad
5303 /usr/sbin/isad -b 60 -s 10 -c 200 -u /var/state /var/const_state
```

41.5.4.2 Checking bin statistics

To check if stats are being collected, enter:

```
root@VA_router:~# cat /var/state/monitor
monitor.bin_0=isad
monitor.bin_0.end_ts=85020
monitor.bin_0.start_ts=84960
monitor.bin_1=isad
monitor.bin_1.end_ts=85080
monitor.bin_1.start_ts=85020
monitor.bin_2=isad
monitor.bin_2.end_ts=85140
monitor.bin_2.start_ts=85080
```

41.5.5 ISAD operation

The bin statistics stored on the router must be periodically pushed statistics to Monitor. This is normally done centrally when statistics are enabled on Monitor. Monitor contacts each router and auto-generates a script that will automatically schedule the upload of the bin statistics.

However, if Monitor cannot access the router WAN IP, you must do this manually on each router using a UDS script. An example is shown below where the bins are uploaded every hour to a Monitor server IP 89.101.154.154 using TFTP.

```
package uds


config script 'isb_upload_scr'
        option enabled '1'
        option exec_type 'periodic'
        option period '1h'
        list text '/usr/sbin/isb_upload.lua 89.101.154.154:69'
```

41.6 Speedtest reporting

To assist in determining WAN line speed characteristics the router can be configured to:

- Implement a Discard Protocol (RFC863)
- Implement a Character Generation Protocol (RFC864)

Note: A central client is required to generate the speedtest traffic and produce the measurement reports.

Configuration is not currently available via the web UI.

<table>
<tr><th>Web Field/UCI/Package Option</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">Web: n/a
UCI: monitor.speedtest.discard_enabled
Opt: discard_enabled</td><td colspan="2">Enables listening on TCP port 9 and discarding all received data.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
<tr><td rowspan="3">Web: n/a
UCI: monitor.speedtest.chargen_enabled
Opt: chargen_enabled</td><td colspan="2">Enables listening on TCP port 19 and streaming data to the connected client at maximum possible speed.</td></tr>
<tr><td>0</td><td>Disabled.</td></tr>
<tr><td>1</td><td>Enabled.</td></tr>
</table>

Table 138: Information table for monitor speedtest configuration options

41.6.1 Configuring speedtest via the command line

Speedtest options are configured in the speedtest configuration section of the monitor package.

41.6.1.1 Speedtest using UCI

```
root@VA_router:~# uci show monitor
…
```

```
monitor.speedtest=speedtest
monitor.speedtest.discard_enabled
monitor.speedtest.chargen_enabled
```

41.6.1.2 Speedtest using package options

```
root@VA_router:~# uci export monitor
package monitor
…
config speedtest
        option discard_enabled '0'
        option chargen_enabled '0'
```

42 Configuring SNMP

SNMP (Simple Network Management Protocol) is an internet-standard protocol for managing devices on IP networks. SNMP exposes management data in the form of a hierarchy of variables in a MIB (Management Information Base). These variables can be queried individually, or in groups using their OIDs (Object Identifiers) defined in MIBs. In addition, information from the router can be pushed to a network management station in the form of SNMP traps.

42.1 Configuration package used

Package	Sections				
snmpd	access agent com2sec constant	exec group heartbeat informreceiver	inventory inventory_iftable monitor_disk monitor_ioerror	monitor_load monitor_memory monitor_process pass	system trapreceiver usm_user view

The SNMP application has several configuration sections:

System and Agent	Configures the SNMP agent.
Com2Sec	Maps SNMP community names into an arbitrary security name.
Group	Assigns community names and SNMP protocols to groups.
View and Access	Creates views and sub-views of the whole available SNMP tree and grants specific access to those views on a group by group basis.
usm_user	Defines a user for SNMPv3 USM.
Trap receiver	Sets the address of a notification receiver that should be sent SNMPv1 TRAPs and SNMPv2c TRAP2s.
Inform receiver	Sets the address of a notification receiver that should be sent SNMPv2 INFORM notifications respectively.

42.2 Configuring SNMP using the web interface

In the top menu, select **Services -> SNMP**. The SNMP Service page appears.

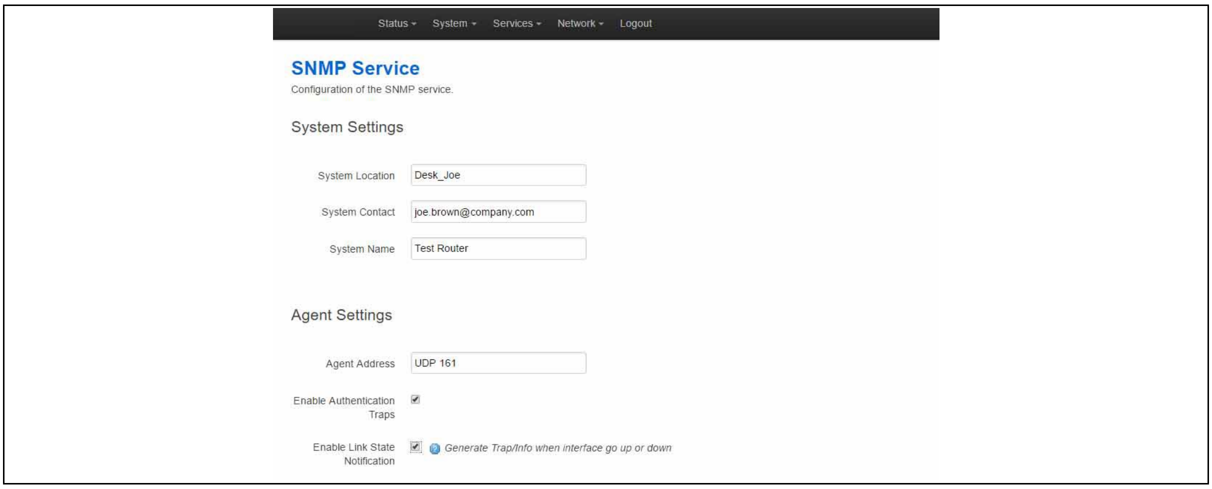

Figure 202: The SNMP service page

42.2.1 System and agent settings

Web Field/UCI/Package Option	Description
System settings	
Web: System Location UCI: snmpd.system[0].sysLocation Opt: sysLocation	Sets the system location, system contact or system name for the agent. This information is reported in the 'system' group in the mibII tree.
Web: System Contact UCI: snmpd.system[0].sysContact Opt: sysContact	
Web: System Name UCI: snmpd.system[0].sysName Opt: sysName	
Agent Settings	
Web: Agent Address UCI: snmpd.agent[0].agentaddress Opt: agentaddress	Specifies the address(es) and port(s) on which the agent should listen. [(udp|tcp):][address:]port [,…] Example: udp:127.0.0.1:161, tcp:161, localhost:9161
Web: Enable Authentication Traps UCI: snmpd.agent[0].authtrapenabled Opt: authtrapenabled	Enables or disables SNMP authentication trap. 0 — Disabled. 1 — Enabled. **Note**: this is the SNMP poll authentication trap you set when there is a community mismatch.
Web: Enable Link State Notification UCI: snmpd.agent[0].link_updown_notify Opt: link_updown_notify	Generates trap/info when interface goes up or down. When enabled, the router sends a trap notification link up or down. 0 — Disabled. 1 — Enabled.

Table 139: Information table for system and agent settings

42.2.2 Com2Sec settings

To access Com2Sec settings, scroll down the SNMP Services page.

Use the COM2Sec section to map SNMP community names into an arbitrary security name. Map community names into security names based on the community name and the source subnet. Use the first source/community combination that matches the incoming packet.

A community string is a password that is applied to a device to restrict both read-only and read-write access to the SNMP data on the device. These community strings should be chosen carefully to ensure they are not trivial. They should also be changed at regular intervals and in accordance with network security policies.

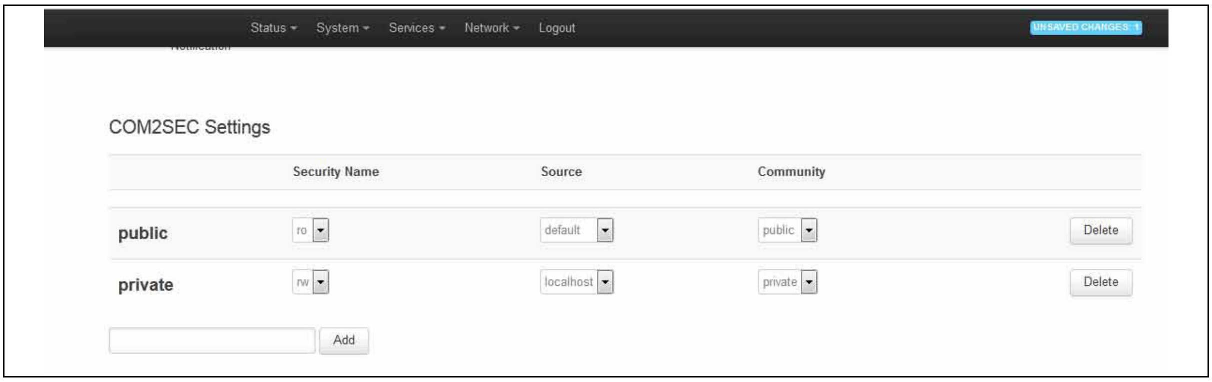

Figure 203: The COM2Sec settings section

Web Field/UCI/Package Option	Description
Web: Security Name UCI: snmpd.com2sec[x].secname Opt: secname	Specifies an arbitrary security name for the user.
Web: Source UCI: snmpd.com2sec[x].source Opt: source	A hostname, localhost or a subnet specified as a.b.c.d/mask or a.b.c.d/bits or 'default' for no restrictions.
Web: Community UCI: snmpd.com2sec[x].community Opt: community	Specifies the community string being presented in the request.

Table 140: Information table for Com2Sec settings

42.2.3 Group settings

Group settings assign community names and SNMP protocols to groups.

Figure 204: The group settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Group
UCI: snmpd.group[x].group
Opt: group</td><td>Specifies an arbitrary group name.</td></tr>
<tr><td>Web: Version
UCI: snmpd.group[x].version
Opt: version</td><td>Specifies the SNMP version number being used in the request: v1, v2c and usm (User-based Security Module) are supported.
<table>
<tr><td>v1</td><td>SNMP v1</td></tr>
<tr><td>v2v</td><td>SNMP v2</td></tr>
<tr><td>usm</td><td>SNMP v3</td></tr>
<tr><td>any</td><td>Any SNMP version</td></tr>
</table></td></tr>
<tr><td>Web: Security Name
UCI: snmpd.group[x].secname
Opt: secname</td><td>Specifies the already defined security name that is being included in this group.</td></tr>
</table>

Table 141: Information table for group settings

42.2.4 View settings

View settings define a named "view", which is a subset of the overall OID tree. This is most commonly a single subtree, but several view directives can be given with the same view name, to build up a more complex collection of OIDs.

Figure 205: The view settings section

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Name
UCI: snmpd.view[x].viewname
Opt: viewname</td><td>Specifies an arbitrary view name. Typically, it describes what the view shows.</td></tr>
<tr><td>Web: Type
UCI: snmpd.view[x].type
Opt: type</td><td>Specifies whether the view lists oids that are included in the view or lists oids to be excluded from the view; in which case all other oids are visible apart from those ones listed.
<table>
<tr><td>included</td><td></td></tr>
<tr><td>excluded</td><td></td></tr>
</table></td></tr>
<tr><td>Web: OID
UCI: snmpd.view[x].oid
Opt: oid</td><td>OID to be included in or excluded from the view. Only numerical representation is supported.
<table>
<tr><td>1</td><td>Everything</td></tr>
<tr><td>1.3.6.1.2.1.2</td><td>Interfaces table</td></tr>
</table></td></tr>
</table>

Table 142: Information table for view settings

42.2.5 Access settings

Access settings map from a group of users/communities, in a specific context and with a particular SNMP version and minimum security level, to one of three views, depending on the request being processed.

Figure 206: The access settings section

Web Field/UCI/Package Option	Description
Web: Group UCI: snmpd.access[x].group Opt: group	Specifies the group to which access is being granted.
Web: Context UCI: snmpd.access[x].context Opt: context	SNMPv3 request context is matched against the value according to the prefix below. For SNMP v1 and SNMP v2c, the context must be **none**. none all
Web: Version UCI: snmpd.access[x].version Opt: version	Specifies the SNMP version number being used in the request: any, v1, v2c and usm are supported. v1 – SNMP v1 v2v – SNMP v2 usm – SNMP v3 any – Any SNMP version
Web: Level UCI: snmpd.access[x].level Opt: level	Specifies the security level. For SNMP v1 and SNMP v2c the level must be **noauth**. noauth auth priv
Web: Prefix UCI: snmpd.access[x].prefix Opt: prefix	Specifies how the context should be matched against the context of the incoming pdu. exact any all
Web: Read UCI: snmpd.access[x].read Opt: read	Specifies the view to be used for read access.
Web: Write UCI: snmpd.access[x].write Opt: write	Specifies the view to be used for write access.
Web: Notify UCI: snmpd.access[x].notify Opt: notify	Specifies the view to be used for notify access.

Table 143: Information table for access settings

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42.2.6 Trap receiver

Trap receiver settings define a notification receiver that should be sent SNMPv1 TRAPs and SNMPv2c TRAP2.

Figure 207: The trap receiver settings page

Web Field/UCI/Package Option	Description
Web: Host UCI: snmpd.trapreceiver[x].host Opt: host	Host address. Can be either an IP address or an FQDN.
Web: Port UCI: snmpd.trapreceiver[x].port Opt: port	UDP port to be used for sending traps. Range 162
Web: Version UCI: snmpd.trapreceiver[x].version Opt: version	SNMP version. v1 V2
Web: Community UCI: snmpd.trapreceiver[x].community Opt: community	Community to use in trap messages for this host.

Table 144: Information table for trap receiver settings

42.2.7 Inform receiver

Inform receiver settings define a notification receiver that should be sent SNMPv2c INFORM notifications.

Figure 208: The inform receiver settings page

Web Field/UCI/Package Option	Description
Web: Host UCI: snmpd.informreceiver[x].host Opt: host	Host address. Can be either an IP address or an FQDN.
Web: Port UCI: snmpd.informreceiver[x].port Opt: port	UDP port to be used for sending traps. Range 162
Web: Community UCI: snmpd.informreceiver[x].community Opt: community	Community to use in inform messages for this host.

Table 145: Information table for trap receiver settings

42.2.8 USM user

Configure a user for for SNMPv3 USM (User Based Security Model).

Figure 209: The USM user settings page

Web Field/UCI/Package Option	Description
Web: Username UCI: snmpd.@usm_user[0].name Opt: name	Defines a USM username.
Web: Auth Protocol UCI: snmpd.@usm_user[0].auth_protocol Opt: auth_protocol	Defines the authentication protocol to use. **Note**: if omitted the user will be defined as `noauth` user. MD5 SHA
Web: Auth Password UCI: snmpd.@usm_user[0].auth_password Opt: auth_password	Defines the authentication password. **Note**: password must be at least 8 characters long.
Web: Priv Protocol UCI: snmpd.@usm_user[0].priv_protocol Opt: priv_protocol	Defines the privacy protocol to use. **Note**: if omitted the user will be defined as `authNoPriv` user. MD5 SHA
Web: Priv Password UCI: snmpd.@usm_user[0].priv_password Opt: priv_password	Defines the privacy password. **Note**: the password must be at least 8 characters long.
Web: OID UCI: snmpd.@usm_user[0].oid Opt: oid	Defines the OID branch to restrict this user to. Similar to view restrictions in v1 and v2c

Table 146: Information table for USM user settings

42.3 Configuring SNMP using command line

SNMP is configured under the snmpd package. The configuration files are stored on **/etc/config/snmpd**.

42.3.1 System settings using UCI

```
root@VA_router:~# uci show snmpd
snmpd.system=system
snmpd.system.sysLocation=Office 123
snmpd.system.sysContact=Mr White
snmpd.system.sysName=Backup Access 4
snmpd.agent=agent
snmpd.agent.agentaddress=UDP:161
snmpd.agent.authtrapenabled=yes
snmpd.agent.link_updown_notify=yes
```

42.3.2 System settings using package options

```
root@VA_router:~# uci export snmpd
package snmpd
config 'system'
      option sysLocation 'Office 123'
      option sysContact 'Mr White'
      option sysName 'Backup Access 4'

config 'agent'
      option agentaddress 'UDP:161'
      option authtrapenabled '1'
       option link_updown_notify '1'
```

Another sample agent configuration shown below causes the agent to listen on UDP port 161, TCP port 161 and UDP port 9161 on only the interface associated with the localhost address.

```
config 'agent'
      option agentaddress 'UDP:161,tcp:161,localhost:9161'
```

42.3.3 com2sec settings

The following sample specifies that a request from any source using "public" as the community string will be dealt with using the security name "ro". However, any request from the localhost itself using "private" as the community string will be dealt with using the security name "rw".

Note: the security names of "ro" and "rw" here are simply names – the fact of a security name having read-only or read-write permissions is handled in the access section and dealt with at a group granularity.

42.3.3.1 Com2sec using UCI

```
snmpd.c2s_1=com2sec
snmpd.c2s_1.source=default
snmpd.c2s_1.community=public
snmpd.c2s_1.secname=rw
snmpd.c2s_2=com2sec
snmpd.c2s_2.source=localhost
snmpd.c2s_2.community=private
snmpd.c2s_2.secname=ro
```

42.3.3.2 Com2sec using package options

```
config 'com2sec' 'public'
      option secname 'ro'
      option source 'default'
      option community 'public'

config 'com2sec' 'private'
      option secname 'rw'
      option source 'localhost'
      option community 'private'
```

42.3.4 Group settings

The following example specifies that a request from the security name "ro" using snmp v1, v2c or USM (User Based Security Model for SNMPv3) are all mapped to the "public" group. Similarly, requests from the security name "rw" in all protocols are mapped to the "private" group.

42.3.4.1 Group settings using UCI

```
snmpd.grp_1_v1=group
snmpd.grp_1_v1.version=v1
snmpd.grp_1_v1.group=public
```

```
snmpd.grp_1_v1.secname=ro
snmpd.grp_1_v2c=group
snmpd.grp_1_v2c.version=v2c
snmpd.grp_1_v2c.group=public
snmpd.grp_1_v2c.secname=ro
snmpd.grp_1_usm=group
snmpd.grp_1_usm.version=usm
snmpd.grp_1_usm.group=public
snmpd.grp_1_usm.secname=ro
snmpd.grp_1_access=access
snmpd.grp_1_access.context=none
snmpd.grp_1_access.version=any
snmpd.grp_1_access.level=noauth
snmpd.grp_1_access.prefix=exact
snmpd.grp_1_access.read=all
snmpd.grp_1_access.write=none
snmpd.grp_1_access.notify=none
snmpd.grp_1_access.group=public
snmpd.grp_2_v1=group
snmpd.grp_2_v1.version=v1
snmpd.grp_2_v1.group=public
snmpd.grp_2_v1.secname=ro
snmpd.grp_2_v2c=group
snmpd.grp_2_v2c.version=v2c
snmpd.grp_2_v2c.group=public
snmpd.grp_2_v2c.secname=ro
snmpd.grp_2_usm=group
snmpd.grp_2_usm.version=usm
snmpd.grp_2_usm.group=public
snmpd.grp_2_usm.secname=ro
snmpd.grp_2_access=access
snmpd.grp_2_access.context=none
snmpd.grp_2_access.version=any
snmpd.grp_2_access.level=noauth
snmpd.grp_2_access.prefix=exact
snmpd.grp_2_access.read=all
snmpd.grp_2_access.write=all
```

```
snmpd.grp_2_access.notify=all
snmpd.grp_2_access.group=public
```

42.3.4.2 Group settings using package options

```
config 'group' 'public_v1'
      option group 'public'
      option version 'v1'
      option secname 'ro'

config 'group' 'public_v2c'
      option group 'public'
      option version 'v2c'
      option secname 'ro'

config 'group' 'public_usm'
      option group 'public'
      option version 'usm'
      option secname 'ro'

config 'group' 'private_v1'
      option group 'private'
      option version 'v1'
      option secname 'rw'
config 'group' 'private_v2c'
      option group 'private'

      option version 'v2c'
      option secname 'rw'

config 'group' 'private_usm'
      option group 'private'
      option version 'usm'
      option secname 'rw'
```

42.3.5 View settings using UCI

The following example defines two views, one for the entire system and another for only mib2.

```
snmpd.all=view
snmpd.all.viewname=all
snmpd.all.oid=.1
snmpd.mib2=view
snmpd.mib2.viewname=mib2
snmpd.mib2.type=included
snmpd.mib2.oid=.iso.org.dod.Internet.mgmt.mib-2
```

42.3.5.1 View settings using package options

```
config 'view' 'all'
      option viewname 'all'
      option type 'included'
      option oid '.1'

config 'view' 'mib2'
      option viewname 'mib2'
      option type 'included'
      option oid '.iso.org.dod.Internet.mgmt.mib-2'
```

42.3.6 Access settings

The following example shows the "public" group being granted read access on the "all" view and the "private" group being granted read and write access on the "all" view. Although it is possible to write some settings using SNMP write permission, it is not recommended as any changes to the configuration made through an `snmpset` command may conflict with the UCI configuration. In this instance the changes will be overwritten by other processes and will not persist after a reboot.

42.3.6.1 Access using package options

```
config 'access' 'public_access'
      option group 'public'
      option context 'none'
      option version 'any'
      option level 'noauth'
      option prefix 'exact'
      option read 'all'
      option write 'none'
      option notify 'none'

config 'access' 'private_access'
```

```
      option group 'private'
      option context 'none'
      option version 'any'
      option level 'noauth'
      option prefix 'exact'
      option read 'all'
      option write 'all'
      option notify 'all'
```

42.3.7 SNMP traps settings using command line

By default, all SNMP trap instances are named 'trapreceiver, it is identified by `@trapreceiver` then the trap receiver position in the package as a number. For example, for the first trap receiver in the package using UCI:

```
snmpd.@trapreceiver[0]=trapreceiver
snmpd.@trapreceiver[0].host=1.1.1.1:161
```

Or using package options:

```
config trapreceiver
        option host '1.1.1.1:161'
```

However, to better identify it, it is recommended to give the trap receiver instance a name. For example, to create a trap receiver instance named TrapRecv1.

To define a named trap receiver instance using UCI, enter:

```
snmpd.TrapRecv1=TrapRecv1
snmpd.TrapRecv1.host=1.1.1.1:161
```

To define a named trap receiver instance using package options, enter:

```
config trapreceiver TrapRecv1
        option host '1.1.1.1:161'
```

42.3.7.1 SNMP trap using UCI

```
snmpd.@trapreceiver[0]=trapreceiver
snmpd.@trapreceiver[0].host=1.1.1.1:161
snmpd.@trapreceiver[0].version=v1
snmpd.@trapreceiver[0].community=public
```

42.3.7.2 SNMP trap using package options

```
# for SNMPv1 or v2c trap receivers
config trapreceiver
   option host 'IPADDR[:PORT]'
   option version 'v1|v2c'
   option community 'COMMUNITY STRING'
```

42.3.8 SNMP inform receiver settings

By default, all SNMP inform receiver instances are named ‘informreceiver’, it is identified by `@informreceiver` then the inform receiver position in the package as a number. For example, for the first inform receiver in the package using UCI:

```
snmpd.@informreceiver [0]=informreceiver
snmpd.@informreceiver [0].host=1.1.1.1
```

Or using package options:

```
config informreceiver
        option host ‘1.1.1.1’
```

However, to better identify it, it is recommended to give the inform receiver instance a name. For example, to create a inform receiver instance named InformRecv1.

To define a named trap receiver instance using UCI, enter:

```
snmpd.InformRecv1=InformRecv1
snmpd.InformRecv1.host=1.1.1.1
```

To define a named trap receiver instance using package options, enter:

```
config informreceiver InformRecv1
        option host ‘1.1.1.1’
```

42.3.8.1 SNMP inform receiver using UCI

```
snmpd.@informreceiver[0]=informreceiver
snmpd.@informreceiver[0].host=1.1.1.1
snmpd.@informreceiver[0].port=67
snmpd.@informreceiver[0].community=private
```

42.3.8.2 SNMP inform receiver using package options

```
config informreceiver
        option host '1.1.1.1'
        option port '67'
```

```
        option community 'private'
```

42.3.9 SNMP USM user settings

By default, all USM User instances are named ‘usm_user’, it is identified by `@usm_user` then the USM user position in the package as a number. For example, for the first USM User in the package using UCI:

```
snmpd.@usm_user[0]=usm_user
snmpd.@usm_user[0].name=username
```

Or using package options:

```
config usm_user
        option name ‘username’
```

However, to better identify it, it is recommended to give the usm_user instance a name. For example, to create a usm_user instance named User1.

To define a named usm_user instance using UCI, enter:

```
snmpd.User1=User1
snmpd.User1.name=username
```

To define a named usm_user instance using package options, enter:

```
config usm_user 'User1'
        option name 'username'
```

42.3.9.1 SNMP USM user using UCI

```
snmpd.@usm_user[0]=usm_user
snmpd.@usm_user[0].name=username
snmpd.@usm_user[0].auth_protocol=SHA
snmpd.@usm_user[0].auth_password=password
snmpd.@usm_user[0].priv_protocol=AES
snmpd.@usm_user[0].priv_password=password
snmpd.@usm_user[0].oid=1.2.3.4
```

42.3.9.2 SNMP USM user using package options

```
config usm_user
        option name 'username'
        option auth_protocol 'SHA'
        option auth_password 'password'
        option priv_protocol 'AES'
        option priv_password 'aespassword'
```

```
        option oid '1.2.3.4'
```

42.4 Configuring SNMP interface alias with static SNMP index

A Linux interface index changes dynamically. This is not ideal for SNMP managers that require static interface indexes to be defined.

The network package interface section allows defining a static SNMP interface alias index for this interface.

An alias entry is created in the SNMP ifEntry table at index (snmp_alias_ifindex + 1000). This entry is a shadow of the real underlying Linux interface corresponding to the UCI definition. You may use any numbering scheme you wish; the alias values do not need to be consecutive.

42.4.1 Configuration package used

Package	Sections
network	interface

42.4.2 Configuring SNMP interface alias

To enter and SNMP alias for an interface, select **Network -> Interfaces -> Edit-> Common Configuration -> Advanced Settings**.

Enter a small index value for **SNMP Alias ifindex** that is unique to this interface. To retrieve SNMP statistics for this interface, configure the SNMP manager to poll `(snmp_alias_ifindex + 1000)`. For example, if an interface is configured with an `snmp_alias_ifindex` of 11, then the SNMP manager should poll `ifIndex=1011`. The `ifIndex` will remain fixed regardless of how many times the underlying interface is added or removed.

If the Linux interface associated with the UCI entry is active when the alias index is polled, the normal `ifEntry` information for that interface is reported. Otherwise, a dummy entry is created with the same `ifDescr`, and its ifOper field set to **DOWN**.

Note: if you are using SIM roaming, where mobile interfaces are created dynamically, you need to specify a fixed `snmp_alias_ifindex` value and a fixed `ifName` value in the roaming template. All roaming entries will then map to the same Linux interface name and underlying device.

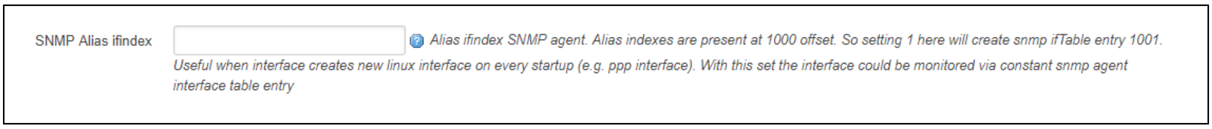

Figure 210: The interface SNMP alias ifindex field advanced settings page

<table>
<tr><th>UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: SNMP Alias ifindex
UCI: network.@interface[X].snmp_alias_ifindex
Opt: snmp_alias_ifindex</td><td>Defines a static SNMP interface alias index for this interface that can be polled using via the SNMP interface index.
snmp_alias_ifindex+1000<table><tr><td>Blank</td><td>No SNMP interface alias index</td></tr><tr><td>Range</td><td>0 - 4294966295</td></tr></table></td></tr>
<tr><td>Web: n/a
UCI: network.@interface[X].snmp_alias_ifdescr
Opt: snmp_alias_ifdescr</td><td>Defines an alias name to be reported for the UCI name in the enterprise MIB for UCI interfaces, and in alias entries in the ifIndex table. If present, this option supercedes the default ifDescr value (usually the UCI interface name, or configured ifName).<table><tr><td>Blank</td><td>No SNMP interface alias name</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 147: Information table for static SNMP alias interface

42.4.3 Configuring SNMP interface alias using the command line

SNMP interface alias is configured under the network package **/etc/config/network**

The following examples use an interface section named MOBILE.

42.4.3.1 SNMP interface alias using UCI

```
root@VA_router:~# uci show network
network.MOBILE=interface
……
network.MOBILE.snmp_alias_ifindex=11
network.MOBILE.snmp_alias_ifdescr=primary_mobile
……
```

42.4.3.2 SNMP interface alias using package options

```
root@VA_router:~# uci show network
config interface ‘MOBILE’
……
      option snmp_alias_ifindex ‘11’
      option snmp_alias_ifdescr ‘primary_mobile’
```

42.4.4 SNMP interface alias MIBS

OID Name	OID
interface alias table	.1.3.6.1.2.1.2.2.1.1.
snmp_alias_ifindex	.1.3.6.1.2.1.2.2.1.1.<snmp_alias_ifindex+1000>
snmp_alias_ifdescr	1.3.6.1.4.1.2078.3.2.66.1.1.<index>.{5,6}

42.5 Automatic SNMP traps

42.5.1 Last gasp

The router will automatically generate an SNMP trap when power loss is detected, and attempt to deliver to the configured trap receiver – ORK firmware family only.

Note: whether the hardware is able to deliver the last gasp trap depends on the hold up time on the particular hardware model and the network conditions.

Event	SNMP Trap format
Shutdown	{ SNMPv1 { Trap(28) E:8072.4 192.168.100.1 enterpriseSpecific s=2 8382 }

Table 148: Example format of last gasp trap

42.5.2 Cold start

On completion of system start up, the router will generate a cold start SNMP trap and deliver to the configured trap receiver.

Event	SNMP Trap format
Startup	{ SNMPv1 { Trap(29) E:8072.3.2.10 192.168.100.1 coldStart 9 } }

Table 149: Example format of cold start trap

42.6 SNMP diagnostics

42.6.1 SNMP process

To check the SNMP process is running correctly, enter:

```
root@VA_router:~# pgrep -fl snmpd
6970 /usr/sbin/snmpd -Lsd0-6 -p /var/run/snmpd.pid -m  -c
/var/conf/snmpd.conf
```

42.6.2 SNMP port

To check that SNMP service is listening on the configured port, enter:

```
root@VA_router:~# netstat -pantu | grep snmp
udp   0 0 0.0.0.0:161  0.0.0.0:*      6970/snmpd
```

42.6.3 Retrieving SNMP values

SNMP values can be queried by an `snmpwalk` or `snmpget` command either locally or remotely.

42.6.3.1 snmpwalk

To create an `snmpwalk` locally, enter `snmpwalk`. An example snmpwalk is shown below:

```
root@VA_router:~# snmpwalk -c public -v 1 localhost .1.3.6.1.2.1.1
```

```
iso.3.6.1.2.1.1.1.0 = STRING: "Virtual Access GWXXXX, SN# 00E0C812D1A0, EDG-21.00.07.008"
iso.3.6.1.2.1.1.2.0 = OID: iso.3.6.1.4.1.2078
iso.3.6.1.2.1.1.3.0 = Timeticks: (71816) 0:11:58.16
iso.3.6.1.2.1.1.4.0 = STRING: "info@virtualaccess.com"
iso.3.6.1.2.1.1.5.0 = STRING: "GWXXXX"
iso.3.6.1.2.1.1.6.0 = STRING: "UK"
iso.3.6.1.2.1.1.7.0 = INTEGER: 79
iso.3.6.1.2.1.1.8.0 = Timeticks: (60) 0:00:00.60
iso.3.6.1.2.1.1.9.1.2.1 = OID: iso.3.6.1.2.1.4
iso.3.6.1.2.1.1.9.1.2.2 = OID: iso.3.6.1.6.3.1
iso.3.6.1.2.1.1.9.1.2.3 = OID: iso.3.6.1.2.1.49
iso.3.6.1.2.1.1.9.1.2.4 = OID: iso.3.6.1.2.1.50
iso.3.6.1.2.1.1.9.1.2.5 = OID: iso.3.6.1.6.3.16.2.2.1
iso.3.6.1.2.1.1.9.1.2.6 = OID: iso.3.6.1.6.3.10.3.1.1
iso.3.6.1.2.1.1.9.1.2.7 = OID: iso.3.6.1.6.3.11.3.1.1
iso.3.6.1.2.1.1.9.1.2.8 = OID: iso.3.6.1.6.3.15.2.1.1
iso.3.6.1.2.1.1.9.1.2.9 = OID: iso.3.6.1.2.1.10.131
iso.3.6.1.2.1.1.9.1.4.4 = Timeticks: (35) 0:00:00.35
iso.3.6.1.2.1.1.9.1.4.5 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.6 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.7 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.8 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.9 = Timeticks: (60) 0:00:00.60
……
```

42.6.3.2 snmpget

To create an `snmpget` command locally, enter:

```
root@VA_router:~# snmpget -c public -v 1 localhost .1.3.6.1.4.1.2078.3.14.2
iso.3.6.1.4.1.2078.3.14.2 = STRING: "EDG-21.00.07.008"
```

42.6.4 SNMP status

To see an overview including tx/rx packets and uptime of the SNMP process, enter:

```
root@VA_router:~# snmpstatus -c public -v 2c localhost
[UDP: [0.0.0.0]->[127.0.0.1]:161]=>[Virtual Access GWXXXX, SN#
00E0C812D1A0, EDG-21.00.07.008] Up: 0:17:05.87
Interfaces: 21, Recv/Trans packets: 47632/9130 | IP: 15045/8256
15 interfaces are down!
```

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43 Event system

Virtual Access routers feature an event system. It allows you to forward Virtual Access specific router events to predefined targets for efficient control and management of devices.

This chapter explains how the event system works and how to configure it using UCI commands.

43.1 Configuration package used

Package	Section
va_eventd	main
	forwarding
	target
	conn_tester

43.2 Event system overview

43.2.1 Implementation of the event system

The event system is implemented by the **va_eventd** application.

The va_eventd application defines three types of object:

Forwardings	Rules that define what kind of events should be generated. For example, you might want an event to be created when an IPSec tunnel comes up or down.
Targets	Define the targets to send the event to. The event may be sent to a target via a syslog message, a snmp trap or email.
Connection testers	Define methods to test the target is reachable. IP connectivity to a server and link state may be checked prior to sending events.

For example, if you want to configure an SNMP trap to be sent when an IPSec tunnel comes up, you will need to:

- Define a forwarding rule for IPSec tunnel up events.
- Set an SNMP manager as the target.
- Optionally use a connection tester to ensure the SNMP manager is reachable.

43.2.2 Supported events

Events have a class, ID, name and a severity. These properties are used to fine tune which events to report.

Note: only VA events can be forwarded using the event system. A comprehensive table of events is available from the CLI by entering '**vae_cli -d**'.

43.2.3 Supported targets

The table below describes the targets currently supported.

Target	Description
Syslog	Event sent to syslog server.
Email	Event sent via email.
SNMP	Event sent via SNMP trap.
Exec	Command executed when event occurs.
SMS	Event sent via SMS.
File	Events written to a file

Table 150: Targets currently supported

The attributes of a target vary significantly depending on its type.

43.2.4 Supported connection testers

The table below describes the methods to test a connection that are currently supported.

Type	Description
link	Checks if the interface used to reach the target is up.
ping	Pings the target. And then assumes there is connectivity during a configurable amount of time.

Table 151: Event system - supported connection tester methods

43.3 Configuring the event system using the web interface

To configure the event system, select **Services -> VA Event System**. The VA Event System page appears.

There are four sections in the VA Event System page.

Section	Description
Basic Settings	Configures basic global event system parameters.
Connection Tester	Configures the connection testers.
Events Destination	Configures the event targets.
Event Filters	Configures the forwarding rules.

43.3.1 Basic settings

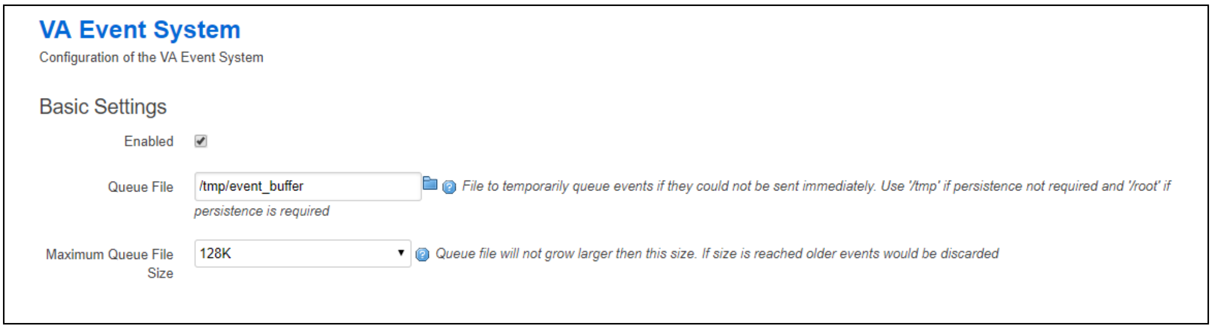

Figure 211: The VA event system basic settings configuration page

Web Field/UCI/Package Option	Description
Web: Enabled UCI: va_eventd.main.enabled Opt: enabled	Enables VA Event System. 0 – Disabled. 1 – Enabled.
Web: Enabled UCI: va_eventd.main.event_queue_file Opt: event_queue_file	Defines the file to temporarily queue events when they cannot be sent immediately. **Note**: Use `/tmp` path if persistence is not required and `/root` if persistence is required. /tmp/event_buffer – Disabled. 1 – Enabled.
Web: Enabled UCI: va_eventd.main.event_queue_size Opt: event_queue_size	Defines the file size for the temporary queue. Older events are discarded once file size is reached. 128K – 128 Kilobytes. Range

Table 152: Information table for event system basic settings

43.3.2 Connection tester

A connection tester is used to verify the event destination before forwarding the event. Connection testers configure the uci `conn_tester` section rules. Multiple connection testers can be configured. There are two types of connection tester:

Type	Description
link	Checks if the interface used to reach the target is up.
ping	Pings the target. And then assumes there is connectivity during a configurable amount of time.

Figure 212: The VA event system connection tester configuration page

Web Field/UCI/Package Option	Description
Web: Enabled UCI: va_eventd.@conn_tester[0].enabled Opt: enabled	Enables a connection tester. 0 – Disabled. 1 – Enabled.
Web: Connection Tester Name UCI: va_eventd.@conn_tester[0].name Opt: name	Defines the connection tester name. This is used when configuring a connection tester for an event destination.
Web: Type UCI: va_eventd.@conn_tester[0].type Opt: type	Defines the connection tester type. **Web Value** – **Description** – **UCI** Ping – Verifies target by ping. – ping Link – Verifies target by checking routed interface is up. – link

<table>
<tr><td>Web: Ping Target
UCI: va_eventd.@conn_tester[0].ping_dest_addr
Opt: ping_dest_addr</td><td>Defines the IP address for the target ping.
Note: only displayed if connection tester type is set to ‘Ping’.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Ping Source
UCI: va_eventd.@conn_tester[0].ping_source
Opt: ping_source</td><td>Defines an interface or IP address to source the pings from.
Note: only displayed if connection tester type is set to ‘Ping’.<table><tr><td>eth0</td><td>Use eth0 IP for ping source.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Ping Success Duration
UCI: va_eventd.@conn_tester[0].ping_success_duration_sec
Opt: ping_success_duration_sec</td><td>Defines the duration, in seconds, for which a successful ping defines a connection tester as up.
Note: only displayed if connection tester type is set to ‘Ping’.<table><tr><td>60</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Link Interface
UCI: va_eventd.@conn_tester[0].link_iface
Opt: link_iface</td><td>Defines the interface to monitor when the connection tester type is set to ‘link’. Configured interfaces are listed.
Note: only displayed if connection tester type is set to ‘Link’.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 153: Information table for event system connection tester settings

43.3.3 Event destination

An event destination is the target for the event. Event destinations configure the uci `target` section rules. Multiple event destinations can be configured. There are currently six configurable event destinations.

Target Type	Description
Syslog	Event sent to syslog server.
Email	Event sent via email.
SNMP	Event sent via SNMP trap.
Execute	Command executed when event occurs.
SMS	Event sent via SMS.
File	Event written to a file

The available configuration options differ depending on the event destination type.

43.3.3.1 Syslog target

When a syslog target receives an event, it sends it to the configured syslog server.

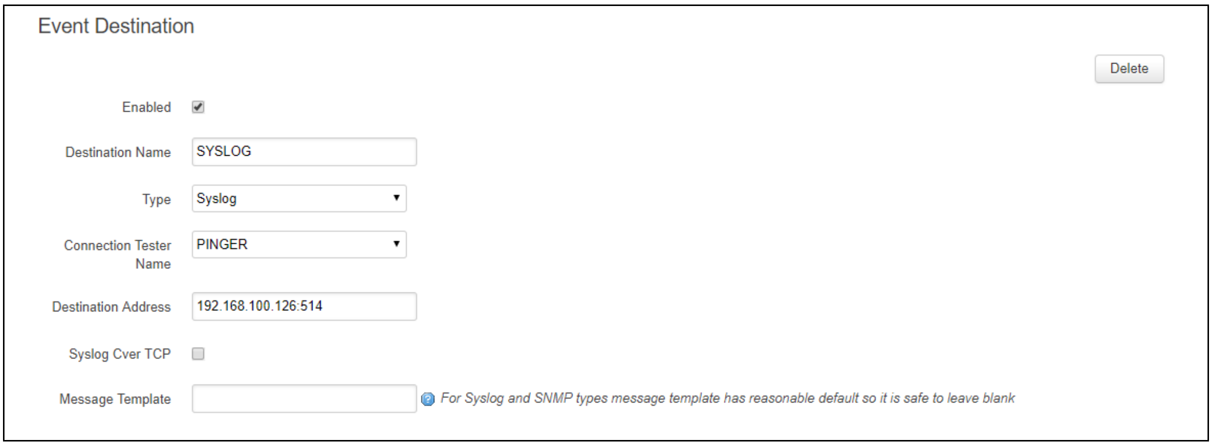

Figure 213: The VA event system syslog event destination configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: va_eventd.@target[0].enabled
Opt: enabled</td><td>Enables an event destination. This is used in the event filters section.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Destination name
UCI: va_eventd.@target[0].name
Opt: name</td><td>Defines a name for the event destination.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Type
UCI: va_eventd.@target[0].type
Opt: type</td><td>Defines the event destination type. For syslog server choose Syslog.<table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td></td><td>syslog</td></tr><tr><td>SNMP Trap</td><td></td><td>snmptrap</td></tr><tr><td>Email</td><td></td><td>email</td></tr><tr><td>Execute</td><td></td><td>exec</td></tr><tr><td>SMS</td><td></td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table></td></tr>
<tr><td>Web: Connection Tester Name
UCI: va_eventd.@target[0]. conn_tester
Opt: conn_tester</td><td>Defines the connection tester (if any) to use to verify the syslog target.<table><tr><td>None</td><td>No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Destination Address
UCI: va_eventd.@target[0]. target_addr
Opt: target_addr</td><td>Defines the syslog target IP/FQDN and port.<table><tr><td></td><td></td></tr><tr><td>Range</td><td>a.b.c.d:port or fqdn:port</td></tr></table></td></tr>
<tr><td>Web: Syslog Over TCP
UCI: va_eventd.@target[0].tcp_syslog
Opt: tcp_syslog</td><td>Defines whether to use TCP for delivery of the syslog event.<table><tr><td>0</td><td>Use UDP</td></tr><tr><td>1</td><td>Use TCP</td></tr></table></td></tr>
<tr><td>Web: Message Template
UCI: va_eventd.@target[0].template
Opt: template</td><td>Defines the message template to use for the event. In general, this should be left empty.
See the section on message templates below.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: n/a
UCI: va_eventd.@target[0].facility
Opt: facility</td><td>Defines a custom facility to overwrite existing facility on syslog messages before delivery to syslog target.<table><tr><td></td><td>Does not overwrite existing facility.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

<table>
<tr><td>Web: n/a
UCI: va_eventd.@target[0].severity
Opt: severity</td><td>Defines a custom severity to overwrite existing severity on syslog messages before delivery to syslog target.<table><tr><td></td><td>Does not overwrite existing severity.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 154: Information table for event system syslog event destination settings

43.3.3.2 Email target

When an email target receives an event, it sends it to the configured email address.

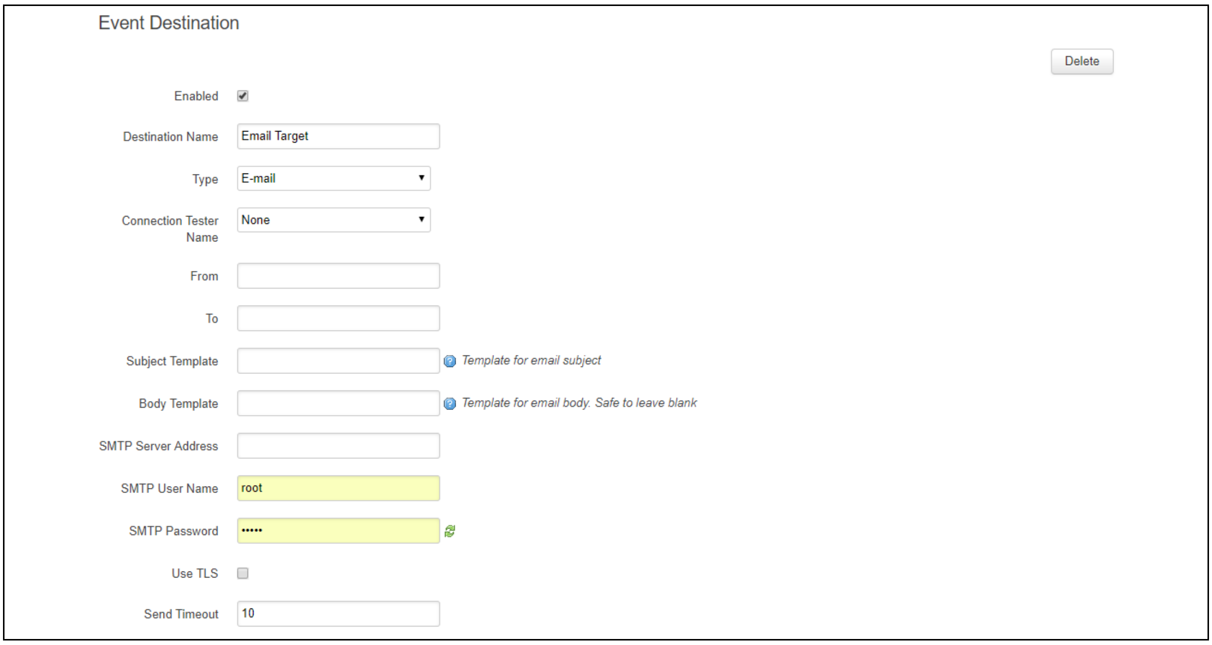

Figure 214: The VA event system email event destination configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: va_eventd.@target[0].enabled
Opt: enabled</td><td>Enables an event destination.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Destination name
UCI: va_eventd.@target[0].name
Opt: name</td><td>Defines a name for the event destination.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Type
UCI: va_eventd.@target[0].type
Opt: type</td><td>Defines the event destination type. For an email server choose Email.<table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table></td></tr>
<tr><td>Web: Connection Tester Name
UCI: va_eventd.@target[0]. conn_tester
Opt: conn_tester</td><td>Defines the connection tester (if any) to use to verify the email target.<table><tr><td>None</td><td>No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: From
UCI: va_eventd.@target[0].from
Opt: from</td><td>Defines the ‘from’ address for the email.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Web: To UCI: va_eventd.@target[0].to Opt: to	Defines the 'to' address for the email. Range
Web: Subject Template UCI: va_eventd.@target[0].subject_template Opt: subject_template	Defines subject template for the email. In general, this should be left empty. Example: `va_eventd.@target[0].subject_template="%{severityName} %{eventName}!!!"` See the section on message templates below. Range
Web: Body Template UCI: va_eventd.@target[0].body_template Opt: body_template	Defines the email body template. In general, this should be left blank. Example: `va_eventd.@target[0].body_template="%{eventName} (%{class}.%{subclass}) happened!"` See the section on message templates below. Range
Web: SMTP Server Address UCI: va_eventd.@target[0].smtp_addr Opt: smtp.addr	Defines the email server address and port. Range: a.b.c.d:port or fqdn:port
Web: SMTP User Name UCI: va_eventd.@target[0].smtp_user Opt: smtp_user	Defines the username for SMTP authentication. Range: name@site.com
Web: SMTP Password UCI: va_eventd.@target[0].smtp_password Opt: smtp_password	Defines the password for SMTP authentication. Range
Web: Use TLS UCI: va_eventd.@target[0].use_tls Opt: use_tls	Enables TLS (Transport Layer Security) support. 0 1
Web: Send Timeout UCI: va_eventd.@target[0].timeout_sec Opt: timeout_sec	Defines the email send timeout in seconds. 10 Range
Web: Use StartTLS UCI: va_eventd.@target[0]. tls_starttls Opt: tls_starttls	Enables StartTLS support for TLS. (Only displayed when TLS is enabled) 0 1
Web: Force SSLv3 UCI: va_eventd.@target[0].tls_forcessl3 Opt: tls_forcessl3	Enables force SSLv3 for TLS. (Only displayed when TLS is enabled) 0 1

Table 155: Information table for event system email event destination settings

43.3.3.3 SNMP target

When a SNMP target receives an event, it sends it in a trap to the configured SNMP manager.

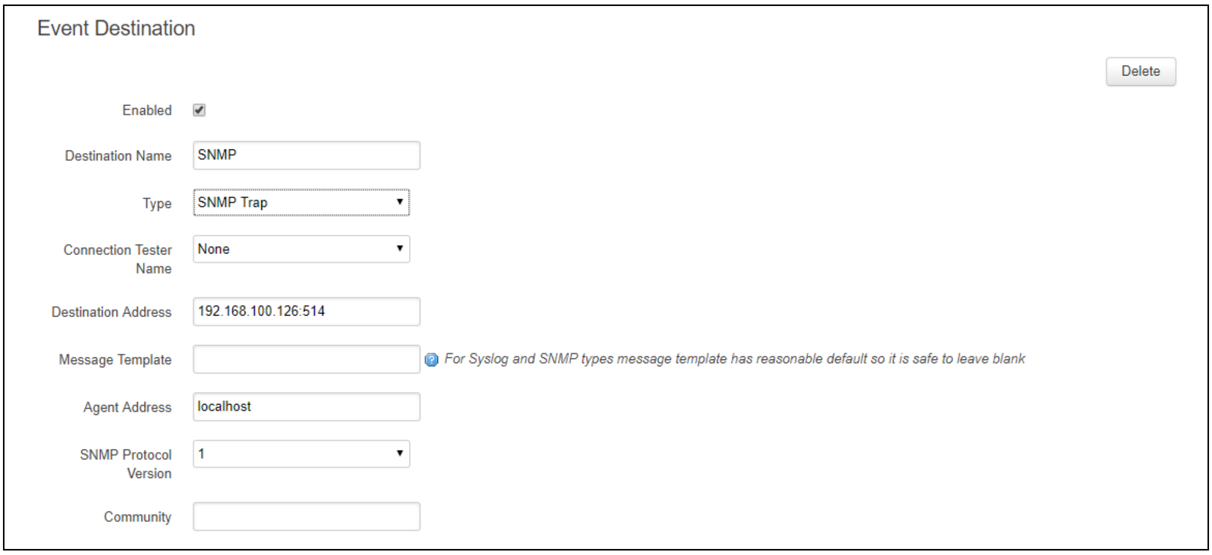

Figure 215: The VA event system SNMP event destination configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: va_eventd.@target[0].enabled
Opt: enabled</td><td>Enables an event destination.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Destination name
UCI: va_eventd.@target[0].name
Opt: name</td><td>Defines a name for the event destination.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Type
UCI: va_eventd.@target[0].type
Opt: type</td><td>Defines the event destination type. For SNMP server, choose SNMP Trap.<table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table></td></tr>
<tr><td>Web: Connection Tester Name
UCI: va_eventd.@target[0]. conn_tester
Opt: conn_tester</td><td>Defines the connection tester (if any) to use to verify the SNMP target.<table><tr><td>None</td><td>No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Destination Address
UCI: va_eventd.@target[0]. target_addr
Opt: target_addr</td><td>Defines the SNMP target IP/FQDN and port.<table><tr><td></td><td></td></tr><tr><td>Range</td><td>a.b.c.d:port or fqdn:port</td></tr></table></td></tr>
<tr><td>Web: Message Template
UCI: va_eventd.@target[0].template
Opt: template</td><td>Defines the message template to use for the event. In general, this should be left empty. Example:
<code>va_eventd.@target[0].template="%{eventName} %{eventSpecificTemplate}"</code>
See the section on message templates below.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Agent Address
UCI: va_eventd.@target[0]. agent_addr
Opt: agent_addr</td><td>Defines the IP address to source the SNMP trap. (optional)<table><tr><td>localhost</td><td>Local IP</td></tr><tr><td>Range</td><td>Localhost or IP address</td></tr></table></td></tr>
</table>

Web: SNMP Protocol Version UCI: va_eventd.@target[0].snmp_version Opt: snmp_version	Defines the SNMP version. 1 — SNMPv1 2c — SNMPv2c 3 — SNMPv3
Web: Community UCI: va_eventd.@target[0].community Opt: community	Defines the community string for SNMPv1. Range
Web: Username UCI: va_eventd.@target[0].snmp_uname Opt: snmp_uname	Defines the username for SNMPv3. Only displayed when SNMP protocol version is SNMPv3 Range
Web: Authentication Protocol UCI: va_eventd.@target[0].snmp_auth_proto Opt: snmp_auth_proto	Defines the SNMPv3 authentication protocol Only displayed when SNMP protocol version is SNMPv3. MD5 SHA
Web: Authentication Password UCI: va_eventd.@target[0].snmp_auth_pass Opt: snmp_auth_pass	Defines the SNMPv3 authentication password. Only displayed when SNMPv3 authentication protocol is configured. MD5 SHA
Web: Privacy Protocol UCI: va_eventd.@target[0].snmp_priv_proto Opt: snmp_priv_proto	Defines the SNMPv3 privacy protocol. Only displayed when SNMP authentication protocol is configured. DES AES
Web: Privacy Password UCI: va_eventd.@target[0].snmp_priv_pass Opt: snmp_priv_pass	Defines SNMPv3 privacy password. Only displayed when SNMP privacy protocol is configured. Range
Web: SNMPv3 Context UCI: va_eventd.@target[0].snmp_context Opt: snmp_context	Defines the SNMPv3 context. Only displayed when SNMP authentication protocol is configured. Range
Web: SNMPv3 Context Engine ID UCI: va_eventd.@target[0].snmp_context_eid Opt: snmp_context_eid	Defines the SNMPv3 context engine ID. Only displayed when SNMP authentication protocol is configured. Range
Web: SNMPv3 Security Engine ID UCI: va_eventd.@target[0].snmp_sec_eid Opt: snmp_sec_eid	Defines the SNMPv3 security engine ID. Only displayed when SNMP authentication protocol is configured. Range

Table 156: Information table for event system SNMP event destination settings

43.3.3.4 Exec target

When an Execute target receives an event, it executes a shell command.

Figure 216: The VA event system exec event destination configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: va_eventd.@target[0].enabled
Opt: enabled</td><td>Enables an event destination.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Destination name
UCI: va_eventd.@target[0].name
Opt: name</td><td>Defines a name for the event destination.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Type
UCI: va_eventd.@target[0].type
Opt: type</td><td>Defines the event destination type. For shell command <code>execution</code>, choose Execute.<table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table></td></tr>
<tr><td>Web: Connection Tester Name
UCI: va_eventd.@target[0]. conn_tester
Opt: conn_tester</td><td>Defines the connection tester, if any, to use to verify the execute target.<table><tr><td>None</td><td>No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Command Template
UCI: va_eventd.@target[0].cmd_template
Opt: cmd_template</td><td>Defines the command template to use for the event.
Example to log a syslog message:
<code>va_eventd.@target[0].cmd_template="logger -t eventer %{eventName}"</code>
See the section on message templates below.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 157: Information table for event system execute event destination settings

43.3.3.5 SMS target

When an SMS target receives an event, it sends an SMS message.

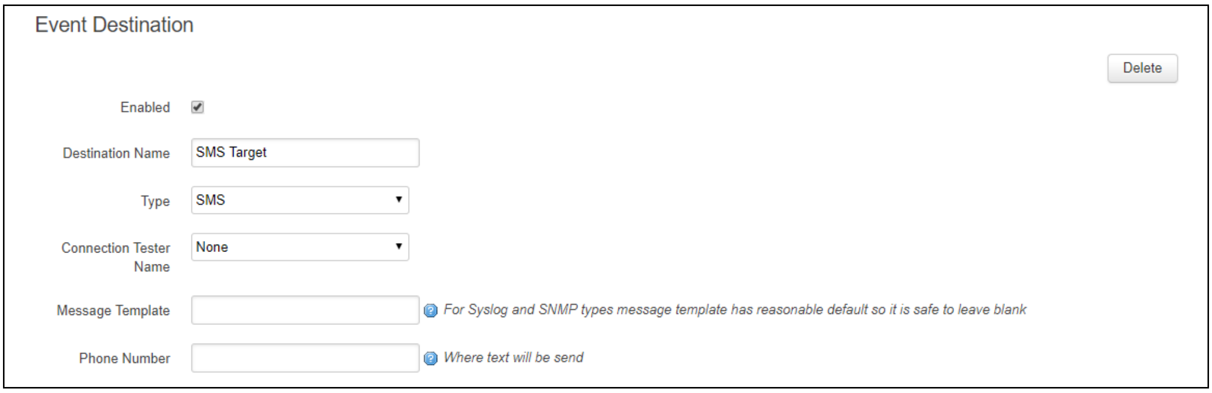

Figure 217: The VA event system SMS event destination configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: va_eventd.@target[0].enabled
Opt: enabled</td><td>Enables an event destination.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Destination name
UCI: va_eventd.@target[0].name
Opt: name</td><td>Defines a name for the event destination.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Type
UCI: va_eventd.@target[0].type
Opt: type</td><td>Defines the event destination type. For SMS destination, choose SMS.<table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td></td><td>syslog</td></tr><tr><td>SNMP Trap</td><td></td><td>snmptrap</td></tr><tr><td>Email</td><td></td><td>email</td></tr><tr><td>Execute</td><td></td><td>exec</td></tr><tr><td>SMS</td><td></td><td>sms</td></tr><tr><td>File</td><td></td><td>file</td></tr></table></td></tr>
<tr><td>Web: Connection Tester Name
UCI: va_eventd.@target[0]. conn_tester
Opt: conn_tester</td><td>Defines the connection tester, if any, to use to verify the SMS target.<table><tr><td>None</td><td>No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Message Template
UCI: va_eventd.@target[0].template
Opt: template</td><td>Defines the message template to use for the event. In general, this should be left empty. Example:
<code>va_eventd.@target[0].template="%{eventName}"</code>
See the section on message templates below.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Phone Number
UCI: va_eventd.@target[0].callee
Opt: callee</td><td>Defines the phone number for sending SMS to.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 158: Information table for event system SMS event destination settings

43.3.3.6 File target

When file target receives an event, it logs to a file.

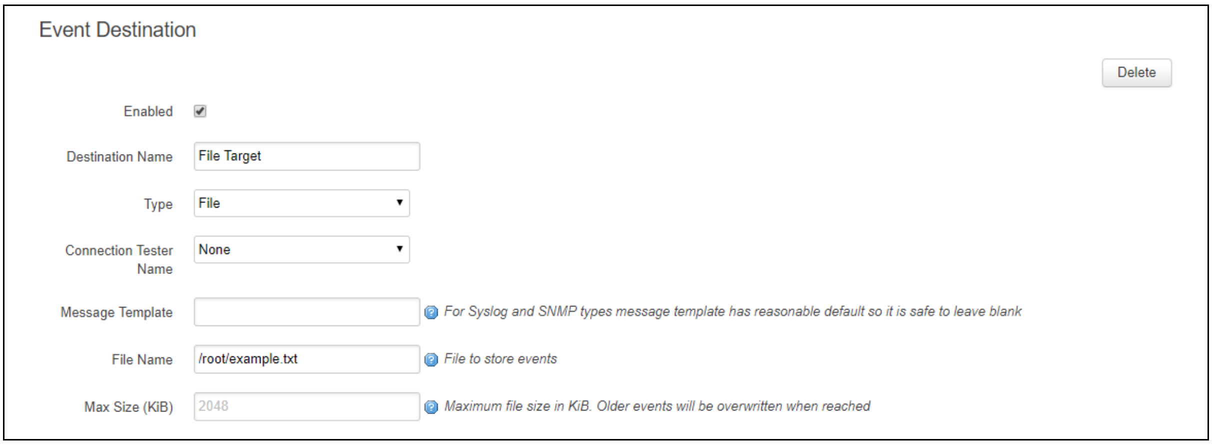

Figure 218: The VA event system file event destination configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: va_eventd.@target[0].enabled
Opt: enabled</td><td>Enables an event destination.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Destination Name
UCI: va_eventd.@target[0].name
Opt: name</td><td>Defines a name for the event destination.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Type
UCI: va_eventd.@target[0].type
Opt: type</td><td>Defines the event destination type. For file choose File.<table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td></td><td>syslog</td></tr><tr><td>SNMP Trap</td><td></td><td>snmptrap</td></tr><tr><td>Email</td><td></td><td>email</td></tr><tr><td>Execute</td><td></td><td>exec</td></tr><tr><td>SMS</td><td></td><td>sms</td></tr><tr><td>File</td><td></td><td>file</td></tr></table></td></tr>
<tr><td>Web: Connection Tester Name
UCI: va_eventd.@target[0]. conn_tester
Opt: conn_tester</td><td>Defines the connection tester (if any) to use to verify the File target.<table><tr><td>None</td><td>No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Message Template
UCI: va_eventd.@target[0].template
Opt: template</td><td>Defines the message template to use for the event. In general, this should be left empty.
See the section on message templates below.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: File Name
UCI: va_eventd.@target[0].file_name
Opt: file_name</td><td>Defines a file name for the event destination. Full path.<table><tr><td></td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Max Size (KiB)
UCI: va_eventd.@target[0].max_size_kb
Opt: file_name</td><td>Defines a file size in kilobits.<table><tr><td>2048</td><td></td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
</table>

Table 159: Information table for event system file event destination settings

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43.3.4 Event filters

Event filters are used to classify the events to be sent to the event destination. Multiple event filters can be defined. Event filters configure the uci `forwarding` section rules.

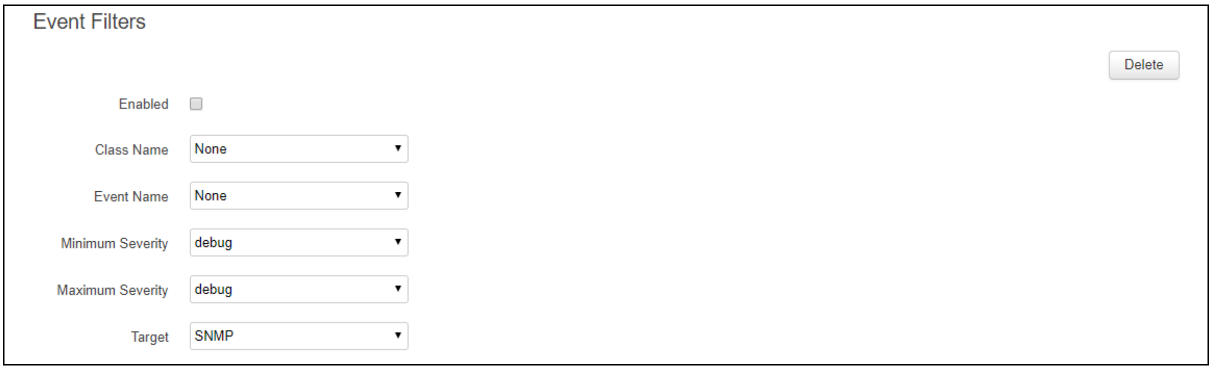

Figure 219: The VA event system event filters configuration page

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enabled
UCI: va_eventd.@forwarding[0].enabled
Opt: enabled</td><td>Enables an event filter.<table><tr><td>1</td><td>Disabled.</td></tr><tr><td>0</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Class Name
UCI: va_eventd.@forwarding[0].className
Opt: className</td><td>Only match events with the given class name. Available class names are listed or can be viewed using the command
<code>vae_cli -d</code></td></tr>
<tr><td>Web: Event Name
UCI: va_eventd.@forwarding[0].eventName
Opt: eventName</td><td>Only match events with the given event name. Available event names are listed. The event name is optional and can be omitted.</td></tr>
<tr><td>Web: Minimum Severity
UCI: va_eventd.@forwarding[0].severity
Opt: severity</td><td>Defines the minimum event severity. The minimum severity event is DEBUG. Events generated within the minimum and maximum event severity will be matched.
Minimum and maximum severity are specified in the one UCI option and entered using a dash (-) separator in the form minimum-maximum. Example:
<code>va_eventd.@forwarding[0].severity=debug-error</code><table><tr><td>debug</td><td>minimum severity</td></tr><tr><td>info</td><td></td></tr><tr><td>notice</td><td></td></tr><tr><td>warning</td><td></td></tr><tr><td>error</td><td></td></tr><tr><td>critical</td><td></td></tr><tr><td>alert</td><td></td></tr><tr><td>emergency</td><td>maximum severity</td></tr></table></td></tr>
</table>

<table>
<tr><td>Web: Maximum Severity
UCI: va_eventd.@forwarding[0].severity
Opt: severity</td><td>Defines the maximum event severity. The maximum event severity is EMERGENCY. Events generated within the minimum and maximum event severity will be matched.
The UCI command for specifying minimum and maximum severity is the same and is entered with two parameters using a dash (-) separator minimum-maximum. Example:
<code>va_eventd.@forwarding[0].severity=debug-error</code>
<table>
<tr><td>debug</td><td>minimum severity</td></tr>
<tr><td>info</td><td></td></tr>
<tr><td>notice</td><td></td></tr>
<tr><td>warning</td><td></td></tr>
<tr><td>error</td><td></td></tr>
<tr><td>critical</td><td></td></tr>
<tr><td>alert</td><td></td></tr>
<tr><td>emergency</td><td>maximum severity</td></tr>
</table></td></tr>
<tr><td>Web: Target
UCI: va_eventd.@forwarding[0].target
Opt: target</td><td>Defines the event destination to forward the event to. All configured event destinations will be displayed.</td></tr>
</table>

Table 160: Information table for event system event filters settings

43.4 Configuring the event system using command line

The event system configuration files are stored at **/etc/config/va_eventd**

There are four config sections main, conn_tester, target and forwarding.

You can configure multiple conn_tester, target and forwarding sections.

By default, all conn_tester instances are named conn_tester, it is identified by `@conn_tester` then the conn_tester position in the package as a number. For example, for the first conn_tester in the package using UCI:

```
va_eventd.@conn_tester[0]=conn_tester

va_eventd.@conn_tester[0].enabled=1
```

Or using package options, enter:

```
config conn_tester

      option enabled '1'
```

By default, all target instances are named target. The target instance is identified by `@target` then the target position in the package as a number. For example, for the first target in the package using UCI:

```
va_eventd.@target[0]=target

va_eventd.@target[0].enabled=1
```

Or using package options, enter:

```
config target

      option enabled '1'
```

By default, all forwarding instances are named forwarding. The forwarding instance is identified by `@forwarding` then the forwarding position in the package as a number. For example, for the first forwarding rule in the package using UCI:

```
va_eventd.@forwarding[0]=forwarding
va_eventd.@forwarding[0].enabled=1
```

Or using package options:

```
config forwarding
      option enabled '1'
```

43.4.1 Event system using UCI

```
root@VA_router:~# uci show va_eventd
#Sample basic settings
va_eventd.main=va_eventd
va_eventd.main.event_queue_file=/tmp/event_buffer
va_eventd.main.event_queue_size=128K

#Sample SNMP
va_eventd.@conn_tester[0]=conn_tester
va_eventd.@conn_tester[0].type=ping
va_eventd.@conn_tester[0].ping_dest_addr=192.168.100.1
va_eventd.@conn_tester[0].ping_success_duration_sec=60
va_eventd.@conn_tester[0].name=SNMPTest
va_eventd.@conn_tester[0].ping_source=LAN1
va_eventd.@target[0]=target
va_eventd.@target[0].suppress_duplicate_forwardings=no
va_eventd.@target[0].type=snmp
va_eventd.@target[0].agent_addr=localhost
va_eventd.@target[0].name=SNMPTarget
va_eventd.@target[0].conn_tester=SNMPTest
va_eventd.@target[0].target_addr=192.168.100.126:68
va_eventd.@target[0].snmp_version=3
va_eventd.@target[0].snmp_uname=v3username
va_eventd.@target[0].snmp_auth_proto=MD5
va_eventd.@target[0].snmp_auth_pass=md5password
va_eventd.@target[0].snmp_priv_proto=AES
va_eventd.@target[0].snmp_priv_pass=aespassword
va_eventd.@target[0].snmp_context=v3context
```

```
va_eventd.@target[0].snmp_context_eid=v3contextID
va_eventd.@target[0].snmp_sec_eid=v3SecurityID
va_eventd.@forwarding[0]=forwarding
va_eventd.@forwarding[0].enabled=yes
va_eventd.@forwarding[0].className=mobile
va_eventd.@forwarding[0].target=SNMPTarget
va_eventd.@forwarding[0].eventName=LinkUp
va_eventd.@forwarding[0].severity=notice-notice

#Sample Syslog
va_eventd.@conn_tester[1]=conn_tester
va_eventd.@conn_tester[1].name=SyslogTest
va_eventd.@conn_tester[1].type=ping
va_eventd.@conn_tester[1].ping_dest_addr=192.168.100.2
va_eventd.@conn_tester[1].ping_source=LAN1
va_eventd.@conn_tester[1].ping_success_duration_sec=60
va_eventd.@target[1]=target
va_eventd.@target[1].name=SyslogTarget
va_eventd.@target[1].type=syslog
va_eventd.@target[1].conn_tester=SyslogTest
va_eventd.@target[1].target_addr=192.168.100.2:514
va_eventd.@target[1].tcp_syslog=0
va_eventd.@forwarding[1]=forwarding
va_eventd.@forwarding[1].enabled=yes
va_eventd.@forwarding[1].severity=debug-error
va_eventd.@forwarding[1].target=SyslogTarget

#Sample Email
va_eventd.@conn_tester[2]=conn_tester
va_eventd.@conn_tester[2].name=EmailTest
va_eventd.@conn_tester[2].type=link
va_eventd.@conn_tester[2].link_iface=PoAADSL
va_eventd.@target[2]=target
va_eventd.@target[2].timeout_sec=10
va_eventd.@target[2].name=EmailTarget
va_eventd.@target[2].type=email
va_eventd.@target[2].conn_tester=EmailTest
```

```
va_eventd.@target[2].from=from@example.com
va_eventd.@target[2].to=to@example.com
va_eventd.@target[2].subject_template=%{serial} %{severityName} %{eventName
}!!!
va_eventd.@target[2].body_template=%{eventName} (%{class}.%{subclass})
happened!
va_eventd.@target[2].smtp_addr=192.168.100.3:25
va_eventd.@target[2].smtp_user=root
va_eventd.@target[2].smtp_password=admin
va_eventd.@target[2].use_tls=0
va_eventd.@target[2].tls_starttls=0
va_eventd.@target[2].tls_forcessl3=0
va_eventd.@forwarding[2]=forwarding
va_eventd.@forwarding[2].enabled=yes
va_eventd.@forwarding[2].className=power
va_eventd.@forwarding[2].eventName=IgnitionOff
va_eventd.@forwarding[2].severity=notice-notice
va_eventd.@forwarding[2].target=EmailTarget

#Sample SMS
va_eventd.@target[3]=target
va_eventd.@target[3].name=SMStarget
va_eventd.@forwarding[3].target=SMStarget
va_eventd.@target[3].type=sms
va_eventd.@target[3].template=%{serial} %{severityName} %{eventName}!!!
va_eventd.@target[3].callee=0123456789
va_eventd.@forwarding[3]=forwarding
va_eventd.@forwarding[3].enabled=yes
va_eventd.@forwarding[3].target=SMStarget
va_eventd.@forwarding[3].className=auth
va_eventd.@forwarding[3].eventName=LoginSSH
va_eventd.@forwarding[3].severity=notice-notice

#Sample Execute
va_eventd.@target[4]=target
va_eventd.@target[4].name=ExecTarget
va_eventd.@target[4].type=exec
```

```
va_eventd.@target[4].cmd_template=logger -t eventer %{eventName}
va_eventd.@forwarding[4]=forwarding
va_eventd.@forwarding[4].enabled=yes
va_eventd.@forwarding[4].target=ExecTarget
va_eventd.@forwarding[4].className=ppp
va_eventd.@forwarding[4].severity=debug-error

#Sample File
va_eventd.@target[5]=target
va_eventd.@target[5].name=FileTarget
va_eventd.@target[5].type=file
va_eventd.@target[5].file_name=\tmp\eventfile
va_eventd.@target[5].max_size_kb=1028
va_eventd.@forwarding[5]=forwarding
va_eventd.@forwarding[5].enabled=yes
va_eventd.@forwarding[5].target=FileTarget
va_eventd.@forwarding[5].severity=debug-error
```

43.4.1.1 Event system using package options

```
root@VA_router:~# uci export va_eventd
package va_eventd

config va_eventd 'main'
        option event_queue_file '/tmp/event_buffer'
        option event_queue_size '128K'

# Sample SNMP
config conn_tester
        option type 'ping'
        option ping_dest_addr '192.168.100.1'
        option ping_success_duration_sec '60'
        option name 'SNMPTest'
        option ping_source 'LAN1'

config target
        option suppress_duplicate_forwardings 'no'
        option type 'snmp'
```

```
        option agent_addr 'localhost'
        option name 'SNMPTarget'
        option conn_tester 'SNMPTest'
        option target_addr '192.168.100.126:68'
        option snmp_version '3'
        option snmp_uname 'v3username'
        option snmp_auth_proto 'MD5'
        option snmp_auth_pass 'md5password'
        option snmp_priv_proto 'AES'
        option snmp_priv_pass 'aespassword'
        option snmp_context 'v3context'
        option snmp_context_eid 'v3contextID'
        option snmp_sec_eid 'v3SecurityID'

config forwarding
        option enabled 'yes'
        option className 'mobile'
        option severity 'notice-notice'
        option target 'SNMPTarget'
        option eventname 'LinkUp'

# Sample Syslog
config conn_tester
        option name 'SyslogTest'
        option type 'ping'
        option ping_dest_addr '192.168.100.2'
        option ping_source 'LAN1'
        option ping_success_duration_sec '60'

config target
        option name 'SyslogTarget'
        option type 'syslog'
        option conn_tester 'SyslogTest'
        option target_addr '192.168.100.2:514'
        option tcp_syslog '0'

config forwarding
```

```
        option enabled 'yes'
        option severity 'debug-error'
        option target 'SyslogTarget'

# Sample Email
config conn_tester
        option name 'EmailTest'
        option type 'link'
        option link_iface 'PoAADSL'

config target
        option timeout_sec '10'
        option name 'EmailTarget'
        option type 'email'
        option conn_tester 'EmailTest'
        option from 'from@example.com'
        option to 'to@example.com'
        option subject_template '%{serial} %{severityName} %{eventName}!!!'
        option body_template '%{eventName} (%{class}.%{subclass})
happened!'
        option smtp_addr '192.168.100.3:25'
        option smtp_user 'root'
        option smtp_password 'admin'
        option use_tls 'no'
        option tls_starttls 'no'
        option tls_forcessl3 'no'

config forwarding
        option enabled 'yes'
        option target 'EmailTarget'
        option className 'power'
        option eventName 'IgnitionOff'
        option severity 'notice-notice'

# Sample SMS
config target
        option name 'SMStarget'
```

```
        option type 'sms'
        option template '%{serial} %{severityName} %{eventName}!!!'
        option callee '0123456789'

config forwarding
        option enabled 'yes'
        option target 'SMSTarget'
        option className 'auth'
        option eventName 'LoginSSH'
        option severity 'notice-notice'

# Sample Execute
config target
        option name 'ExecTarget'
        option type 'exec'
        option cmd_template 'logger -t eventer %{eventName}'

config forwarding
        option enabled 'yes'
        option target 'ExecTarget'
        option className 'ppp'
        option severity 'debug-error'

# Sample File
config target
        option name 'FileTarget'
        option type 'file'
        option file_name '\tmp\eventfile'
        option max_size_kb '1028'

config forwarding
        option enabled 'yes'
        option target 'FileTarget'
        option severity 'debug-error'
```

43.5 Event system diagnostics

43.5.1 Displaying VA events

To view a list of all available class names, events and severity levels, enter:

```
root@VA_router:~# vae_cli -d
```

The following is an example of the output from this command:

```
| Class     | ID  | Name                     | Severity | Specific Template
| internal  |   1 | EventdConfigErr          | error
| %{p1} %{p2}: %{p3} has bad value..
| internal  |   2 | EventdConfigWarn         | warning
| %{p1} %{p2}: %{p3} has bad value..
| internal  |   3 | EventdConfigUnknown      | informat | %{p1} %{p2}:
field '%{p3}' is no..

| internal  |   4 | EventdSystemErr          | error
| %{p1} %{p2}: %{p3} %{p4} %{p5} %..
| internal  |   5 | EventdSystemWarn         | error
| %{p1} %{p2}: %{p3} %{p4} %{p5} %..
| internal  |   6 | EventdUpAndRunning       | informat |
| internal  |   7 | EventdStopped            | warning  | %{p1}
| mobile    |   1 | SIMin         | notice   | SIM card #%{p1}inserted

| mobile    |   2 | SIMout        | notice   | SIM card #%{p1} removed
| mobile    |   3 | LinkUp        | notice   | 3g link %{p1} up using sim
#%{p2..
| mobile    |   4 | LinkDown      | notice   | 3g link %{p1} down
| mobile    |   5 | SMSByPassword | notice   | Received SMS from %{p1} (by
pass..
| mobile    |   6 | SMSByCaller   | notice   | Received SMS from %{p1}
(%{p2}):..
| mobile    |   7 | SMSFromUnknown     | warning  | Received SMS from
unknown sender..
| mobile    |   8 | SMSSendSuccess     | informat | SMS send success: %{p1}
| mobile    |   9 | SMSSendError       | warning  | SMS send error: %{p1}
| mobile    |  10 | SMSSent            | notice   | Sent SMS
to %{p1}: %{p2}
| ethernet  |   1 | LinkUp             | notice   | Ethernet %{p1} up
| ethernet  |   2 | LinkDown           | notice   | Ethernet %{p1} down
| auth      |   2 | BadPasswordSSH     | warning  | SSH login attempt
from %{p2}: ba..
| auth      |   3 | BadUserConsole     | warning  | Console login attempt
```

```
on %{p1}: ..
| auth      |   4 | BadPasswordConsole | warning  | Console login attempt
on %{p2}: ..
| auth      |   5 | BadUserTelnet      | warning  | Telnet login attempt:
bad username
| auth      |   6 | BadPasswordTelnet  | warning  | Telnet login attempt:
bad passwo..
| auth      |   7 | BadUserLuCI        | warning  | LuCI login attempt: bad
username..
| auth      |   8 | BadPasswordLuCI    | warning  | LuCI login attempt: bad
password..
| auth      |   9 | LoginSSH           | notice   | SSH login: user %{p2}
from %{p3}
| auth      |  10 | LogoffSSH          | notice   | SSH logoff: user %{p1}
due to "%..
| auth      |  11 | LoginConsole       | notice   | Console login:
user %{p1} on %{p2}
| auth      |  12 | LogoffConsole      | notice   | Console logoff on %{p1}
| auth      |  13 | LoginTelnet        | notice   | Telnet login:
user %{p1}
| auth      |  14 | LoginLuCI          | notice   | LuCI login: user %{p1}
| auth      |  15 | ConsoleCommand     | informat | %{p1}@%{p2} %{p3}
| auth      |  16 | LuCIAction         | informat
| %{p1}@%{p2} %{p3} %{p4} %{p5}
| ipsec     |   6 | IPSecInitIKE       | informat | IPSec IKE %{p1}
established
| ipsec     |   7 | IPSecInitSA        | informat | IPSec SA %{p1}
established
| ipsec     |   8 | IPSecCloseIKE      | informat | IPSec IKE %{p1} deleted
| ipsec     |   9 | IPSecCloseSA       | informat | IPSec SA %{p1} closed
| ipsec     |  10 | IPSecDPDTimeOut    | informat | IPSec IKE %{p1} DPD
timed out
| wifi      |   1 | WiFiConnectedToAP  | notice   | WiFi %{p1} connected to
AP %{p2}
| wifi      |   1 | WiFiConnectedToAP  | notice   | WiFi %{p1} connected to
AP %{p2}
| wifi      |   2 | WiFiDisconnectedFromAP   | notice   | WiFi %{p1}
disconnected from AP
| wifi      |   2 | WiFiDisconnectedFromAP   | notice   | WiFi %{p1}
disconnected from AP
| wifi      |   3 | WiFiStationAttached      | notice   | WiFi
station %{p2} connected to ..
| wifi      |   3 | WiFiStationAttached      | notice   | WiFi
```

```
station %{p2} connected to ..
| wifi      |   4 | WiFiStationDetached      | notice   | WiFi
station %{p2} disconnected ..
| wifi      |   4 | WiFiStationDetached      | notice   | WiFi
station %{p2} disconnected ..
| wifi      |   5 | WiFiStationAttachFailed  | notice   | WiFi
station %{p2} failed to con..
| wifi      |   5 | WiFiStationAttachFailed  | notice   | WiFi
station %{p2} failed to con..
| ppp       |   1 | LinkUp                   | informat | PPP for
interface %{p2} (protoco..
| ppp       |   2 | LinkDown                 | informat | PPP for
interface %{p2} (protoco..
| ppp       |   3 | ConnEstablished          | informat | PPP connection
for interface %{p..
| adsl      |   1 | LinkUp                   | notice   | ADSL trained.
Starting interface..
| adsl      |   2 | LinkDown                 | notice   | ADSL down.
Stopping interface %{..
| adsl      |   3 | Silent                   | debug    | ADSL silent
| adsl      |   4 | Training                 | debug    | ADSL training
| adsl      |   5 | TrainingSuccess          | notice   | ADSL training
successful: data ..
| system    |   1 | BootSuccess     | informat | Success booting into %{p1}
| system    |   2 | DigitalInputChange       | notice   | Digital
Input %{p1} changed valu..
| ntp       |   1 | InitialSync              | notice   | Initial NTP sync:
time: %{p1}; o..
| ntp       |   2 | Adjust          | informat | NTP adjust by %{p1}
| ntp       |   3 | QueryTimeout    | warning  | NTP query to %{p1} timed
out. Ne..
| ntp       |   4 | QueryFailed     | warning  | NTP query failed: %{p1}
```

44 Configuring data usage monitor

44.1 Introduction

Virtual Access software provides support for monitoring of data usage on mobile interfaces and to disable if the monthly limit is exceeded. This allows an element of control over data usage for SIMs with a limited data plan.

DISCLAIMER: data usage statistics calculated by Virtual Access data usage feature are best estimates and may vary from the mobile carrier statistics that are used for billing. Virtual Access cannot be held liable for any fees charged by the carrier to the customer for their data usage. We recommend that the configured data usage is lower than the allowance and that traffic percentage alerts are used.

44.2 Configuration package used

Package	Sections
procrustes	limit

44.3 Configuring data usage using the web interface

Select **Services -> Data Usage**. The Data Usage page appears.

You can monitor interfaces as a collective group, so enter a name for the group and select **Add**. The examples below show a group name configured as 'wan'.

You can configure multiple groups.

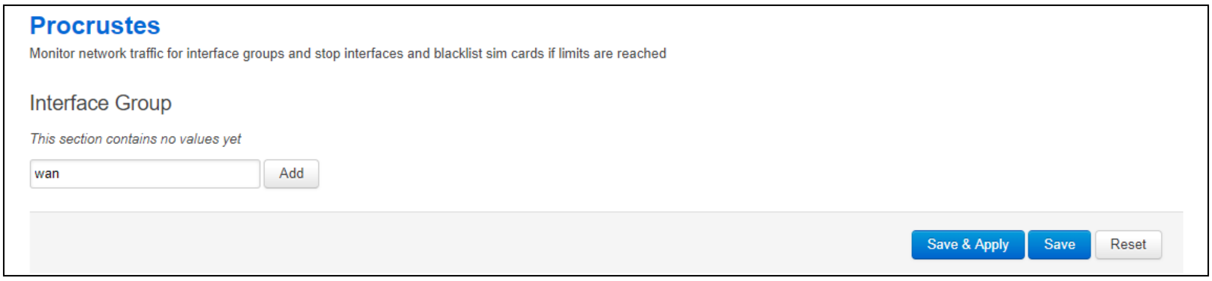

Figure 220: The data usage page

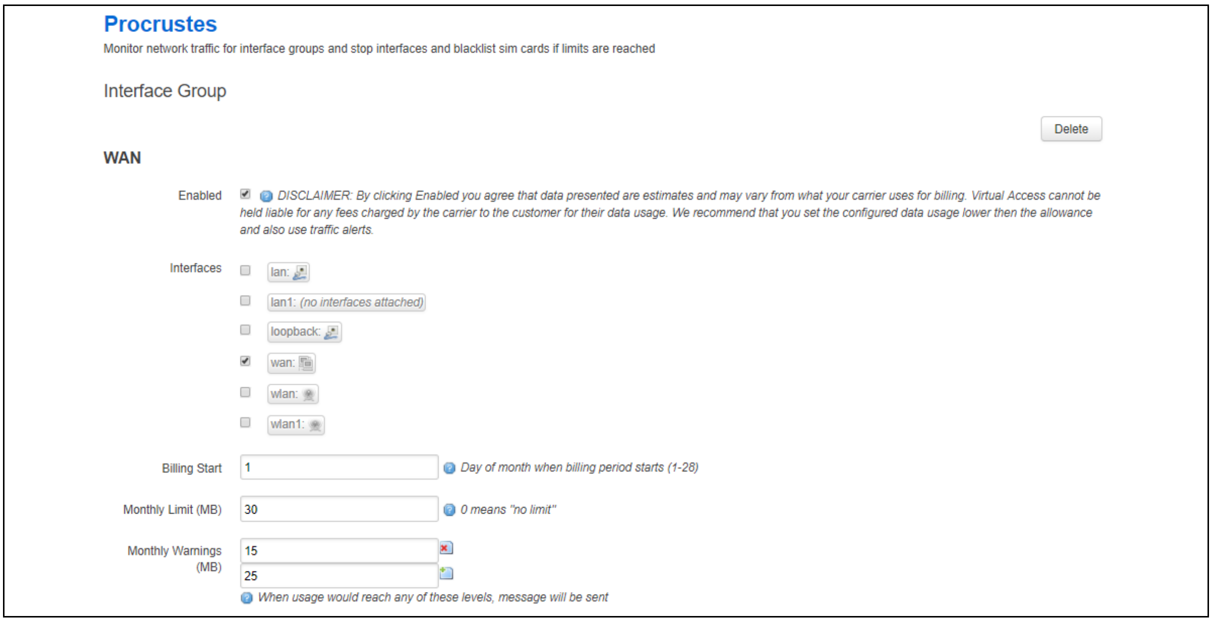

Figure 221: The data usage configuration page

Web Field/UCI/Package Option	Description
Web: Enabled UCI: procrustes.@limit[0].enabled Opt: enabled	Enable data usage monitor on this interface group. 0 – Disabled. 1 – Enabled.
Web: Billing Start UCI: procrustes.@limit[0].billing_period_start_day Opt: billing_period_start_day	Day of month on which the billing period starts. 1 Range – 1 – 28
Web: Interfaces UCI: procrustes.@limit[0].interfaces Opt: interfaces	Monitor and apply limits to these interfaces as a group. Configure multiple interfaces via UCI using a space separator. Example: `uci set procrustes.@limit[0].interfaces="lan wan"`
Web: Monthly Limit (MB) UCI: procrustes..@limit[0].monthly_data_limit Opt: monthly_data_limit	Defines monthly data traffic limit in megabytes (MB). This is total RX and TX on the interface. 0 – Zero means no limit. Range
Web: Monthly Warnings (MB) UCI: procrustes.@limit[0].monthly_warning_levels Opt: monthly_warning_levels	Defines data usage limits for generating a log message and a VA event alert when used traffic reaches specified levels. Levels are specified in MB. Set multiple limits via UCI using a space separator. Example: `uci set procrustes.@limit[0].monthly_warning_levels="15 25"` 0 – Zero means no limit. Range

Table 161: Information table for data usage commands

44.3.1 Configuring data usage using command line

Data usage is configured under the **procrustes** package **/etc/config/procrustes**.

By default, all limit instances are named 'limit', and are identified by `@limit` followed by the limit position in the package as a number. For example, for the first limit in the package using UCI:

```
procrustes.@limit[0]=limit
procrustes.@limit[0].enabled=1
```

Or using package options, enter:

```
config limit
      option enabled '1'
```

However, to better identify instances, it is recommended to give the limit instance a name. For example, create a limit instance named MOBILE1.

To define a named limit instance using UCI, enter:

```
procrustes.@limit[0]=wan
procrustes.wan.enabled=1
```

To define a named limit instance using package options, enter:

```
config limit 'wan'
        option enabled '1'
```

The following examples show two limit groups wan and lan.

44.3.2 Procrustes using UCI

```
root@VA_router:~# uci show procrustes
procrustes.lan=limit
procrustes.lan.enabled=1
procrustes.lan.interfaces=LAN1
procrustes.lan.billing_period_start_day=1
procrustes.lan.monthly_data_limit=30
procrustes.lan.monthly_warning_levels=15 25
procrustes.wan=limit
procrustes.wan.enabled=1
procrustes.wan.interfaces=MOBILE1
procrustes.wan.billing_period_start_day=1
procrustes.wan.monthly_data_limit=30
procrustes.wan.monthly_warning_levels=15 25
```

44.3.3 Procrustes using package options

```
root@VA_router:~# uci export procrustes
package procrustes

config limit 'lan'
        option enabled '1'
        option interfaces 'LAN1'
        option billing_period_start_day '1'
        option monthly_data_limit '30'
        option monthly_warning_levels '15 25'

config limit 'wan'
        option enabled '1'
        option interfaces 'MOBILE1'
        option billing_period_start_day '1'
        option monthly_data_limit '30'
        option monthly_warning_levels '15 25'
```

44.4 Data usage status

Select **Status -> Overview**. The Status page appears.

To check current data usage, scroll to **Network -> Data Usage (MiB)** row.

Data usage is presented as progress bar.

Figure 222: The data usage status progress bar

44.5 Data usage diagnostics

44.5.1 Syslog events

The following events can be generated in logs by the data usage feature:

Severity	**Tag**	**Text**
NOTICE	procrustes	<if_group_name>: using counter 1404674 saved on 2017-09-30 16:26:57
NOTICE	procrustes	<if_group_name>: warning level 2097152 is reached
WARNING	procrustes	<if_group_name>: hard limit 10485760 is reached

NOTICE	procrustes	Data limit on SIM <iccid> exceeded and sim will be banned until the next month
ERROR	procrustes	Could not get iccid for <ifname>
DEBUG	procrustes	Interface <ifname> is not up
WARNING	procrustes	network.<ifname>.ifname is not defined
NOTICE	procrustes	<ifname>: reached billing start. Resetting...
DEBUG	procrustes	Saving current limit values
NOTICE	procrustes	<if_group_name>: not enabled
WARNING	procrustes	<if_group_name>: defines no interfaces
DEBUG	procrustes	<if_group_name>: sim interface <ifname>
ERROR	procrustes	Daemonization failed
ERROR	procrustes	another procrustes is running. Exiting...
NOTICE	procrustes	No limits defined. Exiting...
ERROR	mobile	SIM <iccid> is blacklisted, not establishing connection

44.5.2 Viewing data usage

The router has monitoring application named **procrustatus.lua** that can be used for viewing data usage.

This application displays data statistics used for different interface groups, percentage of time left to next billing period start and percentage of data left for use before the interface will be shut down.

To view the application, enter the command `procrustes.lua`

```
root@VA_router:~# procrustatus.lua
   name    current/       max  time left  data left
   lan:    1404674/  10485760     1.03%     86.60%
   wan:     433436/   1048576     1.03%     58.66%
```

Alternatively, to check total data usage, enter:

```
root@VA_router:~# cat /var/state/procrustes
procrustes.lan.total_bytes=215780
procrustes.wan.total_bytes=433436
```

44.5.3 Addditional debugging commands

Additional useful debug commands via the command line are described in the table below.

Diagnostic Command	**Description**
logread | grep procrustes	Shows logs related to “procrustes” only
ls /root/procrustes/sim_blacklist/	Shows list of blacklisted SIM iccids

45 Configuring terminal server

45.1 Overview

Terminal server is a background application whose main task is to forward data between TCP connections or UDP streams and asynchronous or synchronous serial ports.

The terminal server application serves up to four sessions simultaneously, one for each serial port, depending on the device. Each terminal server session has an IP endpoint and an associated specific serial port.

You can configure the IP endpoint of each terminal server session to be a:

- TCP server: each session is listening on a unique port.
- TCP client: the terminal server makes a TCP connection to external TCP server.
- UDP endpoint: the terminal server forwards data between a UDP stream and a serial port.

45.2 Configuration packages used

Package	Sections
tservd	main
	port

45.3 Configuring terminal server using the web interface

In the top menu, select **Services -> Terminal Server**. The Terminal Server Configuration page appears. You must configure two main sections:

- Main Settings are to enable the terminal server, syslog settings, and to enable log setting.
- The Port Settings section is for general port settings, serial settings such as port mode, port speed, parity stip bit and so on; and finally, network settings to configure the network side of the terminal server.

45.3.1 Configure main settings

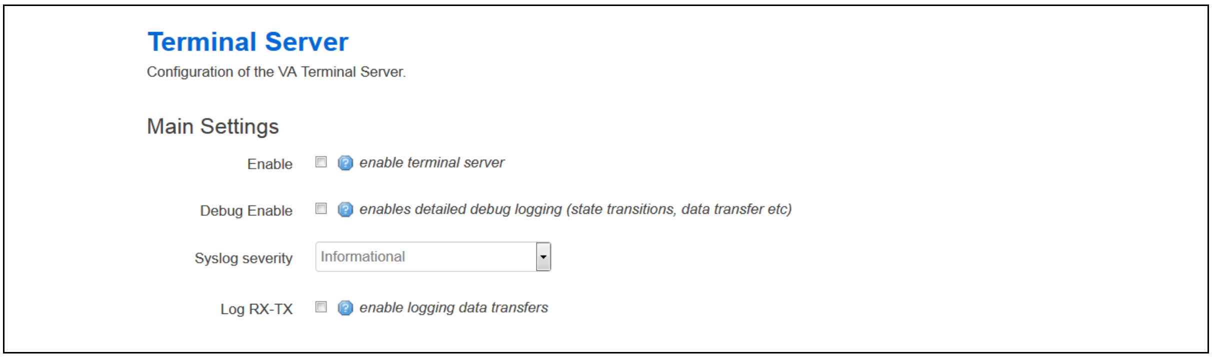

Figure 223: The terminal server main settings page

Web Field/UCI/Package Option	Description
Web: Enable UCI: tservd.main.enable Opt: enable	Enables Terminal Server on the router. 0 — Disabled. 1 — Enabled.
Web: Debug Enable UCI: tservd.main.debug_ev_enable Opt: debug_ev_enable	Enables detailed debug logging. 0 — Disabled. 1 — Enabled.
Web: Syslog severity UCI: tservd.main.log_severity Opt: log_severity	Determines the syslog level. Events up to this priority will be logged. 0 — Emergency 1 — Alert 2 — Critical 3 — Error 4 — Warning 5 — Notice 6 — Informational 7 — Debug
Web: Log RX-TX UCI: tservd.main.debug_rx_tx_enable Opt: debug_rx_tx_enable	Enables logging data transfers. 0 — Disabled. 1 — Enabled.

Table 162: Information table for main settings

45.3.2 Configure port settings

The Port Settings section is divided into 3 sub-sections:

- General
- Serial
- Network

45.3.2.1 Port settings: general section

In this section you can configure general port settings. The settings are usually the same for the central and the remote site.

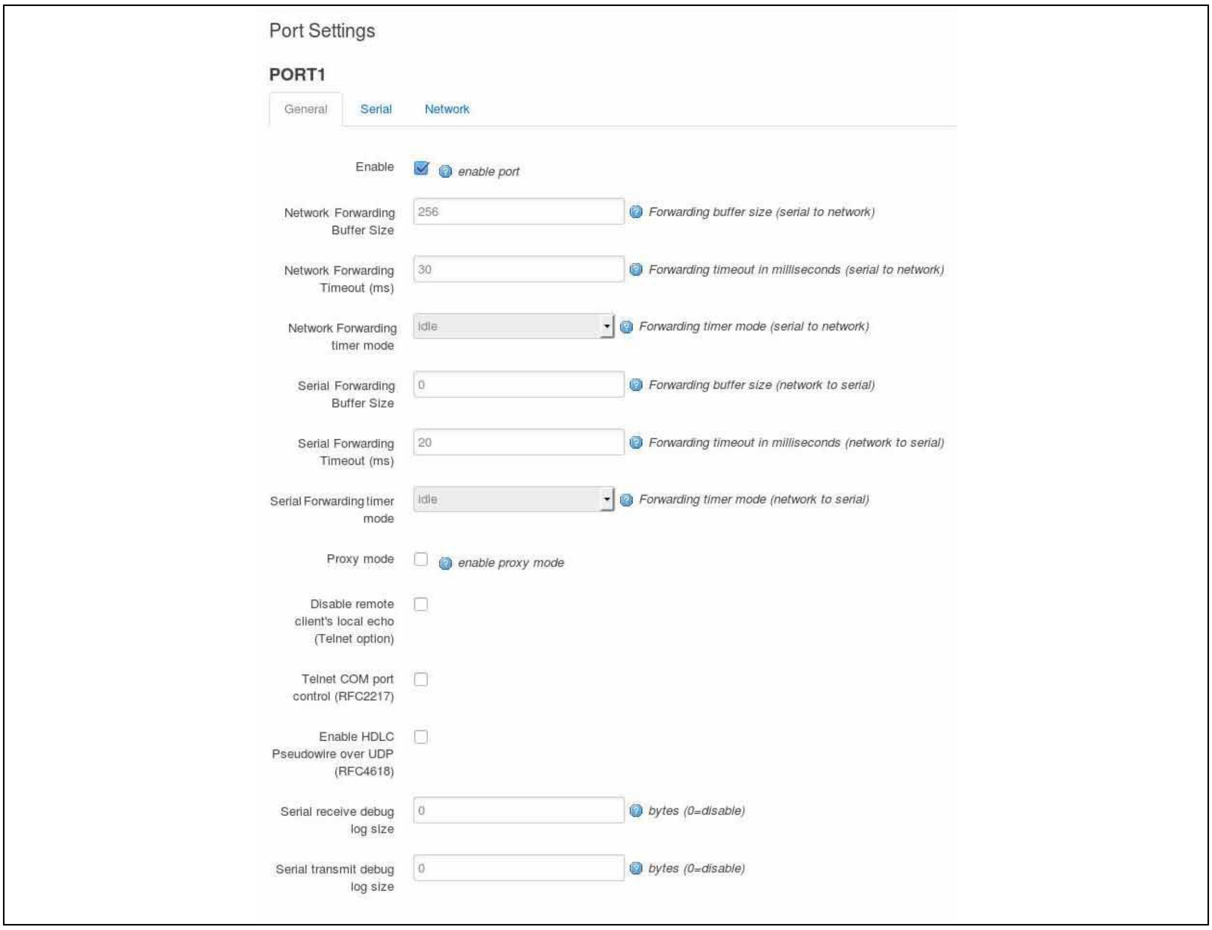

Figure 224: The general tab fields

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Enable
UCI: tservd.@port[0].enable
Opt: enable</td><td>Enables terminal server port.<table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table></td></tr>
<tr><td>Web: Network Forwarding Buffer Size
UCI: tservd.@port[0].fwd_buffer_size
Opt: fwd_buffer_size</td><td>Forwarding buffer size in bytes (serial to network).<table><tr><td>256</td><td>256 bytes</td></tr><tr><td>Range</td><td>0-2048</td></tr></table></td></tr>
<tr><td>Web: Network Forwarding Timeout(ms)
UCI: tservd.@port[0].fwd_timeout
Opt: fwd_timeout</td><td>Forwarding timeout in milliseconds (serial to network).<table><tr><td>30</td><td>30 ms</td></tr><tr><td>Range</td><td>0-10000</td></tr></table></td></tr>
<tr><td>Web: Network Forwarding Timer Mode
UCI: tservd.@port[0].fwd_timer_mode
Opt: fwd_timer_mode</td><td>Forwarding timer mode (serial to network).<table><tr><td>Idle</td><td>Timer is re-started on each received data.</td></tr><tr><td>Aging</td><td>Timer started on the first Rx.</td></tr></table></td></tr>
<tr><td>Web: Serial Forwarding Buffer Size
UCI: tservd.@port[0].sfwd_buffer_size
Opt: sfwd_buffer_size</td><td>Forwarding buffer size in bytes (network to serial).
Set to 0 to use maximum possible network Rx buffer size.<table><tr><td>0</td><td>2048 bytes</td></tr><tr><td>Range</td><td>0-2048</td></tr></table></td></tr>
<tr><td>Web: Serial Forwarding Timeout (ms)
UCI: tservd.@port[0].sfwd_timeout
Opt: sfwd_timeout</td><td>Forwarding timeout in milliseconds (network to serial).
Set to 0 to forward to serial immediately.<table><tr><td>20</td><td>20 ms</td></tr><tr><td>Range</td><td>0-10000</td></tr></table></td></tr>
</table>

Web: Serial Forwarding Timer Mode UCI: tservd.@port[0].sfwd_timer_mode Opt: sfwd_timer_mode	Forwarding timer mode (network to serial). Idle: Timer is restarted on each received data Aging: Timer started on the first Rx.
Web: Proxy Mode UCI: tservd.@port[0].proxy_mode Opt: proxy_mode	Defines if a special proxy mode should be configured to allow ‘hijacking’ of the terminal server. It allows a connection to be made from a remote location and redirect terminal server data temporarily for troubleshooting. When enabled, a TCP proxy server is started which listens for an incoming TCP connection from a remote peer. Once an incoming new TCP connection on the proxy server TCP port is accepted: The existing terminal server TCP client connection is disconnected. The terminal server automatically reconnects the TCP client side but this time to the local loopback address 127.0.0.1 and to the local proxies TCP port number. When the proxy server has both local and remote TCP sessions connected it simply forwards the data between the two connections, taking into account the flow control. When either side TCP socket closes, the main terminal server client reconnects to the normal IP destination and the server proxy returns to listening for another connection from the far end. 0: Disabled. 1: Enabled.
Web: Disable Remote Client’s Local Echo (Telnet option) UCI: tservd.@port[0].disable_echo Opt: disable_echo	Set to **1** to send IAC WILL ECHO Telnet option to remote client forcing it to disable local echo. For server mode only. 0: Disabled. 1: Enabled.
Web: Telnet COM Port Control UCI: tservd.@port[0].com_port_control Opt: com_port_control	Set to **1** to enable support for Telnet COM port control (RFC2217). 0: Disabled. 1: Enabled.
Web: Enable HDLC Pseudowire over UDP (RFC4618) UCI: tservd.@port[0].hdlc_pw_enabled Opt: hdlc_pw_enabled	Set to **1** to enable HDLC pseudowire over UDP support based on RFC4618. Requires Transport Mode (udpmode) to be enabled. 0: Disabled. 1: Enabled.
Web: Serial Receive Debug Log Size UCI: tservd.@port[0].serialRxLogSize Opt: serialRxLogSize	Configures serial receive log size in bytes and enables receive data logging. 0: Disabled. 1: Enabled.
Web: Serial Transmit Debug Log Size UCI: tservd.@port[0].serialTxLogSize Opt: serialTxLogSize	Configures serial transmit log size in bytes and enables transmit data logging. 0: Disabled. 1: Enabled.

Table 163: Information table for port settings section

45.3.2.2 Port settings: serial section

In this section you can configure serial interface settings, such as port mode, port speed, parity stip bit and so on.

Note:

- The displayed settings vary depending on options selected.
- DTR <--> DSR signalling is not available on GW2028 router models.

The figure below shows the options available if you have selected RS232 mode.

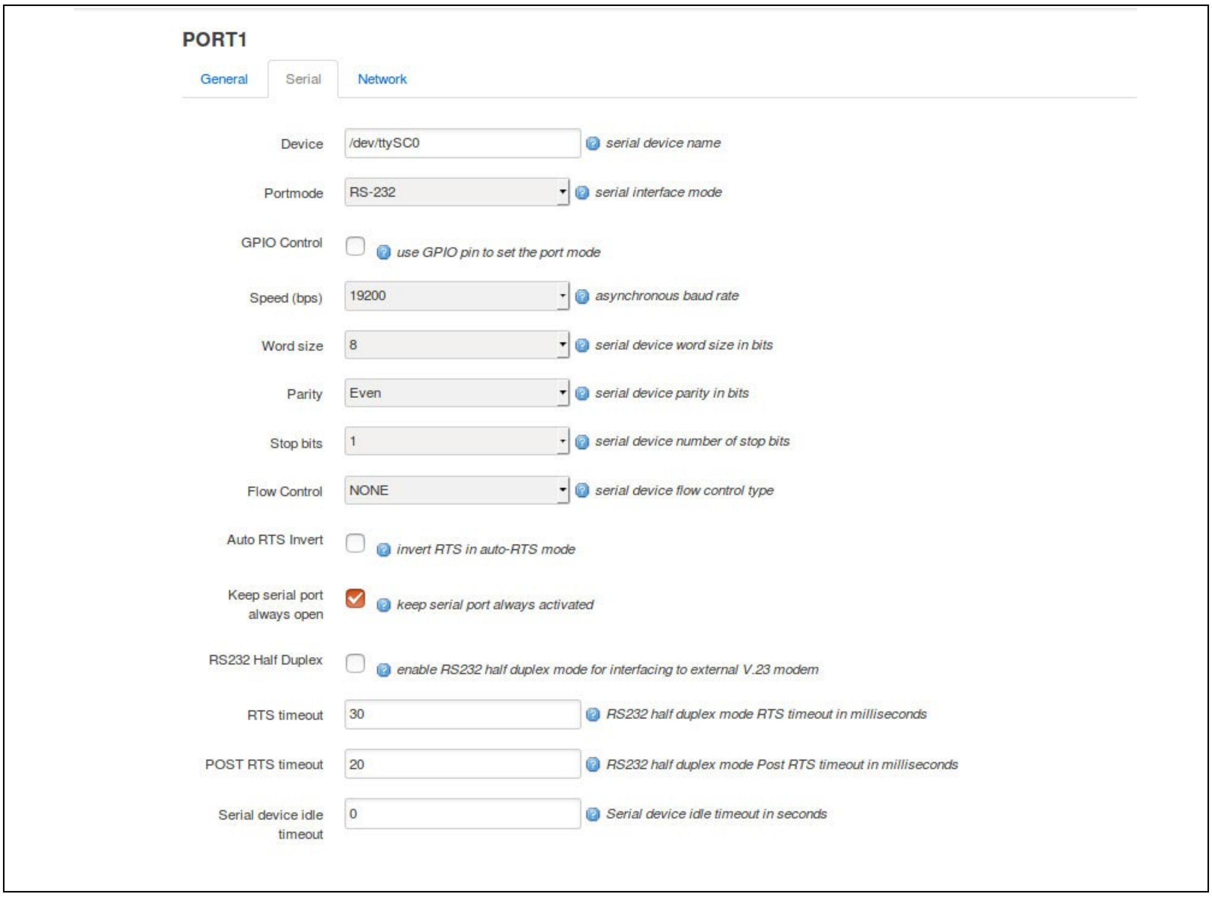

Figure 225: The serial section fields (port mode RS232)

The figure below shows the options available if you have selected RS485 mode.

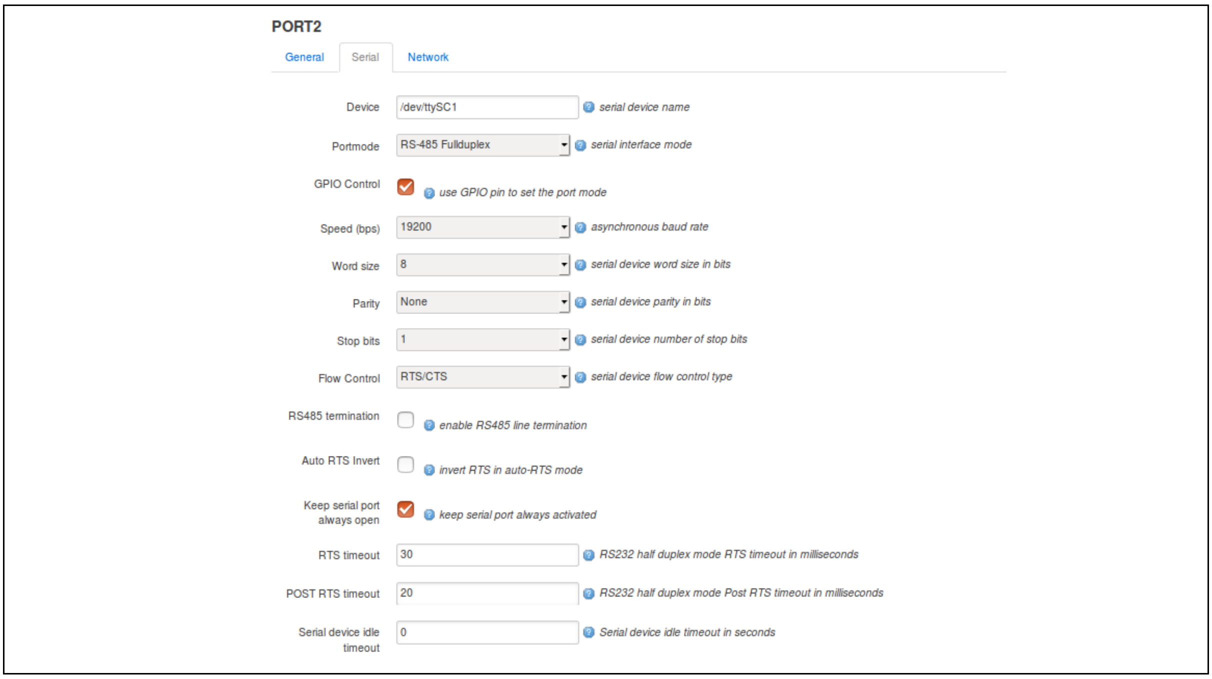

Figure 226: The serial section fields (port mode RS485)

The figure below shows the options available if you have selected X.21 mode.

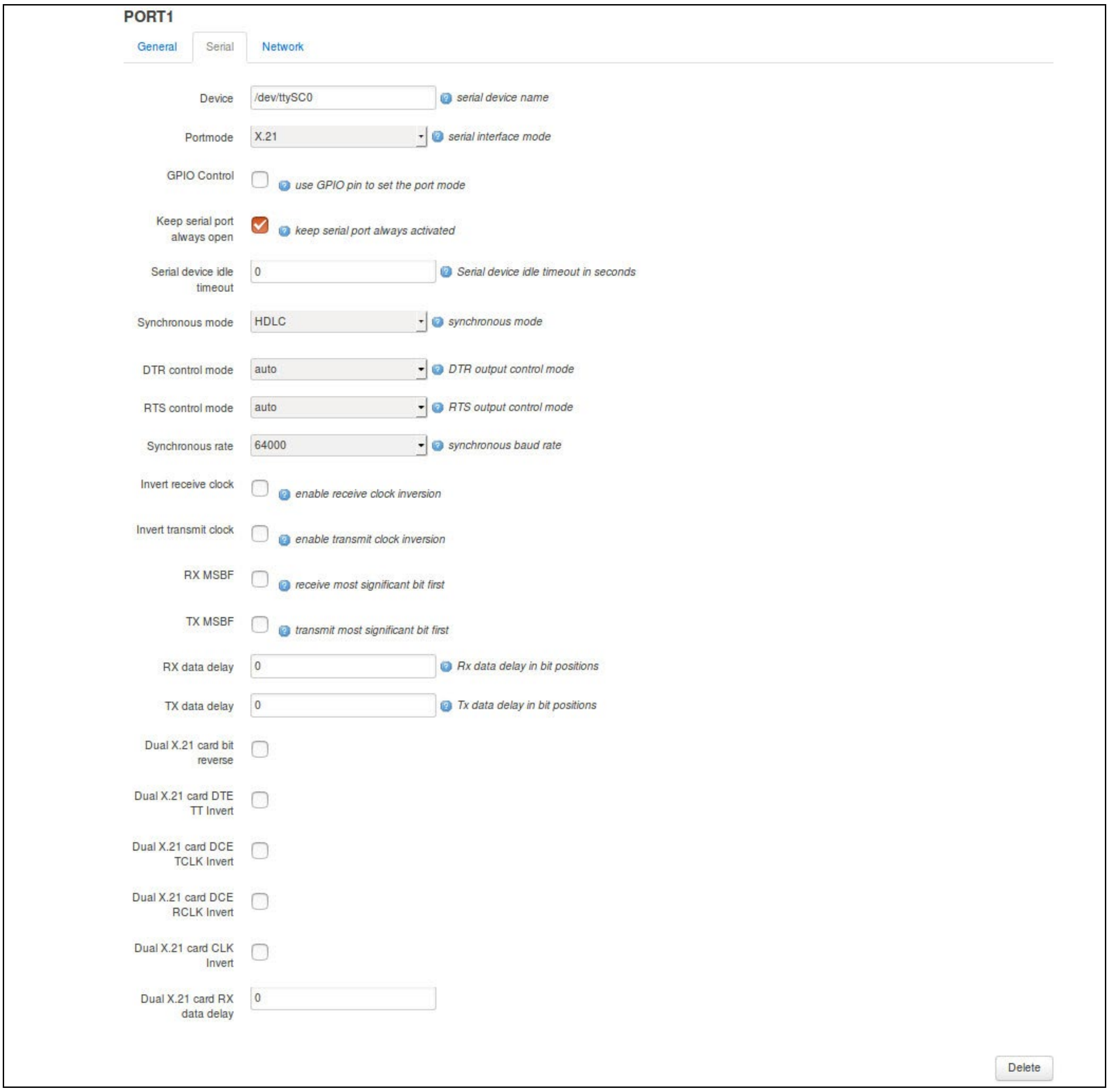

Figure 227: The serial section fields (port mode X.21)

<table>
<tr><th>Web Field/UCI/Package Option</th><th>Description</th></tr>
<tr><td>Web: Device
UCI: tservd.@port[0].devName
Opt: devName</td><td>Serial device name.<table><tr><td>/dev/ttySC0</td><td>serial port 1</td></tr><tr><td>/dev/ttySC1</td><td>serial port 2</td></tr><tr><td>/dev/ttySC2</td><td>serial port 3</td></tr><tr><td>/dev/ttySC3</td><td>serial port 4</td></tr></table></td></tr>
<tr><td>Web: Port mode
UCI: tservd.@port[0].port_mode
Opt: port_mode</td><td>Sets the serial interface mode.<table><tr><td>rs232</td><td>RS232 mode.</td></tr><tr><td>rs485hdx</td><td>RS485 2-wire half-duplex mode in which the transmitter drives the RTS.</td></tr><tr><td>rs485fdx</td><td>RS485 4-wire full-duplex mode.</td></tr><tr><td>v23</td><td>Uses V.23 leased line card driver.</td></tr><tr><td>x21</td><td>Uses USB serial card in sync mode.</td></tr></table></td></tr>
</table>

Web: GPIO Control UCI: tservd.@port[1].serial_mode)gpio_control Opt: serial_mode_gpio_control	Enables or disables software control of the port mode between RS232 and RS485. Applies only to port 1 (ttySC1) and not to port 0. **Note**: the port mode is set with the option port mode described above. 0: Port mode is configured by hardware settings and is not user configurable. Set to **0** for port 0. 1: Enabled. Port mode is configurable by software settings. This is applicable to serial port 1 on devices that are capable of RS485.
Web: Speed (bps) UCI: tservd.@port[0].speed Opt: speed	Serial device speed in baud (bps). 9600 Range: 115200; 57600; 38400; 19200; 9600 4800; 2400; 1800; 1200; 600; 300; 200; 150; 134; 110; 75; 50
Web: Word size UCI: tservd.@port[0].wsize Opt: wsize	Serial device word size. 8 Range: 5-8
Web: Parity UCI: tservd.@port[0].parity Opt: parity	Serial device parity. 0: None 1: Even 2: Odd 3: Space
Web: Stop Bits UCI: tservd.@port[0].stops Opt: stops	Serial device number of stop bits. 1 Range: 1-2
Web: Flow Control UCI: tservd.@port[0].fc_mode Opt: fc_mode	Serial flow control mode. 0: None 1: RTS/CTS 2: XON/XOFF
Web: RS485 Termination UCI: tservd.@port[0].rs485_line_termination Opt: rs485_line_termination	Enables or disables RS485 termination. Applies only if port mode is set to RS485. 0: Disabled. 1: Enabled.
Web: Auto RTS Invert UCI: tservd.@port[0].rtsinvert Opt: rtsinvert	Invert RTS in auto-RTS mode, if port mode is set to RS485. 0: Disabled. 1: Enabled.
Web: Keep Serial Port Always Open UCI: tservd.@port[0].tty_always_open Opt: tty_always_open	Keep serial port always open. 0: Disabled. 1: Enabled.
Web: RS232 Half Duplex UCI: tservd.@port[0].hd_mode Opt: hd_mode	Defines whether to enable special mode in the asynchronous serial driver for communication to an externally connected V.23 half-duplex modem. **Note**: this setting does not enable half-duplex mode in the serial hardware of the router. 0: Full-duplex mode. 1: Half-duplex mode.
Web: RTS Timeout UCI: tservd.@port[0].rts_timeout Opt: rts_timeout	In RS232 half-duplex mode, time in milliseconds between raising RTS and enabling the transmitter. For use with an externally connected V.23 modem. 30: 30ms Range:

<table>
<tr><td>Web: POST RTS Timeout
UCI: tservd.@port[0].post_rts_timeout
Opt: post_rts_timeout</td><td>In RS232 half-duplex mode, sets the time in milliseconds between dropping RTS (transmission finished) and enabling the receiver. For use with externally connected V.23 modem.<table><tr><td>20</td><td>20 ms</td></tr><tr><td>Range</td><td></td></tr></table></td></tr>
<tr><td>Web: Synchronous mode
UCI: tservd.@port[0].sync mode
Opt: sync mode</td><td>Defines synchronous frame mode. This setting is only displayed if an Atmel USB serial card is enabled.<table><tr><td>hdlc</td><td>HDLC frame mode.</td></tr><tr><td>transp</td><td>Transparent mode.</td></tr></table></td></tr>
<tr><td>Web: Use CRC32
UCI: tservd.@port[0].sync_crc32
Opt: sync_crc32</td><td>Defines whether to use CRC32 or CRC16 in HDLC mode. This setting is only displayed if an Atmel USB serial card is enabled.<table><tr><td>0</td><td>Use CRC16.</td></tr><tr><td>1</td><td>Use CRC32.</td></tr></table></td></tr>
<tr><td>Web: DTR control mode
UCI: tservd.@port[0].dtr_control_mode
Opt: dtr_control_mode</td><td>Defines DTR line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21.<table><tr><td>auto</td><td>DTR set to On when port is open; Off when the port is closed.</td></tr><tr><td>on</td><td>DTR always on.</td></tr><tr><td>off</td><td>DTR always off.</td></tr><tr><td>app</td><td>DTR controlled by the application.</td></tr><tr><td>ontx</td><td>In HDLC mode DTR is on during frame transmission.</td></tr></table></td></tr>
<tr><td>Web: RTS control mode
UCI: tservd.@port[0].rts_control_mode
Opt: rts_control_mode</td><td>Defines RTS line control modes. Only displayed if an Atmel USB serial card is enabled and port mode is X21.<table><tr><td>auto</td><td>RTS set to On when port is open; Off when the port is closed.</td></tr><tr><td>on</td><td>RTS always on.</td></tr><tr><td>off</td><td>RTS always off.</td></tr><tr><td>app</td><td>RTS controlled by the application.</td></tr><tr><td>ontx</td><td>In HDLC mode RTS is on during frame transmission.</td></tr></table></td></tr>
<tr><td>Web: Synchronous rate
UCI: tservd.@port[0].sync_speed
Opt: sync_speed</td><td>Defines the synchronous speed in bps. Set to 0 for external clock. If not set to 0, an internal clock is used. This setting is only displayed if an Atmel USB serial card is enabled.<table><tr><td>64000</td><td>64 kbps</td></tr><tr><td>Range</td><td>2048000; 1024000; 768000; 512000; 384000; 256000; 128000; 19200; 9600</td></tr></table></td></tr>
<tr><td>Web: Invert receive clock
UCI: tservd.@port[0].sync_invert_rxclk
Opt: sync_invert_rxclk</td><td>Defines receive clock inversion. Normal clock data is sampled on falling edge. Inverted clock data is sampled on rising edge. This setting is only displayed if an Atmel USB serial card is enabled.<table><tr><td>0</td><td>Normal.</td></tr><tr><td>1</td><td>Invert.</td></tr></table></td></tr>
<tr><td>Web: Invert transmit clock
UCI: tservd.@port[0].sync_invert_txclk
Opt: sync_invert_txclk</td><td>Defines transmit clock inversion. Normal clock data transmitted on falling edge. Inverted clock data transmitted on rising edge. Only displayed if an Atmel USB serial card is enabled.<table><tr><td>0</td><td>Normal.</td></tr><tr><td>1</td><td>Invert.</td></tr></table></td></tr>
<tr><td>Web: RX MSBF
UCI: tservd.@port[0].sync_rx_msbf
Opt: sync_rx_msbf</td><td>Defines whether most significant bit is received first. This setting is only displayed if an Atmel USB serial card is enabled.<table><tr><td>0</td><td>Receive least significant bit first.</td></tr><tr><td>1</td><td>Receive most significant bit first.</td></tr></table></td></tr>
<tr><td>Web: TX MSBF
UCI: tservd.@port[0].sync_tx_msbf
Opt: sync_tx_msbf</td><td>Defines whether most significant bit is transmitted first. This setting is only displayed if an Atmel USB serial card is enabled.<table><tr><td>0</td><td>Transmit least significant bit first.</td></tr><tr><td>1</td><td>Transmit most significant bit first.</td></tr></table></td></tr>
</table>

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Web: RX data delay UCI: tservd.@port[0].sync_rxdata_dly Opt: sync_rxdata_dly	Defines the number of bit positions to delay sampling data from the detecting clock edge. This setting is only displayed if an Atmel USB serial card is enabled. 0 | Range |
Web: TX data delay UCI: tservd.@port[0].sync_txdata_dly Opt: sync_txdata_dly	Defines the number of bit positions to delay the output of data from the detecting clock edge. This setting is only displayed if an Atmel USB serial card is enabled. 0 | Range |
Web: Dual X.21 card bit reverse UCI: tservd.@port[0].bit_reverse Opt: bit_reverse	Enables bit reversal of all bits in 8 byte word during transmission. 0 | Normal. 1 | Reverse.
Web: Dual X.21 card DTE TT Invert UCI: tservd.@port[0].dte_tt_inv Opt: dte_tt_inv	Enables X.21 TT clock signal inversion. 0 | Normal. 1 | Invert.
Web: Dual X.21 card DCE TCLK Invert UCI: tservd.@port[0].dce_tclk_inv Opt: dce_tclk_inv	Enables X.21 DCE TCLK signal inversion. 0 | Normal. 1 | Invert.
Web: Dual X.21 card DCE RCLK Invert UCI: tservd.@port[0].dce_rclk_inv Opt: dce_rclk_inv	Enables X.21 DCE RCLK signal inversion. 0 | Normal. 1 | Invert.
Web: Dual X.21 card CLK Invert UCI: tservd.@port[0].x21_clk_invert Opt: x21_clk_invert	Enables X.21 DCE CLK signal inversion. 0 | Normal. 1 | Invert.
Web: Dual X.21 card RX data delay UCI: tservd.@port[0] x21_data_delay Opt: x21_data_delay	Sets X.21 card RX data delay in number of bit positions. 0 | Range | 0 – 7
Web: n/a UCI: tservd.@port[0].sync_tx_idle Opt: sync_tx_idle	Defines the value of idle character (decimal) to transmit in case of transmit underrun. In HDLC mode, this configures inter-frame fill. 0 | Transmit 0 (in HDLC mode) 126 | Transmit flags (in HDLC mode) 255 | Transmit 1 (in HDLC mode) Range | 0 – 255
Web: n/a UCI: tservd.@port[0].v23_inband_carrier_signalling Opt: v23_inband_carrier_signalling	Enables signalling of carrier by sending special characters. 0 | Disabled. 1 | Enabled.
Web: n/a UCI: tservd.@port[0].v23_inband_carrier_on_char Opt: v23_inband_carrier_on_char	Defines the character decimal to signal remote carrier on. 255 | Range | 0 - 255
Web: n/a UCI: tservd.@port[0].v23_tx_gain Opt: v23_tx_gain	Defines the transmit gain for v23 mode. 2 | Transmit samples multiplied by 2 Range |
Web: n/a UCI: tservd.@port[0].v23_rx_loss Opt: v23_rx_loss	Defines the receive loss for v23 mode. 1 | Receive samples divided by 1. Range |
Web: n/a UCI: tservd.@port[0].v23_rts_to_cts_delay Opt: v23_rts_to_cts_delay	Defines the v23 modem RTS to CTS delay in milliseconds. 20 | Range |

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Web: n/a UCI: tservd.@port[0].v23_is_four_wire Opt: v23_is_four_wire	Defines the V23 modem LIM operation. 0 : 2-wire 1 : 4-wire
Web: n/a UCI: tservd.@port[0].v23_tx_timeout Opt: v23_tx_timeout	Defines the V23 modem receive echo suppression timeout in milliseconds. 20 Range
Web: n/a UCI: tservd.@port[0].v23_tx_rampdown Opt: v23_tx_rampdown	Defines the time, in milliseconds, it takes the V23 transmitter to rampdown carrier from peak to zero. 30 Range
Web: n/a UCI: tservd.@port[0].v23_tx_maxfill Opt: v23_tx_maxfill	Defines the maximum transmit queue fill level in bytes. 127 Range : 0 - 255

Table 164: Information table for port settings serial section

45.3.2.3 Port settings: network section

In this section you can configure the network side of the terminal server.

Note: the displayed settings vary depending on options selected.

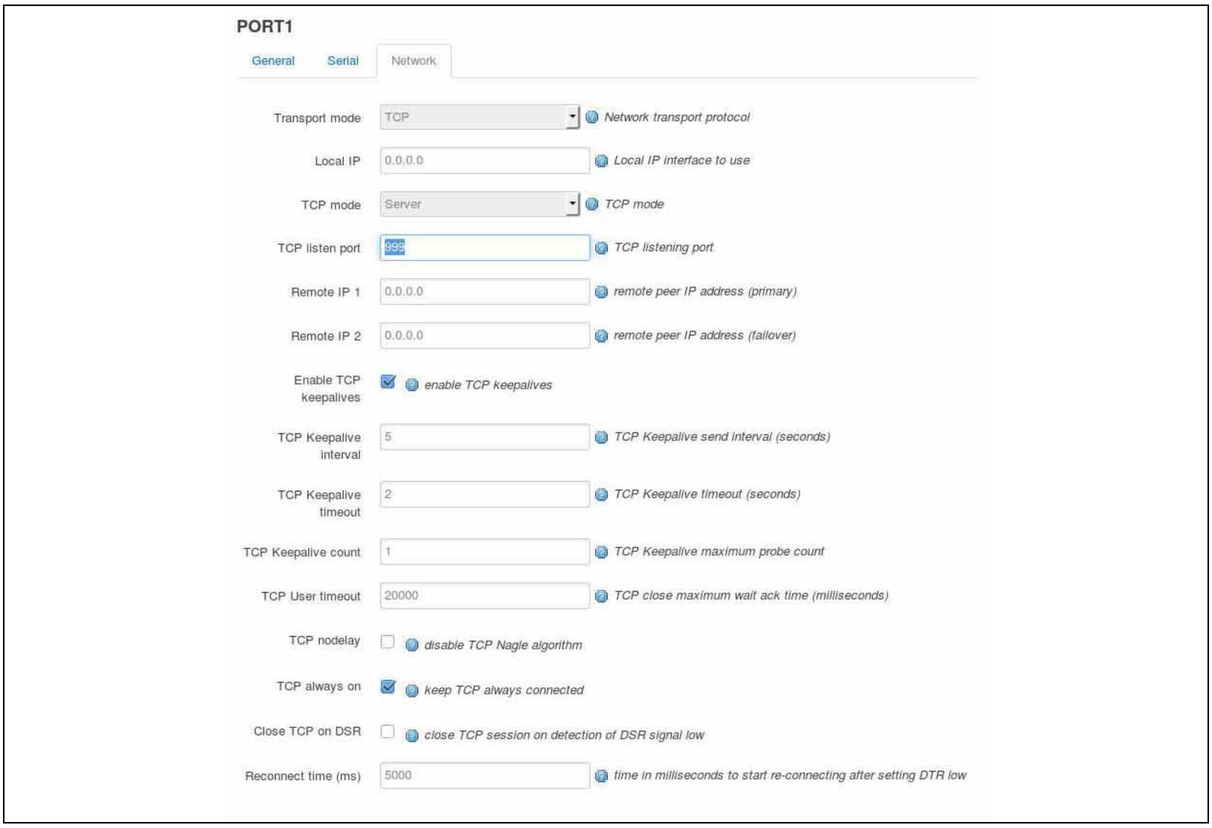

Figure 228: The port settings network fields (TCP server mode)

Web Field/UCI/Package Option	Description
Web: Transport Mode UCI: tservd.@port[0].udpMode Opt: udpMode	Selects the transport mode. 0 : TCP 1 : UDP

Web: Local IP UCI: tservd.@port[0].local_ip Opt: local_ip	Sets the local IP address to listen on. 0.0.0.0 — Listen on any interface. Range — IPv4 address.
Web: TCP Mode UCI: tservd.@port[0].server_mode Opt: server_mode	Select between server and client modes of TCP. Only displayed if Transport Mode is TCP. 0 — Client Mode. 1 — Server Mode.
Web: TCP Listen Port UCI: tservd.@port[0].listen_port Opt: listen_port	Sets the TCP listen port for server mode. Only displayed if transport mode is TCP and server mode is enabled. 999 Range — 1 - 65535
Web: Remote TCP Port 1 UCI: tservd.@port[0].ip_port1 Opt: ip_port1	Destination peer port IP 1 number. Only displayed if client mode is enabled. 951 Range — 1 - 65535
Web: Remote TCP Port 2 UCI: tservd.@port[0].ip_port2 Opt: ip_port2	Destination peer port IP 2 number for failover. Only displayed if client mode is enabled. 951 Range — 1 - 65535
Web: Remote IP 1 UCI: tservd.@port[0].remote_ip1 Opt: remote_ip1	Destination peer IP 1 address. 0.0.0.0 Range — IPv4 address.
Web: Remote IP 2 UCI: tservd.@port[0].remote_ip2 Opt: remote_ip2	Destination peer IP 2 address for failover. 0.0.0.0 Range — IPv4 address.
Web: Enable TCP Keepalives UCI: tservd.@port[0].tcp_keepalives_enabled Opt: tcp_keepalives_enabled	Enables or disables TCP keepalives. Only displayed if transport mode is TCP. 0 — Disabled. 1 — Enabled.
Web: TCP Keepalive Interval UCI: tservd.@port[0].tcp_keepalive_interval Opt: tcp_keepalive_interval	Interval in seconds between TCP keepalive probes. Only displayed if transport mode is TCP. 5 — 5 seconds. Range — 0-65535
Web: TCP Keepalive Timeout UCI: tservd.@port[0].tcp_keepalive_timeout Opt: tcp_keepalive_timeout	Time in seconds to wait for response to a TCP keepalive probe. Only displayed if transport mode is TCP. 2 — 2 seconds. Range — 0-65535
Web: TCP Keepalive Count UCI: tservd.@port[0].tcp_keepalive_count Opt: tcp_keepalive_count	Number of TCP keepalive probes to send before connection is closed. Only displayed if transport mode is TCP. 1 Range — 0-65535
Web: TCP User Timeout UCI: tservd.@port[0].tcp_user_timeout Opt: tcp_user_timeout	Maximum time in milliseconds for TCP to wait for transmitted data to be ‘acked’ before closing connection in established state. Set to **0** to use kernel defaults. Only displayed if transport mode is TCP. 20000 — 20 seconds. Range — 0-65535
Web: TCP Nodelay UCI: tservd.@port[0].tcp_nodelay Opt: tcp_nodelay	Sets TCP to delay behaviour. Only displayed if transport mode is TCP. 0 — Normal operation. 1 — Disable TCP Nagle algorithm. Only displayed if transport mode is TCP.

Web: TCP Always on UCI: tservd.@port[0].tcp_always_on Opt: tcp_always_on	Keep TCP session always connected. Only displayed if transport mode is TCP and client mode is enabled. 0: Disabled. TCP connection/UDP session is initiated on detecting high state on the DSR interface signal. 1: Enabled. If it disconnects in the established state the TCP connection/UDP session is re-initiated.
Web: Close TCP on DSR UCI: tservd.@port[0].close_tcp_on_dsr Opt: close_tcp_on_dsr	Close TCP session on detection of DSR signal low. Only displayed if Transport Mode is TCP and client mode is enabled. 0: Disabled. Detecting DSR down does not affect the TCP connection. 1: Enabled. Detecting DSR down closes the established TCP connection.
Web: Reconnect Time (ms) UCI: tservd.@port[0].disc_time_ms Opt: disc_time_ms	Time in milliseconds to start reconnecting after setting DTR low. 5000: 5 seconds. Range: 0 – 10000
Web: UDP Keepalive Interval UCI: tservd.@port[0].udpKaIntervalMs Opt: udpKaIntervalMs	Defines time in milliseconds to send UDP keepalives (empty UDP packets) when no data to send. Only displayed if transport mode is UDP. 0: Disabled. Range: 0-65535
Web: UDP Keepalive Count UCI: tservd.@port[0].udpKaCount Opt: udpKaCount	Defines the maximum number of remote UDP keepalives not received before UDP stream is considered broken. Only displayed if transport mode is UDP. 3 Range: 0-65535
Web: local UDP Port UCI: tservd.@port[0].udpLocalPort Opt: udpLocalPort	Local UDP port used by terminal server. Only displayed if transport mode is UDP. 0 Range: 0-65535
Web: remote UDP Port UCI: tservd.@port[0].udpRemotePort Opt: udpRemotePort	Remote UDP port used by terminal server. Only displayed if transport mode is UDP. 0 Range: 0-65535

Table 165: Information table for port settings network section

45.4 Configuring terminal server using UCI

```
root@VA_router:~# uci show tservd
tservd.main=tservd
tservd.main.log_severity=0
tservd.main.debug_rx_tx_enable=1
tservd.main.debug_ev_enable=1
tservd.@port[0]=port
tservd.@port[0].devName=/dev/ttySC0
tservd.@port[0].remote_ip1=0.0.0.0
tservd.@port[0].remote_ip2=0.0.0.0
```

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45.5 Configuring terminal server using package options

```
root@VA_router:~# uci export tservd
package tservd

config tservd 'main'
        option log_severity '0'
        option debug_rx_tx_enable '1'
        option debug_ev_enable '1'

config port
        option devName '/dev/ttySC0'
        option remote_ip1 '0.0.0.0'
        option remote_ip2 '0.0.0.0'
```

45.6 Configuring terminal server DSR signal management network

On the IP network side, the terminal server can operate in one of three modes:

- TCP Client
- TCP Server
- UDP

Based on the chosen network configuration, the DSR behaviour may vary.

45.6.1 DSR signal behaviour in TCP client mode

45.6.1.1 TCP connection management

Initial TCP connection initiation or next TCP connection initiation after disconnection is affected by configuration options `tcp_always_on` and `close_tcp_on_dsr`.

When option `tcp_always_on` is enabled terminal server keeps the TCP session always connected. If it disconnects in the established state, the TCP session is reinitiated.

If `tcp_always_on` is disabled TCP connection is initiated on detection of a high state on the DSP interface signal.

When option `close_tcp_on_dsr` is enabled terminal server detecting DSR down signal and closes the established TCP connection.

If option `close_tcp_on_dsr` is disabled then detecting DSR down does not affect the TCP connection.

45.6.1.2 TCP connection initiation at startup

If you have set option `tcp_always_on1`, or DSR state is UP, the TCP connection setup is initiated immediately.

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If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal. When DSR UP is detected, the TCP connection is initiated.

45.6.1.3 TCP connection clearing

The TCP connection is cleared either by the network or by the terminal server application itself.

The TCP connection is cleared by the terminal server when it detects DSR interface signal DOWN and option `close_tcp_on dsr` is 1.

45.6.1.4 TCP connection re-initiation

After TCP connection clearing, the terminal server takes action to re-setup the TCP connection after a hand off timeout.

If you have set option `tcp_always_on1`, or DSR state is UP, the TCP connection setup is initiated.

If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal and then initiates a new TCP connection.

45.6.2 DSR signal behaviour in TCP server mode

45.6.2.1 TCP connection initiation at startup

After a short startup delay, the terminal server starts listening for an incoming TCP connection from the remote peer.

45.6.2.2 TCP connection clearing

When in a TCP connection state, the TCP connection is cleared only by the network. Serial interface signals such as DSR do not cause TCP disconnection.

45.6.2.3 TCP connection re-initiation

When a TCP session goes down in the connected state, the terminal server immediately restarts listening for a new TCP connection from a remote peer.

45.6.3 DSR signal behaviour in UDP mode

45.6.3.1 UDP session setup at startup

If you have set option `tcp_always_on1`, or DSR state is UP, the UDP session is setup immediately on startup.

If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal. When DSR UP is detected, the UDP session is setup.

45.6.3.2 UDP session clearing

A UDP session is normally never cleared, but if it is closed by the network sub-system, it gets re-setup after a hand off timeout.

A DSR signal DOWN event does not clear UDP session in the connected state.

45.6.3.3 UDP session reset

After UDP session clearing the terminal server takes action to reset up a UDP session after a hand off timeout.

If you have set option `tcp_always_on1`, or DSR state is UP, the UDP session is setup.

If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal and then it resets up the UDP session.

45.7 Serial mode GPIO control

On some models of Virtual Access routers it is possible to change the physical transmission mode between RS232 and RS485. This is only applicable to the second serial port on the routers: /dev/ttySC1.

To enable `serial_mode_gpio_control` set the option to **1**.

Use the portmode option in addition to `serial_mode_gpio_control` to select between RS232, RS485 full duplex, RS485 half duplex, X.21 and V.23.

45.7.1 Checking the current serial_mode_gpio_control

To check if terminal server is running, enter the following command:

```
root@VA_router:~# uci show tservd | grep serial_mode_gpio_control
```

The output of the above command will look similar to the example below if `serial_mode_gpio_control` is enabled for the second serial port.

```
tservd.port0.serial_mode_gpio_control=0

tservd.port1.serial_mode_gpio_control=1
```

45.8 Terminal server diagnostics

The tservd process has to be running otherwise diagnostics options for terminal server will not be available.

45.8.1 Checking the terminal server process

To check if the terminal server is running, enter:

```
root@VA_router:~# -fl tservd

 1264 root      1032 S  tservd
```

If terminal server is running it will be shown with its process ID.

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45.8.2 Terminal server statistics

To view Terminal Server statistics, enter:

```
root@VA_router:~# tserv show stats
TERMINAL 1, Dev: /dev/ttySC0
State:          LISTENING
Serial Bytes    Rx (0)  Tx (0)  TxErrs (0)
TCP Packets     Rx (0)  Tx (0)  TxErrs (0)      TxBlocked (0)
TCP Bytes       Rx (0)  Tx (0)
UDP Datagrams   Rx (0)  Tx (0)  TxErrs (0)
UDP Bytes       Rx (0)  Tx (0)
DSR             Up (0)  Down (0)
```

45.8.3 Terminal Server debug statistics

To see debug statistics about Terminal Server, enter:

```
root@VA_router:~# tserv show debug all

TERMINAL 1, Dev: /dev/ttySC0
State:          LISTENING
netRxBuf length=0 offset=0 hdrsz=0
ttyRxBuf length=0 offset=16 hdrsz=16
line_status_mask = 0x0 line_status = 0x0
RFC2217 negotiated=0
Tcp tx last error: 0
```

45.8.4 Terminal Server serial signals debugging

To see Terminal Server serial signals statistics, enter:

```
root@VA_router:~# tserv show serial

TERMINAL-1, Dev: /dev/ttySC1
DSR=0 DTR=1 RTS=1 CTS=0 CAR=0 CD=0 RNG=0 LE=0 RI=0 ST=0 SR=0

TERMINAL-2, Dev: /dev/ttySC0
DSR=0 DTR=1 RTS=1 CTS=0 CAR=0 CD=0 RNG=0 LE=0 RI=0 ST=0 SR=0
```

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45.8.5 Terminal Server advanced debugging

To view Terminal Server advanced debug commands for the terminal server, enter:

```
root@VA_router:~# tserv
=== Termserv diagnostics. Command syntax: ===
tserv show stats - show statistics
tserv clear stats - clear statistics
tserv show serial - show serial interface status
tserv send serial0 <data>- send data to serial port 0
tserv start capture N, N=port number (0 to 3) - start capturing rx serial
data
tserv print capture N, N=port number (0 to 3) - print captured rx serial
data
tserv show serial txlog-hex <Port> [length], Port=port cfg index (0 to 3),
length=length to show
tserv show serial rxlog-hex <Port> [length], Port=port cfg index (0 to 3),
length=length to show
tserv show serial txlog-asc <Port> [length], Port=port cfg index (0 to 3),
length=length to show
tserv show serial rxlog-asc <Port> [length], Port=port cfg index (0 to 3),
length=length to show
tserv show debug - show debug info
tserv start userial rxlog - start USB serial card rx log
tserv show userial rxlog <offs> <length> - show USB serial card rx log
tserv quit - terminate termserv process
```

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46 Configuring terminal package

Terminal package is used to automatically add entries for getty to inittab for extra incoming console/terminal connections.

46.1 Configuration packages used

Package	Sections
terminal	terminal

46.2 Configuring terminal package using the web interface

Terminal package is not available to configure using the web interface.

Web Field/UCI/Package Option	Description
Web: n/a UCI: terminal.console.enabled Opt: enabled	Enables Terminal on the router. 0: Disabled. 1: Enabled.
Web: n/a UCI: terminal.console.device Opt: device	String value point at the tty device in /dev folder. None: Default. <string>: Device name.(e.g. ttySC0 to use serial port 0)
Web: n/a UCI: terminal.console.speed Opt: speed	Set the speed of serial connection. 115200: Default. <range>: Supported port speed.
Web: n/a UCI: terminal.console.type Opt: type	String value represents supported terminal emulation mode. vt100: Default. <string>: Supported terminal type.
Web: n/a UCI: terminal.console.flowcontrol Opt: flowcontrol	Enables hardware flow control RTS/CTS. 0: Disabled. 1: Enabled.

Table 166: Information table for terminal settings

46.3 Configuring terminal package using UCI

```
root@VA_router:~# uci show terminal
terminal.ttySC0=terminal
terminal.ttySC0.enabled=1
terminal.ttySC0.device=ttySC0
terminal.ttySC0.speed=115200
terminal.ttySC0.type=vt100
terminal.ttySC0.flowcontrol=1
```

46.4 Configuring terminal using package options

```
root@VA_router:~# uci export terminal
package terminal


config terminal 'ttySC0'
        option enabled '0'
        option device 'ttySC0'
        option speed '115200'
        option type 'vt100'
        option flowcontrol '1'
```

46.5 Terminal diagnostics

46.5.1 Checking terminal entry in inittab

To check if terminal configuration is running, enter the following commands and confirm the line referring to the device name is present and looks similar to the last line below:

```
root@VA_router:~# cat /etc/inittab
::sysinit:/etc/init.d/rcS S boot
::shutdown:/etc/init.d/rcS K stop
ttyLTQ0::askfirst:getty -L 115200 ttyLTQ0 vt100
ttyLTQ1::askfirst:getty -L 115200 ttyLTQ1 vt100
ttySC0::respawn:getty -h -L 115200 ttySC0 vt100
```

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47 Serial interface

47.1 Overview

Many different applications and device drivers use the serial interface. You configure the serial interface using the relevant application; for example, Terminal Server; therefore there is no standalone serial configuration page.

You can monitor the various serial interfaces using either the command line or the web interface.

47.2 Monitoring serial interfaces using the web interface

In the top menu, select **Status -> Serial Interfaces**. Depending on the number of serial interfaces present on the device, a number of tabs will appear giving access to information about each interface. The information presented will also depend on the actual type of the serial interface.

47.2.1 Serial statistics

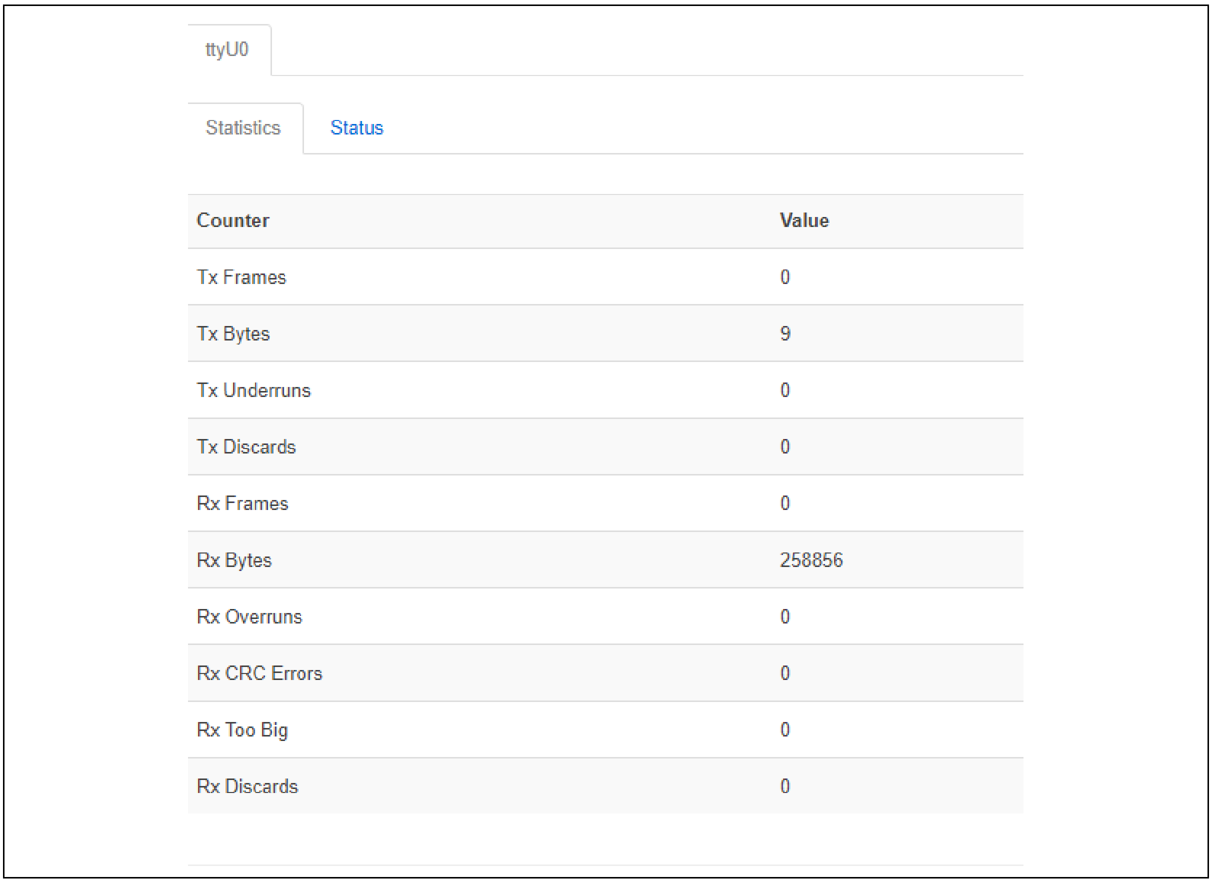

Figure 229: The serial statistics page for serial-0

47.2.2 Serial status

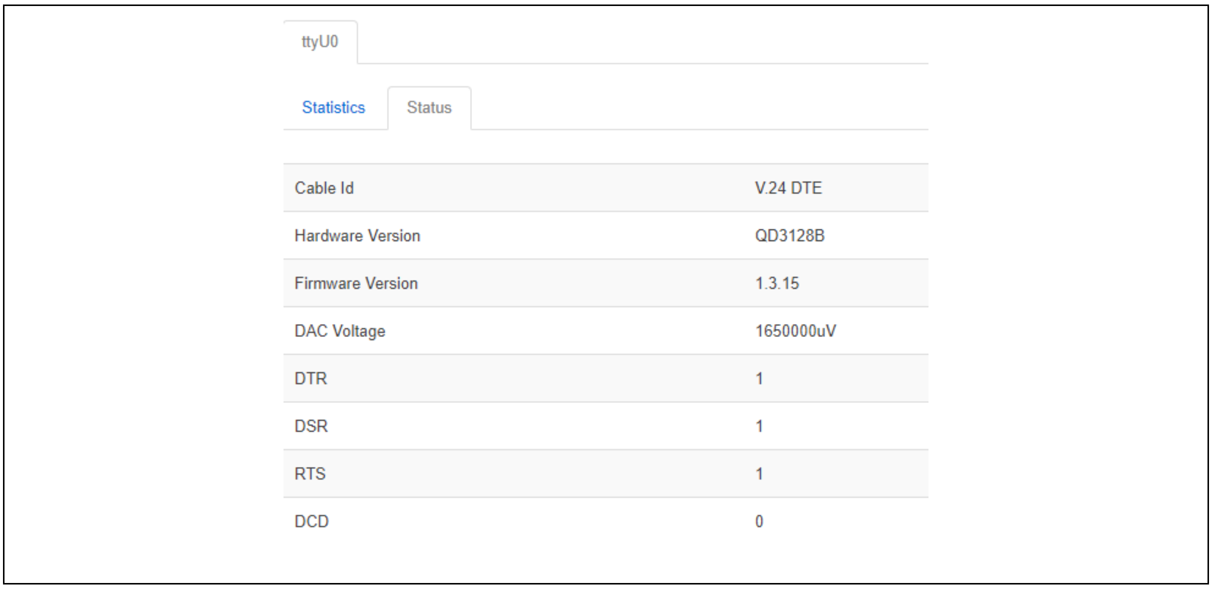

Figure 230: The serial status page for serial-0

47.3 Monitoring serial interfaces using command line

47.3.1 Serial statistics using command line

To view serial statistics, enter:

```
root@VirtualAccess:~# serial_stats
ttyU0 statistics
Tx Frames               0
Tx Bytes                9
Tx Underruns            0
Tx Discards             0
Rx Frames               0
Rx Bytes                258856
Rx Overruns             0
Rx CRC Errors           0
Rx Too Big              0
Rx Discards             0
```

47.3.2 Serial status using command line

To view serial statistics, enter:

```
root@VirtualAccess:~# serial_status
ttyU0 status
Cable Id                 V.24 DTE
Hardware Version         QD3128B
Firmware Version         1.3.15
DAC Voltage              1650000uV
DTR                      1
DSR                      1
RTS                      1
DCD                      0
```

47.3.3 Resetting serial statistics

To reset serial statistics, enter:

```
root@VirtualAccess:~# serial_stats_reset ttyU0
Serial interface statistics reset
```

You can reset statistics for all or individual serial interfaces.