APPLICATION NOTE AN-004-WUK

VRRP with VPN FAILOVER

How to share a default gateway using a BRD-355 Broadband Router and a MRD-455 4G router - including VPN failover

INTRODUCTION

What is VRRP?

The Virtual Router Redundancy Protocol (VRRP) eliminates the single point of failure by allowing 2 or more gateway routers to share a single virtual IP address and virtual MAC address. This virtual IP address is used by IP devices on the local area Ethernet network as their default gateway.

The benefit of VRRP is that the routers running VRRP act as one virtual router. Failover from one router to the other is transparent and requires no additional configuration to devices on the LAN. As far as these are concerned, the default gateway never changes even if the primary gateway goes offline.

VRRP dynamically assigns responsibility for the virtual gateway IP address to one of the physical routers on a LAN according to a priority value that is set. The VRRP router that controls the default gateway IP address is called the **Master** and takes charge of forwarding packets received from devices on the LAN. When the Master becomes unavailable, (or also in this case if the DSL link becomes offline), a backup gateway router, known as the **Slave**, is promoted to Master and controls the forwarding of IP packets from the LAN.

New Features

The Westermo **BRD-355** and **MRD-455** routers allow us to go a step further. The BRD-355 can now be set to demote itself to Slave if the DSL link goes down, promoting the MRD-455 to Master. And the MRD-455 can now keep the 4G link up, but hold off from bringing up the VPN until it is the VRRP Master, avoiding routing errors where the VPN concentrator doesn't know which VPN to use.

Firmware Versions

Applies to Firmware versions;
BRD-355 v1.7.6.14 onwards.
MRD-455 v1.7.4.0 onwards.

Assumptions

This application note applies to the BRD-355 DSL router MRD-455 4G router. It assumes both routers are starting from a factory default configuration.

NB: This application note does not go into detail about setting up VPN tunnels. Please refer to specific application notes available from Westermo with regards to setting up VPN tunnels if required.

Corrections

Requests for corrections or amendments to this application note are welcome and should be addressed technical@westermo.co.uk

Requests for new application notes can be sent to the same address.

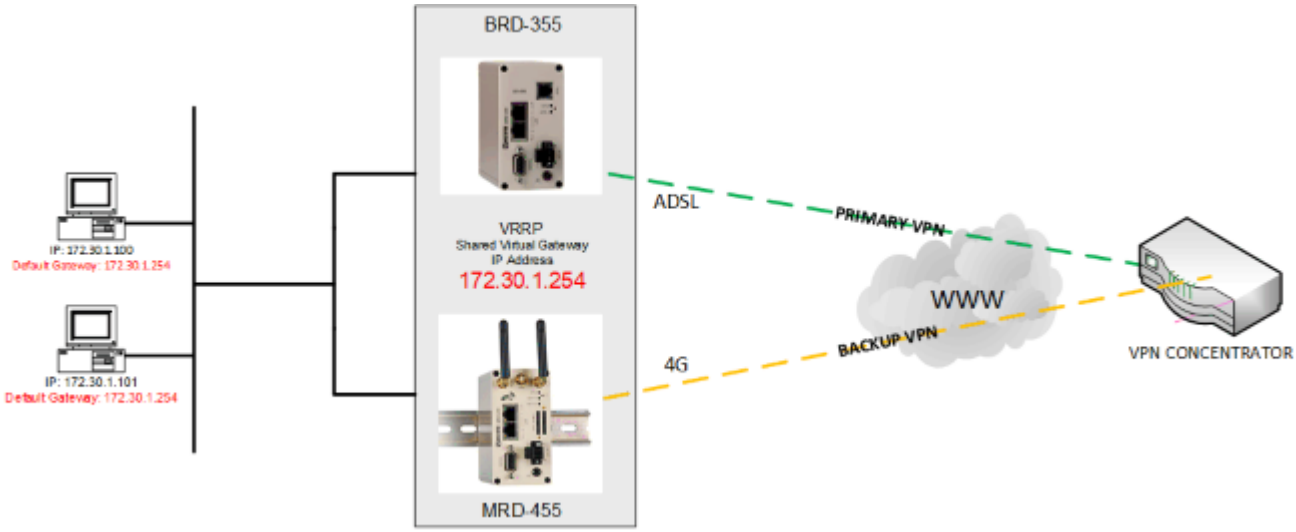
Overview

The following pages show how to implement VRRP between an BRD-355 designated as the **Master** and an MRD-455 4G router designated as the **Slave**. Together these become one virtual router sharing the same LAN IP address.

This VRRP Virtual LAN address is used as the Default Gateway for devices on the LAN.

This application note also shows how to set up link monitoring on the DSL line, so should the link go down, the MRD-455 and its 4G link will be promoted to Master.

Both routers have a VPN to a central VPN Concentrator, but the MRD-455 will prevent its VPN from establishing unless it is promoted to VRRP Master.



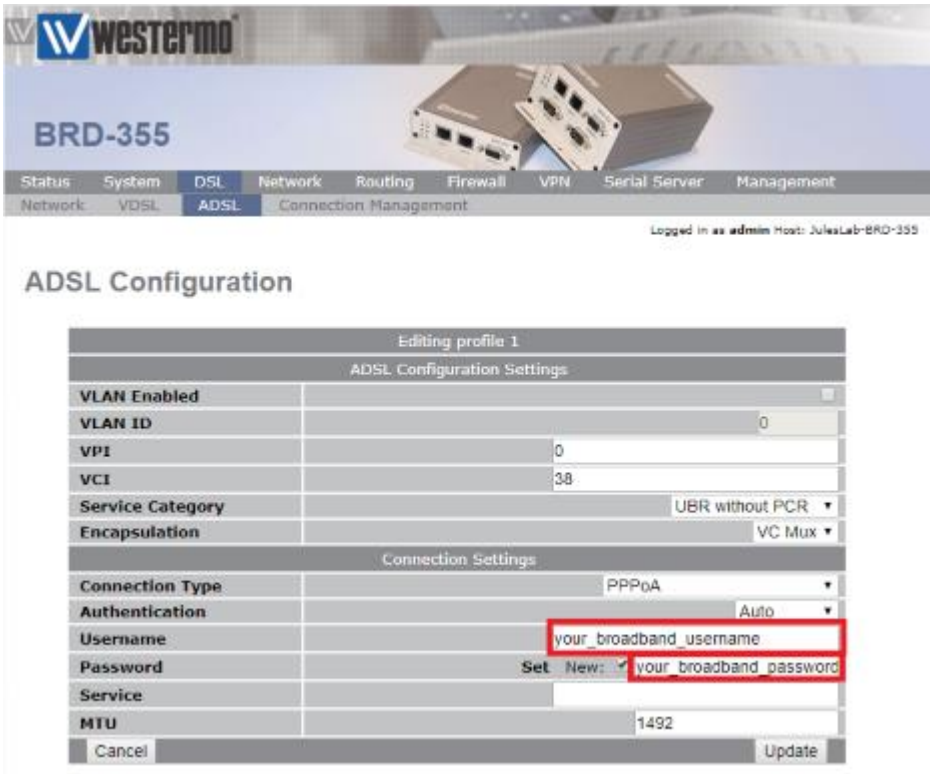
ADSL Broadband Configuration

NB: If you have working ADSL and 4G links already, skip to chapter 4.0

Browse to ADSL → Connection

Click **Add New Profile**.

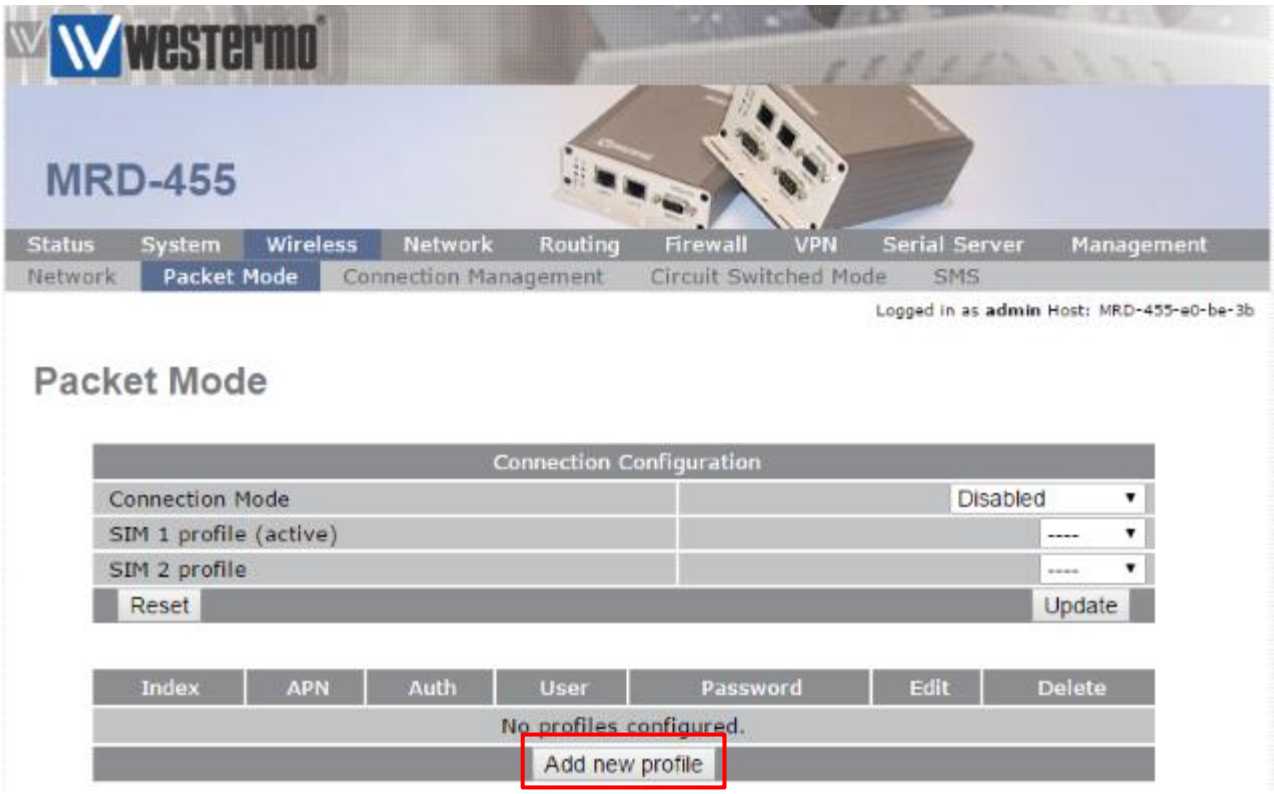
Broadband Settings



Default settings a standard UK BT ADSL line

MRD-455 4G CONNECTION

Browse to Wireless → Packet Mode



Click **Add New Profile**

Profile

Enter the correct APN (Access Point Name) for your SIM card.
You may need to contact your SIM network provider.

MRD-455 4G CONNECTION

Connection Configuration

Set the **Connection Mode** to **Always Connect**.

MANAGEMENT LAN IP ADDRESSES

It's important to give the router a unique management IP address on the LAN subnet, as well as the VRRP IP address to enable permanent admin access.

BRD-355: Browse to Network → LAN

LAN

Interface Configuration	
Enabled	✔
IP Address	172.30.1.1
Netmask	255.255.255.0
MTU	1500

IP Address: 172.30.1.1 **Netmask:** 255.255.255.0

MRD-455: Browse to Network → LAN

LAN

Interface Configuration	
Enabled	✔
IP Address	172.30.1.2
Netmask	255.255.255.0
MTU	1500

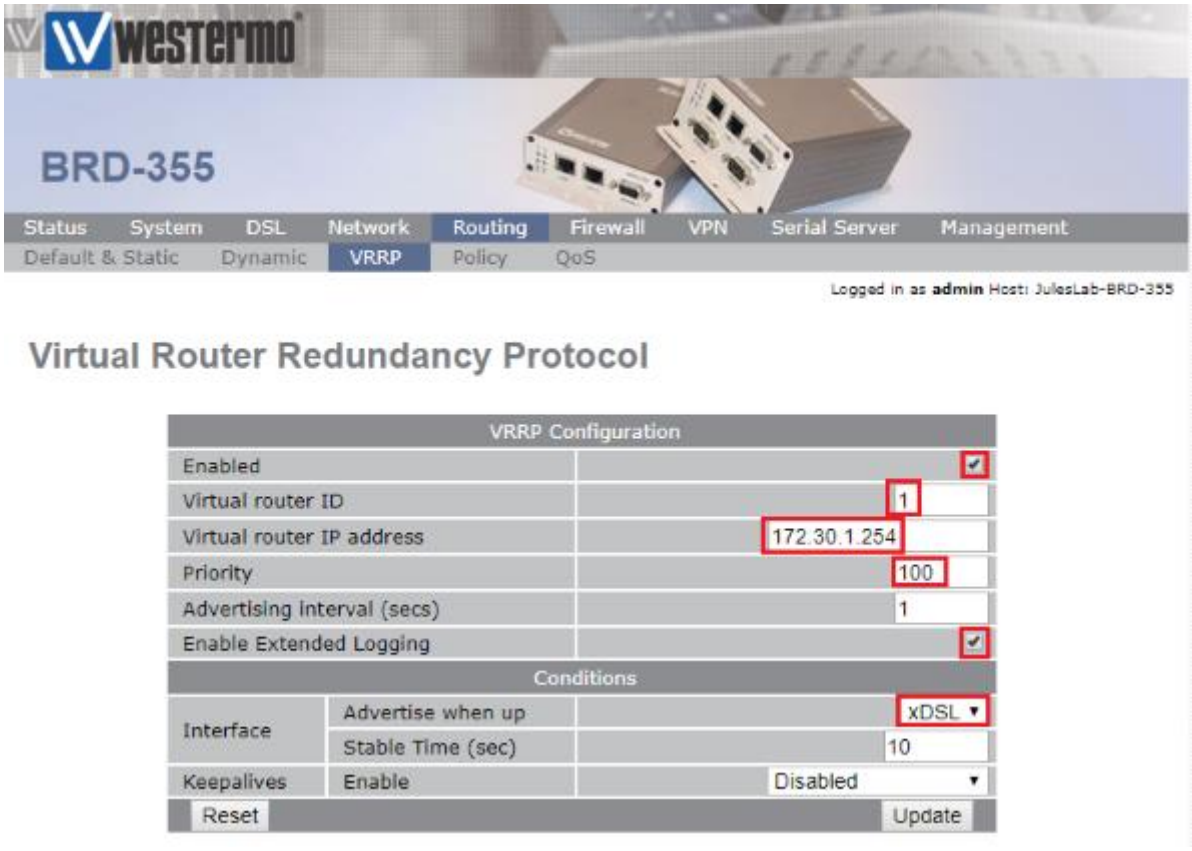
IP Address: 172.30.1.2 **Netmask:** 255.255.255.0

VIRTUAL ROUTER REDUNDANCY PROTOCOL (VRRP) SETTINGS

Next set up the VRRP virtual IP address on both routers. For the purpose of this application note, the two routers will share the VRRP IP address 172.30.1.254 subnet mask 255.255.255.0. This will be the Default Gateway IP address for devices on the LAN.
The **BRD-355** will be the **VRRP Master**. The **MRD-455** will be the **VRRP Slave**.

BRD-355 VRRP Master

Browse to Routing → VRRP



Enabled: ✓

Virtual Router ID: 1
The ID must be identical on both routers. This identifies which routers should be sending and receiving the VRRP status messages.

Virtual Router IP address: 172.30.1.254
The VRRP IP address is the virtual address to be shared and should be identical on both routers.

Priority: 100
Can be a number between 1 and 255. The router with the highest priority is the default VRRP Master

Enable Extended Login: ✓

Conditions: Interface – Advertise when up: xDSL-1
Sets the condition to only send VRRP advertisements then the DSL link is up.

VIRTUAL ROUTER REDUNDANCY PROTOCOL (VRRP) SETTINGS

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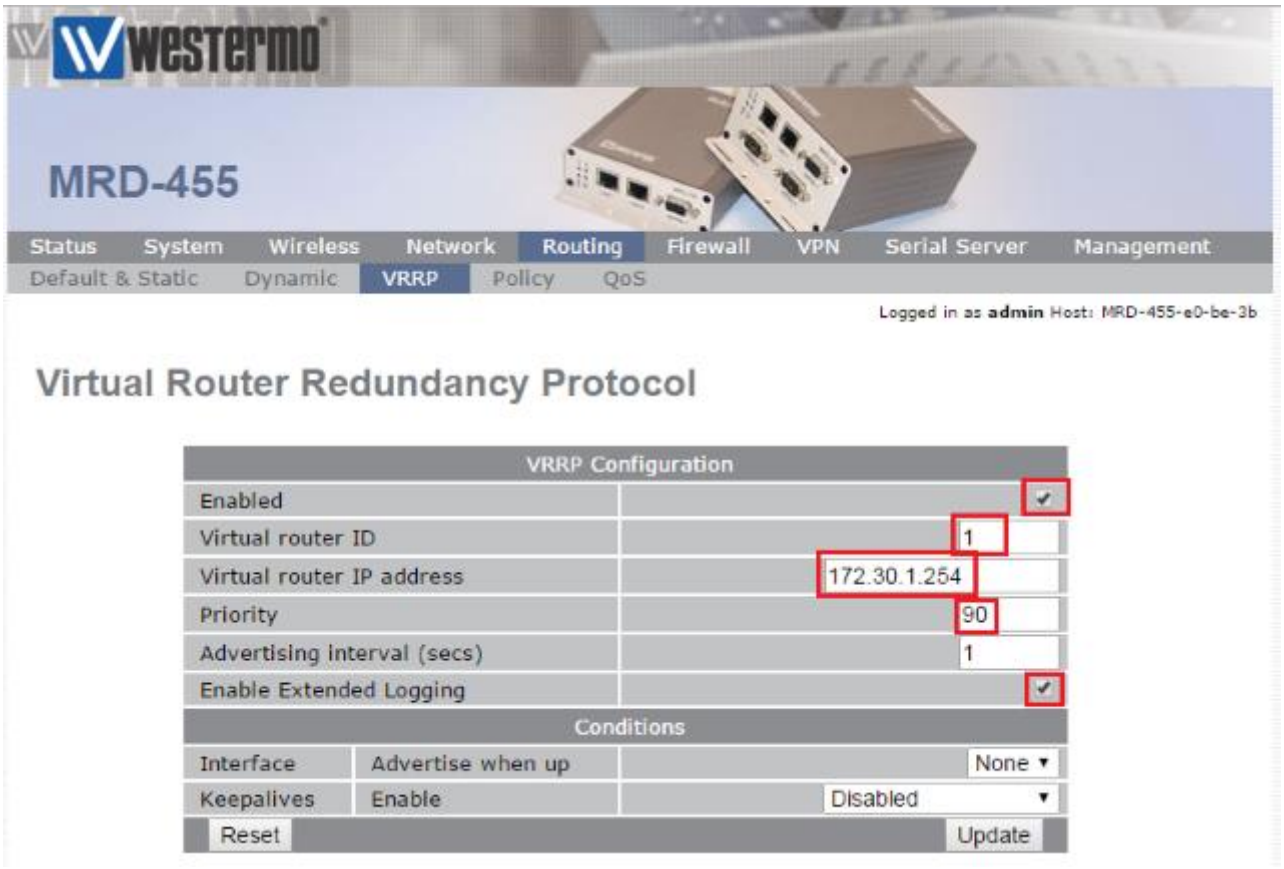
MRD-455 VRRP Slave

Browse to Routing → VRRP



Enabled: ✓

Virtual Router ID: 1
The ID must be identical on both routers. This identifies which routers should be sending and receiving the VRRP status messages.

Virtual Router IP address: 172.30.1.254
The VRRP IP address is the virtual address to be shared and should be identical on both routers.

Priority: 90
Can be a number between 1 and 255. The router with the lowest priority is the default VRRP Slave

Enable Extended Login: ✓

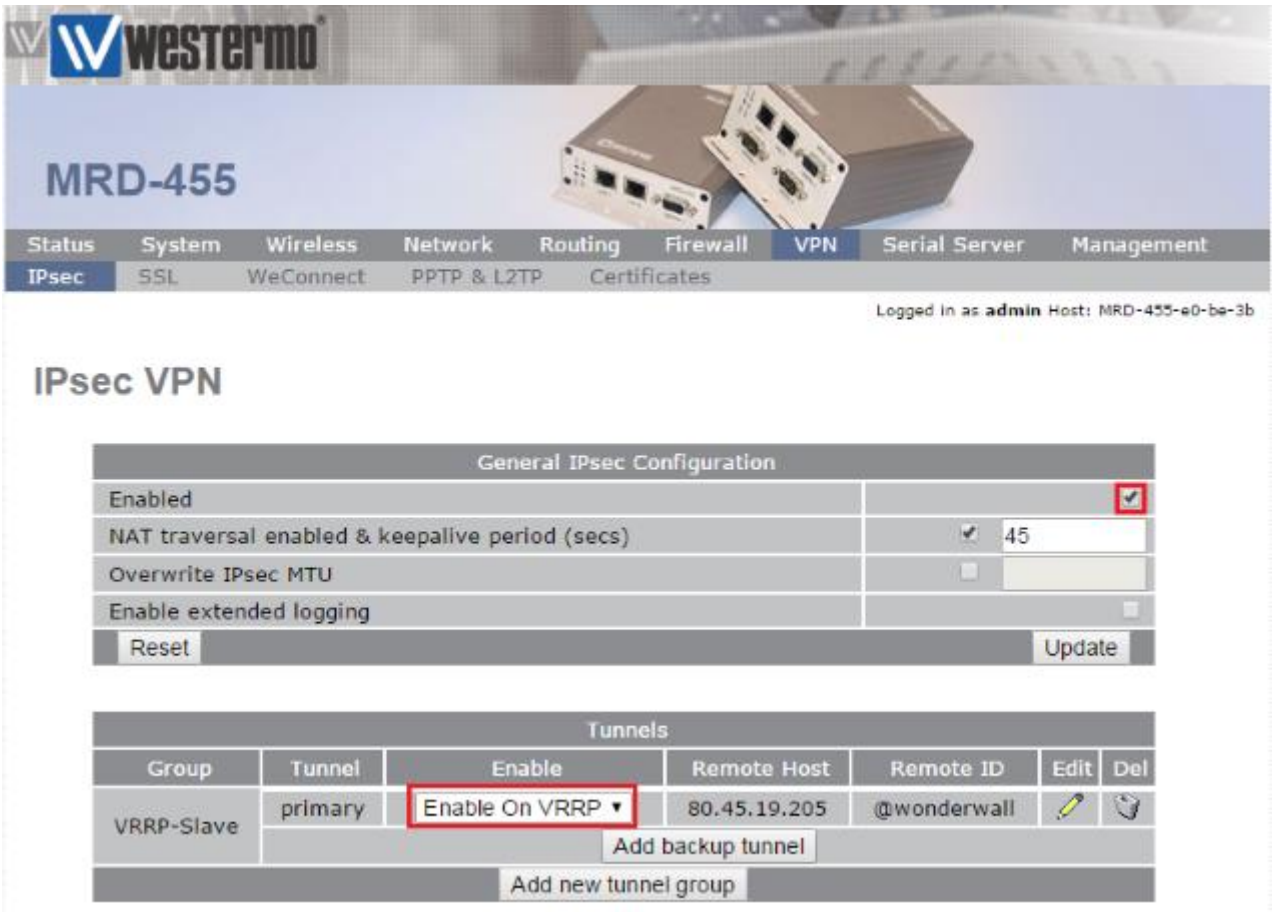
MRD-455: ENABLE VPN ONLY WHEN VRRP MASTER

Next configure the MRD-455 to only establish the preconfigured VPN tunnel when it is the VRRP Master.

The combination of only allowing the BRD-355 to be VRRP Master when the ADSL link is up - and only allowing the MRD-455 to establish a VPN when it is VRRP Master, prevents a situation where VPN traffic is sent to the wrong Gateway and VPN traffic from the VPN Concentrator going down the wrong VPN Tunnel.

NB: This application note does not go into detail about setting up VPN tunnels. Please contact Westermo Technical Support (technical@westermo.co.uk) for application notes specific to setting up VPN tunnels if required.

Browse to VPN → IPSec



Enabled: ✓

Tunnels – Enable: Enable on VRRP

TESTING – NORMAL CIRCUMSTANCES

BRD-355

Under normal circumstances the BRD-355 will be the VRRP Master. The ADSL link will be up and the VPN will be active over that link.

Alarms 13:00:35 04/05/2018

System	
Power On Self Test	Passed
Temperature (°C)	now: 32.75, min: 31.50, max: 33.00
Uptime	01:45:25
DSL	
Network Status	No Fault
Connection Status	No Fault
Network	
Loopback	No Fault
LAN	No Fault
Services	
DHCP Server	Disabled
VPN	No Fault
Serial Server	Disabled
VRRP	Master

LAN

Description	Loopback	LAN
Status	Down	Up
IP Address	0.0.0.0	172.30.1.1
Netmask	255.255.255.0	255.255.255.0
Packets Received	113	61,429
Bytes Received	6.36 kB	22.95 MB
Packets Transmitted	113	44,417
Bytes Transmitted	6.36 kB	18.40 MB

VRRP	
Status	Master
Conditions	
Bound Interface (LAN)	No Fault
xDSL	No Fault

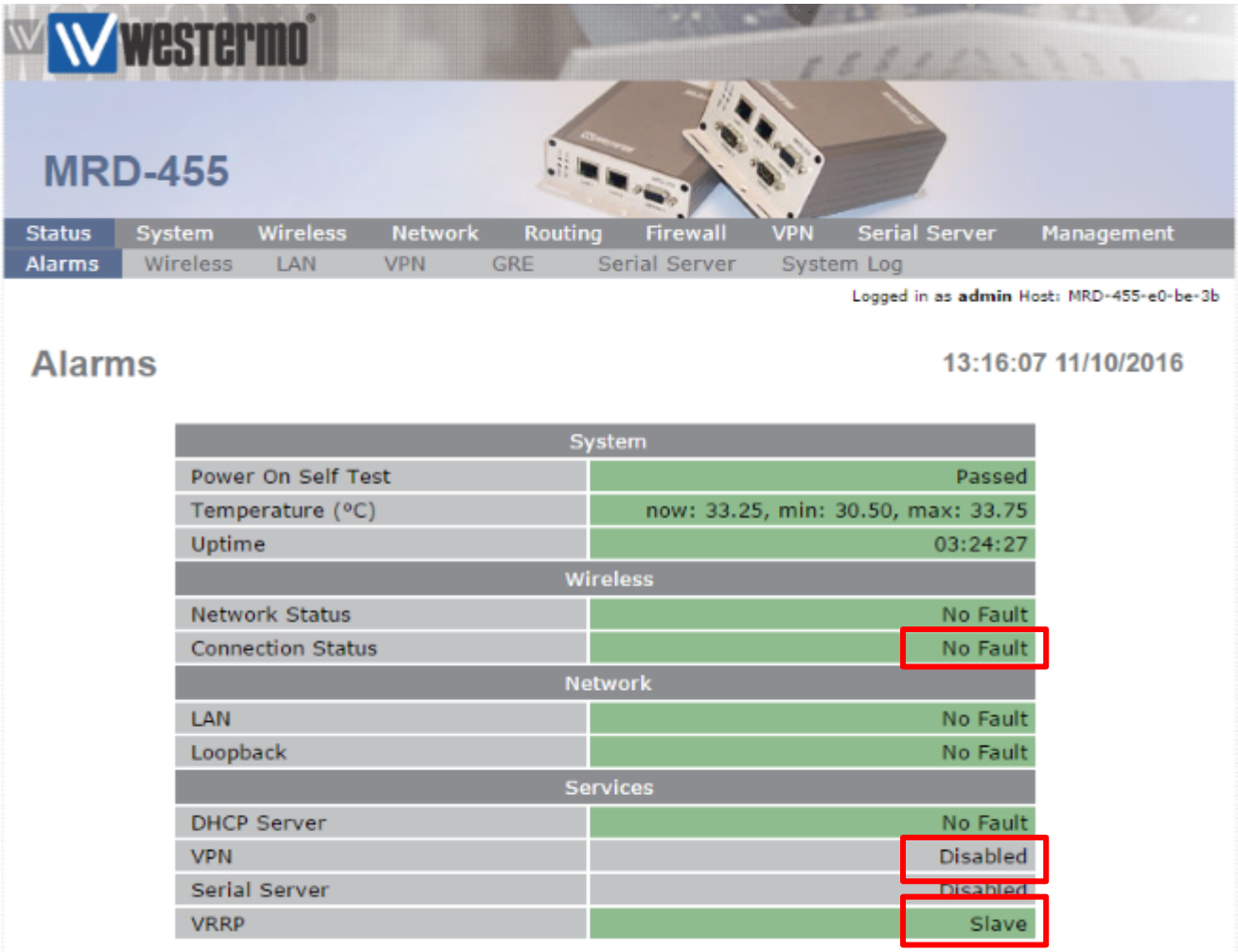
VPN

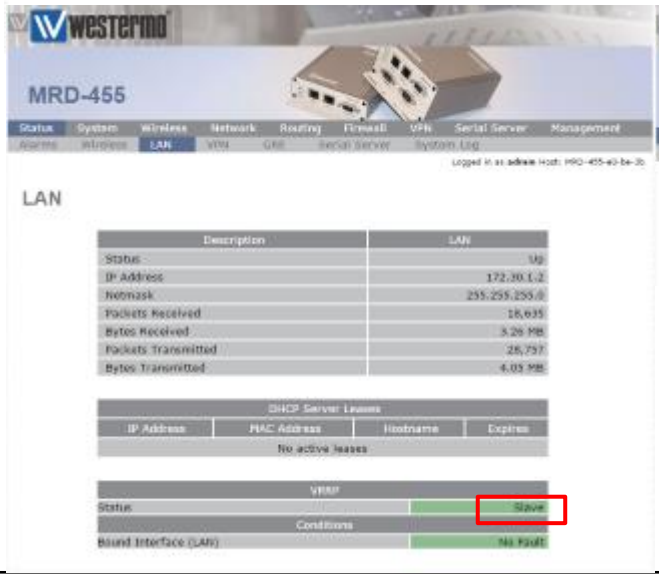
IPsec Connection Status								
Label	Tunnel	Status	Uptime	Time Since Rekey	Local IP	Connection Management		
						Status	Restarts	
VRRP_Test primary		Connected	00:19:07	00:19:07	172.30.1.1	Disabled		
Detailed IPsec status								

TESTING – NORMAL CIRCUMSTANCES

MRD-455

Under normal circumstances the MRD-455 will be the VRRP Slave. The 4G link will be up but the VPN will be disabled.





TESTING – WITH FAILOVER

BRD-355

To test the Failover, disconnect the ADSL line from the BRD-355. You should now see that the BRD-355 reports a fault for the connection status, VPN and VRRP.

Alarms 13:15:16 04/05/2018

System	
Power On Self Test	Passed
Temperature (°C)	now: 33.00, min: 31.50, max: 33.00
Uptime	02:00:06
DSL	
Network Status	Fault
Connection Status	Fault
Network	
Loopback	No Fault
LAN	No Fault
Services	
DHCP Server	Disabled
VPN	Fault
Serial Server	Disabled
VRRP	Fault

LAN

Description	Loopback	LAN
Status	Down	Up
IP Address	0.0.0.0	172.30.1.1
Netmask	255.255.255.0	255.255.255.0
Packets Received	113	74,574
Bytes Received	6.26 kB	25.79 MB
Packets Transmitted	113	48,606
Bytes Transmitted	6.26 kB	20.00 MB

VRRP	
Status	Fault
Conditions	
Bound Interface (LAN)	No Fault
xDSL	Fault

VPN

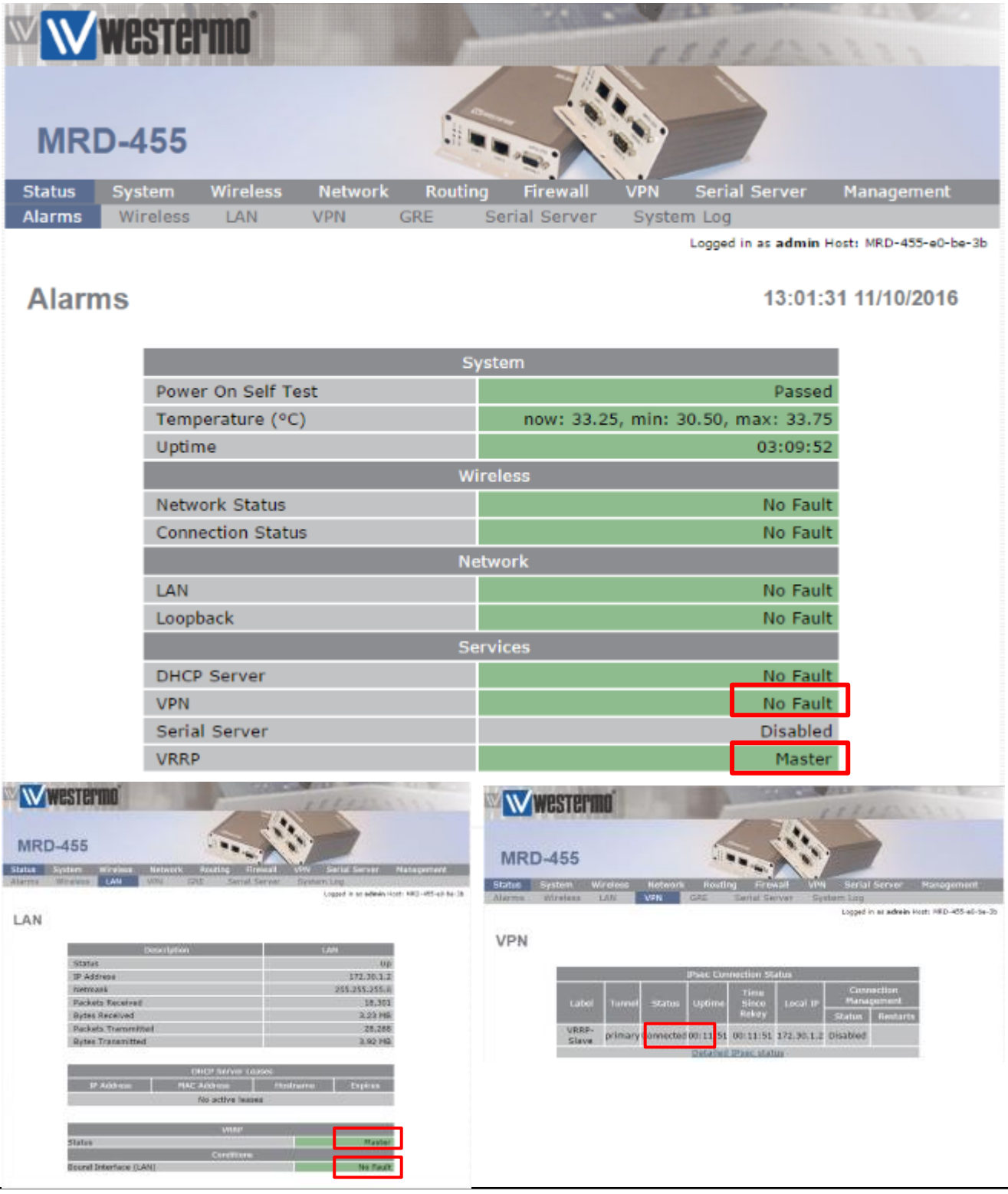
IPsec Connection Status							
Label	Tunnel	Status	Uptime	Time Since Rekey	Local IP	Connection Management	
						Status	Restarts
VRRP_Test	primary	Not connected			0.0.0.0	Disabled	

Detailed IPsec status

TESTING – WITH FAILOVER

MRD-455

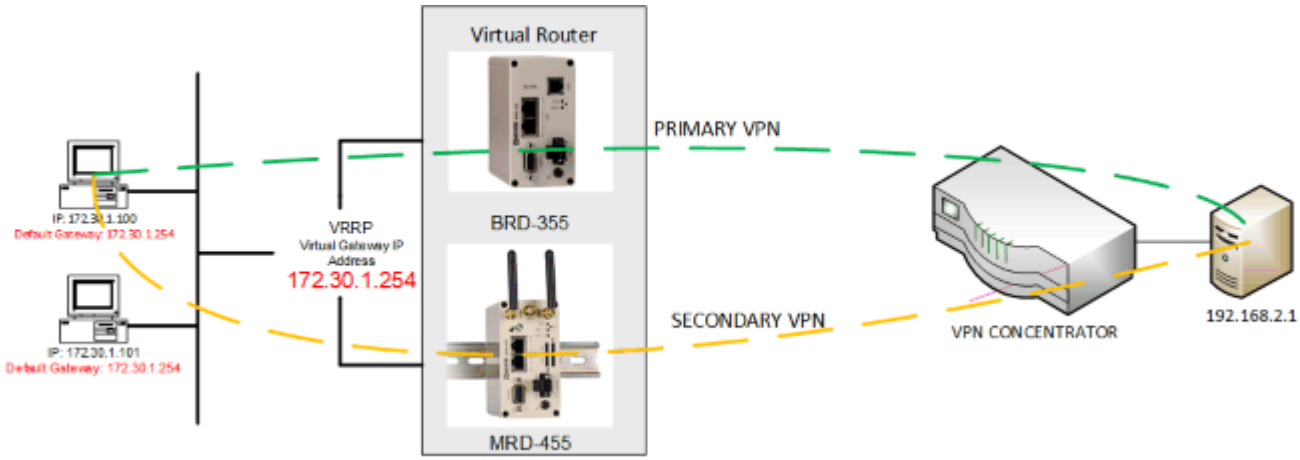
After the DSL link has been disconnected, (or the BRD-355 has been taken offline), the MRD-455 will promote itself to VRRP Master and take ownership of the virtual IP address 172.30.1.254. The VPN is also allowed to establish over the 4G connection.



TESTING – WITH FAILOVER

TEST PINGS TO AN IP ADDRESS ON THE INTERNET.

To test connectivity from your PC behind the VRRP routers, assign it an IP address on the same LAN and configure the VRRP IP address to be the Default Gateway and DNS Server.

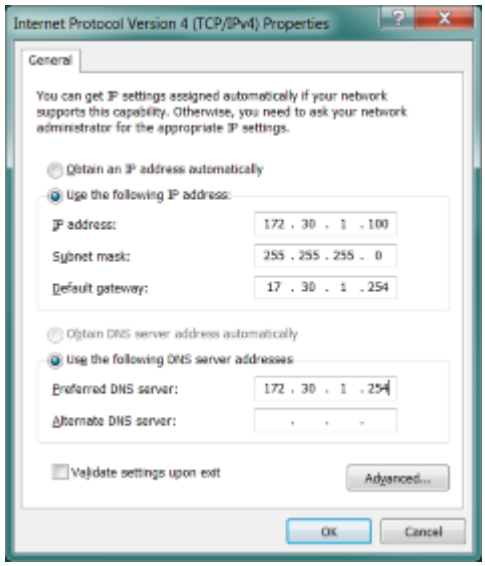


NB: Example IP address to ping is 8.8.8.8 which is a public DNS server for public use.

```
C:\Windows\System32>ping 8.8.8.8 -t

Pinging 8.8.8.8 with 32 bytes of data:

Reply from 8.8.8.8: bytes=32 time=40ms TTL=53
Reply from 8.8.8.8: bytes=32 time=40ms TTL=53
Reply from 8.8.8.8: bytes=32 time=40ms TTL=53
Reply from 8.8.8.8: bytes=32 time=39ms TTL=53
Reply from 8.8.8.8: bytes=32 time=40ms TTL=53
Reply from 8.8.8.8: bytes=32 time=39ms TTL=53
Reply from 8.8.8.8: bytes=32 time=40ms TTL=53
Reply from 8.8.8.8: bytes=32 time=39ms TTL=53
Reply from 8.8.8.8: bytes=32 time=41ms TTL=53
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 8.8.8.8: bytes=32 time=668ms TTL=51
Reply from 8.8.8.8: bytes=32 time=597ms TTL=51
Reply from 8.8.8.8: bytes=32 time=2699ms TTL=51
Reply from 8.8.8.8: bytes=32 time=754ms TTL=51
Reply from 8.8.8.8: bytes=32 time=1921ms TTL=51
Reply from 8.8.8.8: bytes=32 time=338ms TTL=51
Reply from 8.8.8.8: bytes=32 time=259ms TTL=51
```



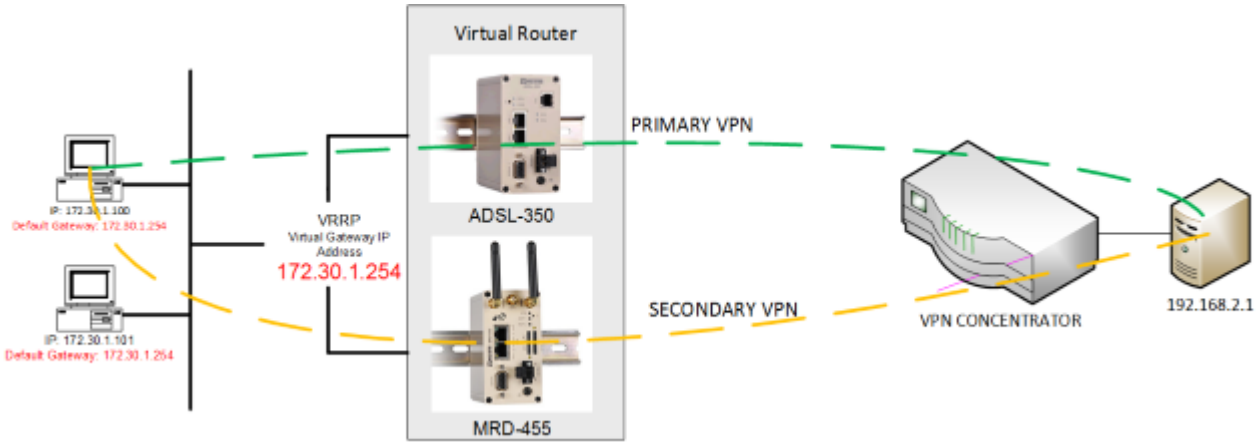
The transition where the DSL line is disconnected to where the MRD-455 becomes the VRRP Master can be clearly seen. Although there is some brief downtime of a few seconds, the traffic from the PC has automatically been rerouted via the MRD-455 from the BRD-355 without having to re-configure the PC.

TESTING – WITH FAILOVER

TEST PINGS TO AN IP ADDRESS DOWN THE VPN TUNNEL.

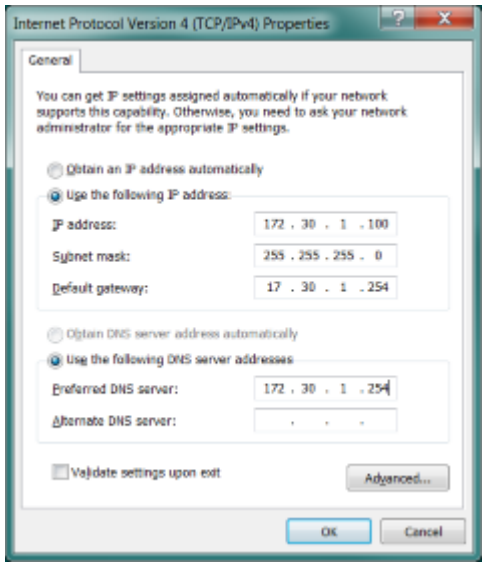
To test connectivity from your PC behind the VRRP routers, assign it an IP address on the same LAN and configure the VRRP IP address to be the Default Gateway and DNS Server.

This time ping an IP address at the LAN side of the VPN Concentrator.




```
C:\Windows\System32>ping 192.168.2.1 -t

Pinging 192.168.2.1 with 32 bytes of data:
Reply from 192.168.2.1: bytes=32 time=64ms TTL=249
Reply from 192.168.2.1: bytes=32 time=64ms TTL=249
Reply from 192.168.2.1: bytes=32 time=65ms TTL=249
Reply from 192.168.2.1: bytes=32 time=64ms TTL=249
Reply from 192.168.2.1: bytes=32 time=64ms TTL=249
Reply from 192.168.2.1: bytes=32 time=65ms TTL=249
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 192.168.2.1: bytes=32 time=1324ms TTL=249
Reply from 192.168.2.1: bytes=32 time=3496ms TTL=249
Reply from 192.168.2.1: bytes=32 time=2421ms TTL=249
Reply from 192.168.2.1: bytes=32 time=1115ms TTL=249
Reply from 192.168.2.1: bytes=32 time=621ms TTL=249
Reply from 192.168.2.1: bytes=32 time=1146ms TTL=249
```



The transition where the DSL line is disconnected to where the MRD-455 becomes the VRRP Master and establishes the VPN can be clearly seen. Although there is some brief downtime of a few seconds, the traffic from the PC has automatically been rerouted via the MRD-455 from the BRD-355 without having to re-configure the PC.

Revision history for version 2.0

Revision	Rev by	Revision note	Date
1.0	JM	Supersedes AN-0195-ENG Rev. 1.0 Rev 2.0 includes standby VPN on the VRRP Slave. The VPN on the VRRP Slave MRD-455/355 can be prohibited unless it is promoted to VRRP Master. Applies to 3G and 4G MRD-xxx routers only from firmware version 1.7.4.0.onwards.	19/10/2016
2.0	JM	Changed ADSL-350 to BRD-355	
2.1	JM	Change diagrams to include BRD-355	

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