

APPLICATION NOTE AN-0198-ENG-V2.1

DUAL SIM FAILOVER

4G Connection Management



Introduction

Overview

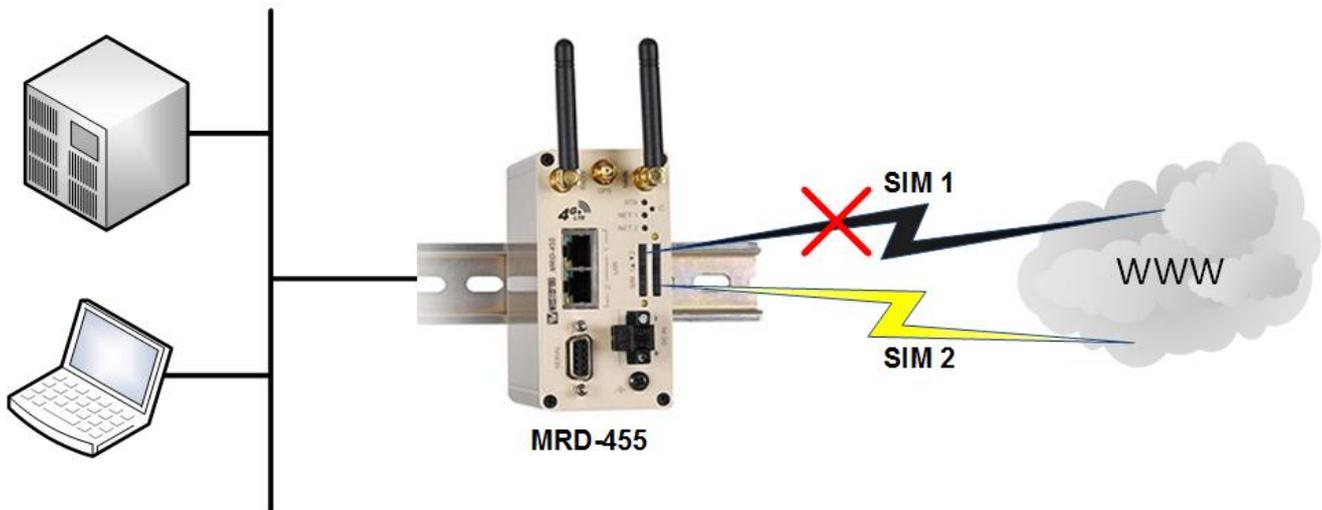
The Westermo MRD-455 is a compact, DIN rail mountable dual SIM mobile 4G router. The dual SIM failover feature has been developed for 2 main reasons.

- The first being for mobile applications, where the router is installed in vehicles, boats, trains etc and likely to be moving between strong and weak areas of coverage by different mobile providers.
- The second for mission critical applications where the remote network may be static, but the customer needs resilience against a failure with the mobile network. Wireless WAN technologies such as GPRS, 3G And 4G have proven to be extremely reliable. But because cellular routers tend to be placed in remote and difficult to reach places, (and outside the reach of wired networks), it warrants extra precautions. Especially when the consequences of losing contact with a remote network can be severe in terms of recovery costs and site visits.

This application note describes a basic and advanced method of SIM to SIM failover. The advanced method configures the router to actively monitor the 4G link to test its ability to route traffic. It then drops the link and goes into recovery/failover mode if it detects a problem.

The router initially tries to recover the link on the same SIM card before failing over to the second SIM card after a specified number of retries.

4G Network Failure



Overview

This application note applies to the MRD-455 4G router and assumes you are starting from a factory default configuration.

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.

Configuration

Wireless 4G Link

Browse to **Wireless** → **Packet Mode**

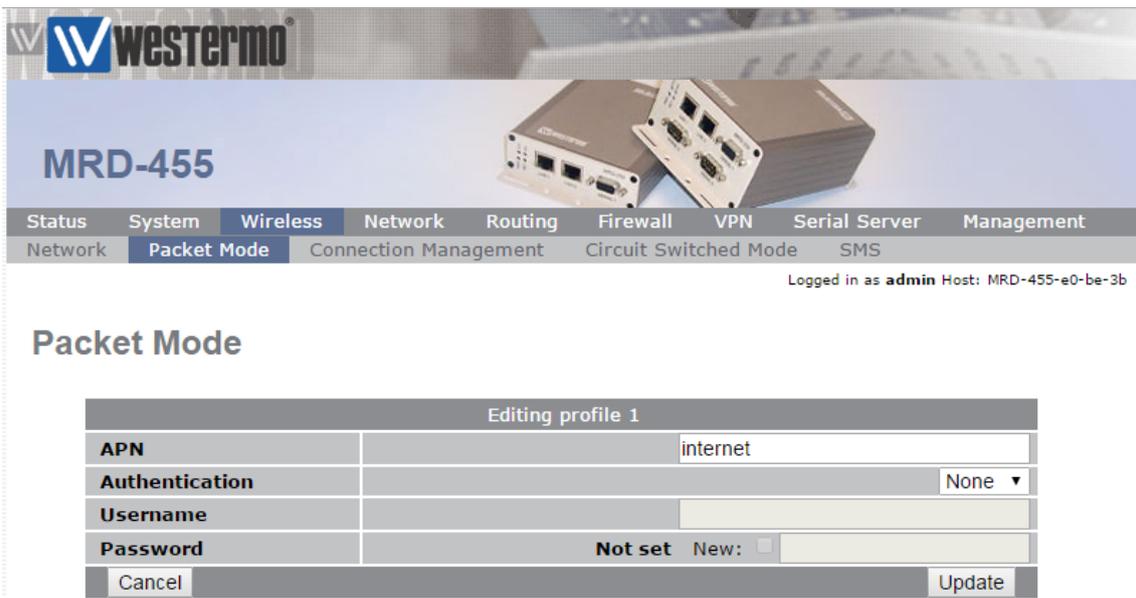


The screenshot shows the Westermo MRD-455 configuration interface. The 'Wireless' menu is selected, and 'Packet Mode' is active. The 'Connection Configuration' section shows 'Connection Mode' set to 'Disabled', 'SIM 1 profile (active)' set to '----', and 'SIM 2 profile' set to '----'. There are 'Reset' and 'Update' buttons. Below this is a table for SIM profiles:

| Index | APN | Auth | User | Password | Edit | Delete |
|---------------------------------|-----|------|------|----------|------|--------|
| No profiles configured. | | | | | | |
| Add new profile | | | | | | |

SIM 1

Click **Add new profile** and create a profile for your first SIM card provider.



The screenshot shows the 'Editing profile 1' form in the Westermo MRD-455 configuration interface. The 'Wireless' menu is selected, and 'Packet Mode' is active. The form fields are:

- APN:** internet
- Authentication:** None
- Username:** (empty)
- Password:** Not set

There are 'Cancel' and 'Update' buttons at the bottom of the form.

APN: Enter the APN (Access Point Name) given by your SIM card provider.

NB: Standard 4G tariffs do not often require authentication.

Configuration

Wireless 4G Link

SIM 2

For SIM 2 click **Add new profile** again and create a profile for your second SIM card provider as you did for SIM 1



Packet Mode

| Connection Configuration | | | | | | |
|--------------------------|--|--|--|--|--------|------------------|
| Connection Mode | | | | | | Always connect ▾ |
| SIM 1 profile (active) | | | | | | 1 ▾ |
| SIM 2 profile | | | | | | 2 ▾ |
| Reset | | | | | Update | |

| Index | APN | Auth | User | Password | Edit | Delete |
|-------|-----------------|------|------|----------|---|---|
| 1 | internet | None | | Not set |  |  |
| 2 | mobile.o2.co.uk | None | | Not set |  |  |

[Add new profile](#)

Set the *connection mode* to *Always connect* and associate SIM 1 and 2 to the appropriate profile.

Configuration

Dual SIM Failover – Basic Method

The basic method will fail-over to the second SIM card if the router is unable to bring up the 4G link or if it loses network registration.

NB: The basic method will not monitor the health of an active 4G link.



Dual SIM Failover - Basic

Option 1 – Both SIM cards have equal priority

Browse to **Wireless** → **Connection Management**

The following example will cause the 4G link to fail-over to the secondary SIM. The link will remain on the secondary SIM until either the SIM is out of range of its network, or disconnected. It will then failover to the other SIM.

NB: This method is suitable for mobile applications or where there is no SIM preference.

| Connection Establishment | |
|---|-------------------------------------|
| Rotate SIM | <input checked="" type="checkbox"/> |
| Secondary SIM hold period (mins) | <input type="checkbox"/> 0 |
| Timeout for network initialisation (secs, min 60) | 120 |
| Timeout for connection establishment (secs, min 30) | 45 |
| Poll on connection establishment, period (secs, min 15) | <input type="checkbox"/> 15 |
| Failed polls before restarting the connection | 0 |
| Failed establishment attempts before interface restart | 3 |
| Failed establishment attempts before modem reboot | 12 |
| Failed establishment attempts before dropping to CSD | 0 |
| Time to spend in CSD (mins) | 15 |

Rotate SIM: ✓

Failed establishment attempts before interface restart: 3 (default)

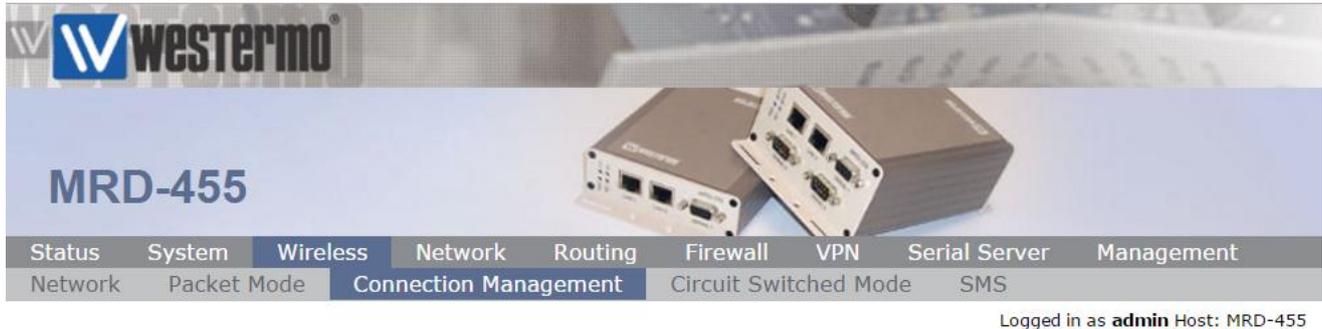
Failed establishment attempts before modem reboot: 12 (default)

Configuration

Dual SIM Failover – Basic Method

The basic method will fail-over to the second SIM card if the router is unable to bring up the 4G link or if it loses network registration.

NB: The basic method will not monitor the health of an active 4G link.



Dual SIM Failover – Basic continued...

Option 2 – Fall back to primary SIM card after a specified time.

The following example will cause the 4G link to fail-over to the secondary SIM but the link will retry the primary SIM after a specified time.

NB: This method is suitable if you have a preference for the primary SIM.

| Connection Establishment | |
|---|--|
| Rotate SIM | <input checked="" type="checkbox"/> |
| Secondary SIM hold period (mins) | <input checked="" type="checkbox"/> 1800 |
| Timeout for network initialisation (secs, min 60) | 120 |
| Timeout for connection establishment (secs, min 30) | 45 |
| Poll on connection establishment, period (secs, min 15) | <input type="checkbox"/> 15 |
| Failed polls before restarting the connection | 0 |
| Failed establishment attempts before interface restart | 3 |
| Failed establishment attempts before modem reboot | 12 |
| Failed establishment attempts before dropping to CSD | 0 |
| Time to spend in CSD (mins) | 15 |

Rotate SIM: ✓

Secondary SIM hold period (mins): 1800

Failed establishment attempts before interface restart: 3 (default)

Failed establishment attempts before modem reboot: 12 (default)

These are the same settings as shown with option 1 except now include a timer to retry the connection over SIM card 1.

Configuration

Dual SIM Failover – Basic Method

The basic method will fail-over to the second SIM card if the router is unable to bring up the 4G link or if it loses network registration.

NB: The basic method will not monitor the health of an active 4G link.



Dual SIM Failover – Advanced

Continued from the settings applied in the chapter headed **Dual SIM Failover – Basic**.

The advanced dual SIM failover mode actively monitors the ability to transfer data of the 4G network. It works by generating ICMP pings from the 4G link over the mobile network to a reliable, *always available*, fixed public IP address. This has the advantage of working in the background 24/7 and 365 days a year and is transparent to your everyday M2M connectivity.

NB: Additional data charges from your network provider may result from transmitting the link monitoring pings. The amount of traffic generated by the monitoring pings can however be adjusted to make any additional costs, if any, negligible. E.g. By decreasing the frequency of the pings if a quick recovery is not required. Any additional data charges will almost certainly be less expensive and more convenient than sending an Engineer to site.

Connection Maintenance

| Connection Maintenance | |
|--|--|
| Remote polling mode | Poll at fixed interval |
| Poll period (secs, min 15) | 1800 |
| Retry period (secs, min 15) | <input checked="" type="checkbox"/> 30 |
| Failed polls before restarting the connection | 4 |
| Network registration timeout (mins) | 5 |
| Traffic generator enabled, interval (secs) & address | <input type="checkbox"/> 10 |

Remote polling mode: Poll at fixed interval

Poll period (secs, min 15): 1800 – Send a ping every 1800 seconds (30 minutes)

Retry period(secs, min 15): 30 – increase ping frequency to 30 seconds after no reply.

Failed polls before restarting the connection: 4 – Restart the wireless link and instigate dual SIM failover after 4 consecutive ping failures.

Configuration

Dual SIM Failover – Advanced continued...

Remote Poll Setup

Here you set the poll type and the IP addresses to poll.

Important: It is crucial to poll IP addresses that are fixed, reliable and always on. If the addresses go offline then the router will assume there has been a link failure, disconnect the 4G link and enter recovery mode.

| Remote Poll Setup | |
|----------------------|---------------|
| Primary poll type | Ping (ICMP) ▾ |
| Primary poll address | 8.8.8.8 |
| Primary test | Test |
| Backup poll type | Disabled ▾ |
| Backup poll address | |
| Secondary test | Test |

NB: Set up the **backup poll type** and **address** if you want to send test pings to a second IP address should pings to the primary IP address fail.

Send debug to the system log

| Miscellaneous Options | |
|------------------------------|-------------------------------------|
| Automatically obtain DNS | <input checked="" type="checkbox"/> |
| Verbose output to system log | <input checked="" type="checkbox"/> |
| Reset | Update |

Verbose output to system log: ✓

Testing

Basic Dual SIM Failover Testing

If you have configured basic failover only, (chapter **Dual SIM Failover – Basic**), disconnect the antenna and try to reduce the signal level so that the primary SIM loses network registration.

Browse to **Status → System Log**

If the router fails to re-establish the link on SIM 1, it restarts the RF module after a specified number of failed establishment attempts and then activates SIM 2.



The screenshot shows the Westermo MRD-455 web interface. The 'System Log' menu item is highlighted in the navigation bar. Below the navigation bar, the system log entries are visible:

```

Nov 9 13:08:03 mrx[2058]: WLS / PKT: Failed to establish connection 3 consecutive times
Nov 9 13:08:03 mrx[2058]: WLS / PKT: restarting RF module.
Nov 9 13:08:06 mrx[2058]: MSPDriver: activated sim 2
    
```

Logged in as **admin** Host: MRD-455

Browse to **Status → Wireless**

View the *Network Status*. Here you will see the *Active SIM* and mobile *provider*.



The screenshot shows the Westermo MRD-455 web interface with the 'Wireless' menu item highlighted. The 'Network Status' section is visible, showing the active SIM and mobile provider.

Logged in as **admin** Host: MRD-455

Using SIM 1 before failover

| Network Status | |
|----------------|-------|
| Active SIM | SIM 1 |

Using SIM 2 after failover

| Network Status | |
|----------------|--------------|
| Active SIM | SIM 2 |

Testing

Advanced Dual SIM Failover Testing

If you have configured advanced Dual SIM failover (chapter **Dual SIM Failover – Advanced**), then test as per the basic method but also temporarily point the monitoring pings to an IP address which you can control and block the pings (or to an address that does not exist). This will simulate a faulty link and will force the router into recovery mode.

Browse to **Status** → **System Log**



This event appears when the test pings have failed.

```
Nov 9 14:29:06 mrx[2058]: ConnectionTester: ICMP resetting
```

The router will try and re-establish the 4G link via the primary SIM but if it fails to do so then it activates SIM 2.

```
Nov 9 14:31:03 mrx[2058]: WLS / PKT: Failed to establish connection 3 consecutive times
```

```
Nov 9 14:31:03 mrx[2058]: WLS / PKT: restarting RF module.
```

```
Nov 9 14:31:15 mrx[2058]: MSPDriver: activated sim 2
```

NB: If the 4G link fails to re-establish on either SIM, the router will eventually reboot the router as specified in the **Failed establishment attempts before modem reboot** setting detailed in page 5.

Connection Maintenance and Remote Poll Status

The **Interface Restarts** shows how often the interface has been restarted due to failed responses to the monitoring pings. This page also shows how many pings have been transmitted (Data sent) and how many replies have been received (Data Received).

| Connection Maintenance | |
|------------------------------|-----------------|
| Outstanding Request | No |
| Interface Restarts | 3 |
| Active Poll | ICMP to 1.2.3.4 |
| Remote poll: ICMP to 1.2.3.4 | |
| Data Sent | 12 |
| Data Received | 0 |

NB: For testing purposes we sent pings to IP address 1.2.3.4 which was unreachable.

SMS Triggers

As an additional failsafe, the SMS Triggers option, are a very useful feature to have if you think the remote router has lost its connection and doesn't seem to be recovering.

The following settings are disabled by default. The router needs only to GSM registration only to receive and send SMS messages and does not need to be connected to the 4G network for the SMS function to work.

Browse to Wireless → SMS



MRD-455

Status System **Wireless** Network Routing Firewall VPN Serial Server Management

Network Packet Mode Connection Management Circuit Switched Mode **SMS**

Logged in as **admin** Host: MRD-455

SMS

| SMS Triggers | | | |
|--------------|-------------------------------------|----------|--------------|
| Action | Enabled | Match on | Trigger |
| System | | | |
| Status query | <input checked="" type="checkbox"/> | Exact ▾ | Query status |
| Reboot | <input checked="" type="checkbox"/> | Exact ▾ | Reboot |

Status query: ✓

reboot: ✓

This allows you to send an SMS text to the router with the trigger phrases **Status query** and **Reboot**. The *Status query* SMS will return the link status including the signal strength. The *Reboot* SMS will initiate a full reboot - Although there shouldn't be a need to manually *Reboot* if the instructions in this application note have been followed correctly.

Revision history for version 1.0

| Revision | Rev by | Revision note | Date |
|----------|--------|---------------|------|
| 00 | | | |
| 01 | | | |
| 02 | | | |
| 03 | | | |
| 04 | | | |
| 05 | | | |
| 06 | | | |
| 07 | | | |

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