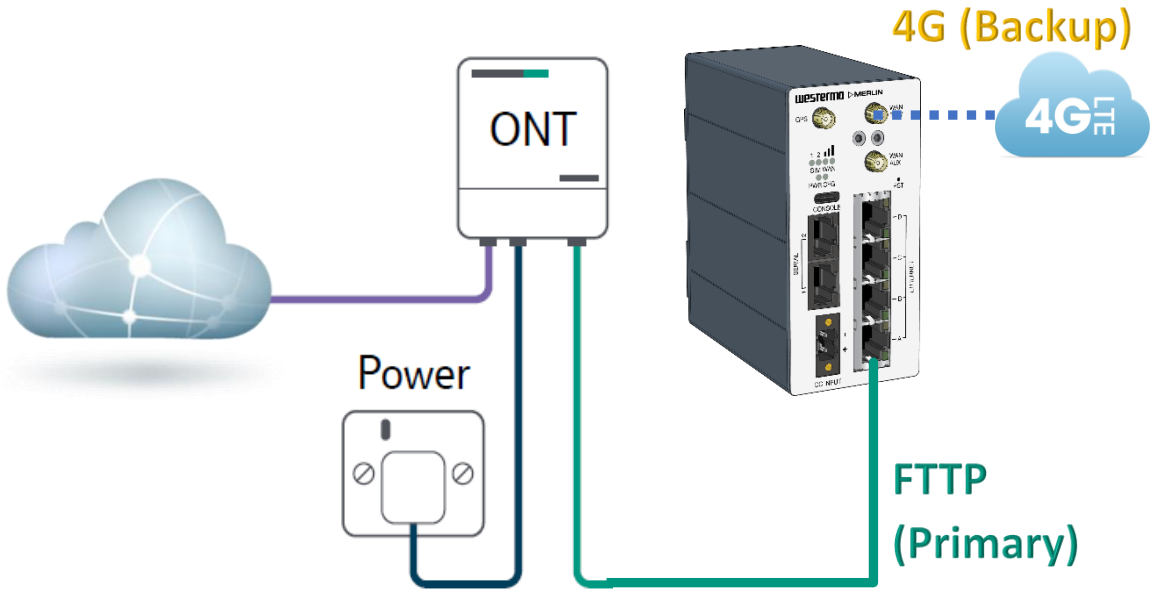
APPLICATION NOTE: AN-033-WUK

# MERLIN Multi-WAN:
# FTTP with 4G as backup

**How to configure the Multi-WAN feature to enable a Westermo Merlin cellular router to use FTTP as the primary connection and 4G as backup.**



# Contents

## Introduction

What is the Merlin Multi-WAN Feature?

By default the Merlin has a single WAN interface configured, which is usually the 4G connection (unless it's a 4708 with a DSL connection). For models that support two SIM cards, a secondary 4G interface can be created to allow failover to a different cellular network. You can also configure an ethernet port as a WAN interface for connectivity through an existing LAN network or to create a dedicated WAN port.

The Multi-WAN feature is used to create multiple WAN interface profiles on the Merlin and set each interface with a different priority according to the preferred primary and backup connection.

It's becoming increasingly common to see fibre to the premise (FTTP) available for installation at industrial locations and while the technology has some reliability improvements, it is still prone to outages caused by the ISP or accidental damage to the fibre infrastructure. A backup 4G connection is always desirable for continuity of communications. The Merlin can be configured for just this type of failure scenario.

If you have an FTTP line the ISP will have supplied an optical network terminal (ONT) which connects the incoming fibre and presents a standard RJ45 ethernet port for the customer to connect their supplied router.

Typically the supplied router is designed for a domestic/office environment and not suited to the environmental challenges of an industrial application and this is where the Merlin comes in. It can be configured to use a dedicated ethernet port for the FTTP WAN connection to the ONT. If that line consequently suffers any outages it can be configured to failover to its 4G interface to maintain connectivity.

The following method details how to achieve this configuration within the Merlin and test the failover is working correctly. It will also describe how to monitor the status of these interfaces and identify the sequence of events in the system log.

## Overview

This application note shows how to configure the Multi-WAN function within a Westermo Merlin 4407 Mobile router. However it is applicable to all cellular routers in the Merlin range.

It does not cover the general configuration of the firewall which should be a pre-requisite prior to operational deployment. For information on how to setup the firewall please refer to the following document:

- AN-027-WUK Merlin Firewall Rules

This can be downloaded from the application note section of the westermo.com website.

Router firmware version used for this document: SXL-25.04.16.000

**Assumptions**

A Merlin-4407 cellular router is the model used in this document and assumes the router has a factory default configuration. The features described can also be applied to the other routers in the Merlin range.

## Corrections

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

Requests for new Application Notes and Quick Notes can be sent to the same address.

# Merlin 4407 Mobile Router Configuration

## LAN IP Address

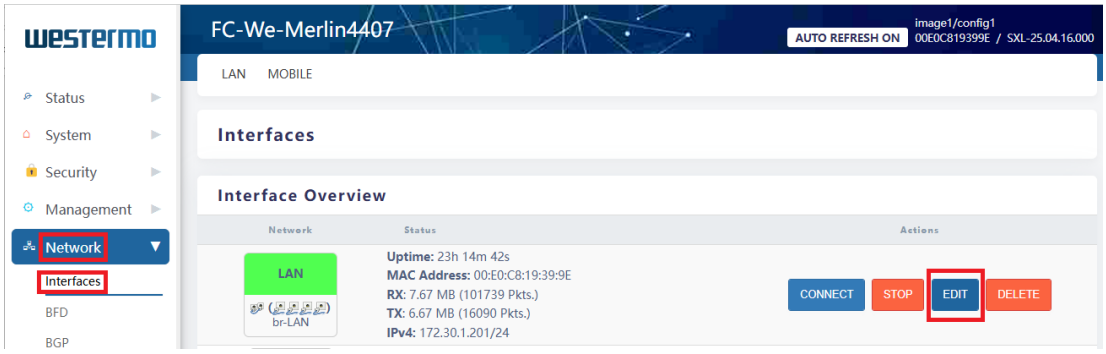
In this application note we will be using the default IP address of 192.168.100.1.

If you need to adjust this IP address for your application you can do this as follows:

Login to the Merlin using the default IP address and enter the following credentials:

Username: **root**
Password: **admin**

Browse to **Network > Interfaces**. In the LAN section, click the **EDIT** button.

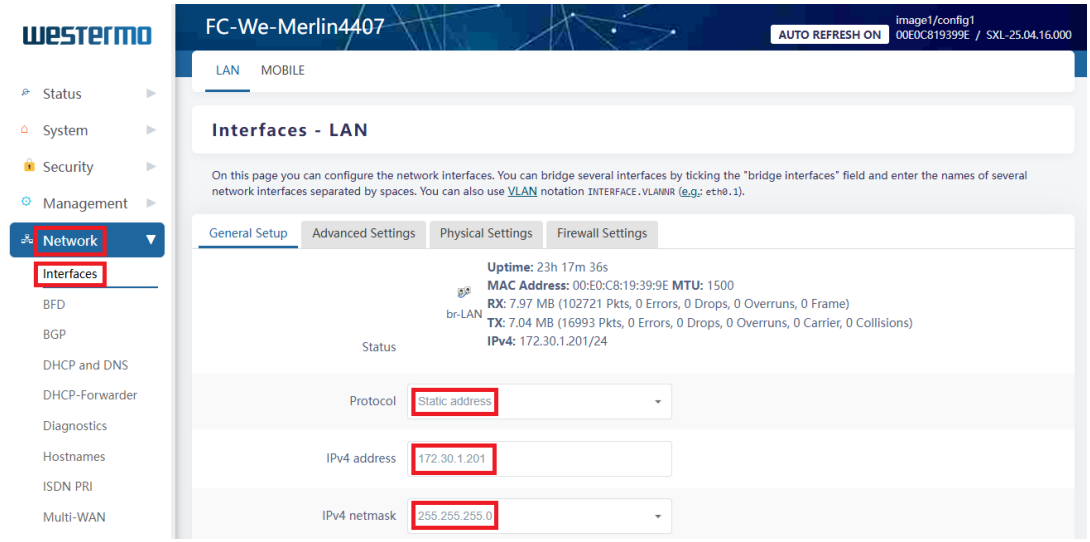



Next enter the new LAN IP address and subnet mask:

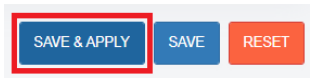
**Protocol:** Static address

**IPv4 address:** <enter desired IP address>

**IPv4 netmask:** <enter desired subnet mask>




Scroll to the bottom of the page and click on the "**SAVE & APPLY**" button



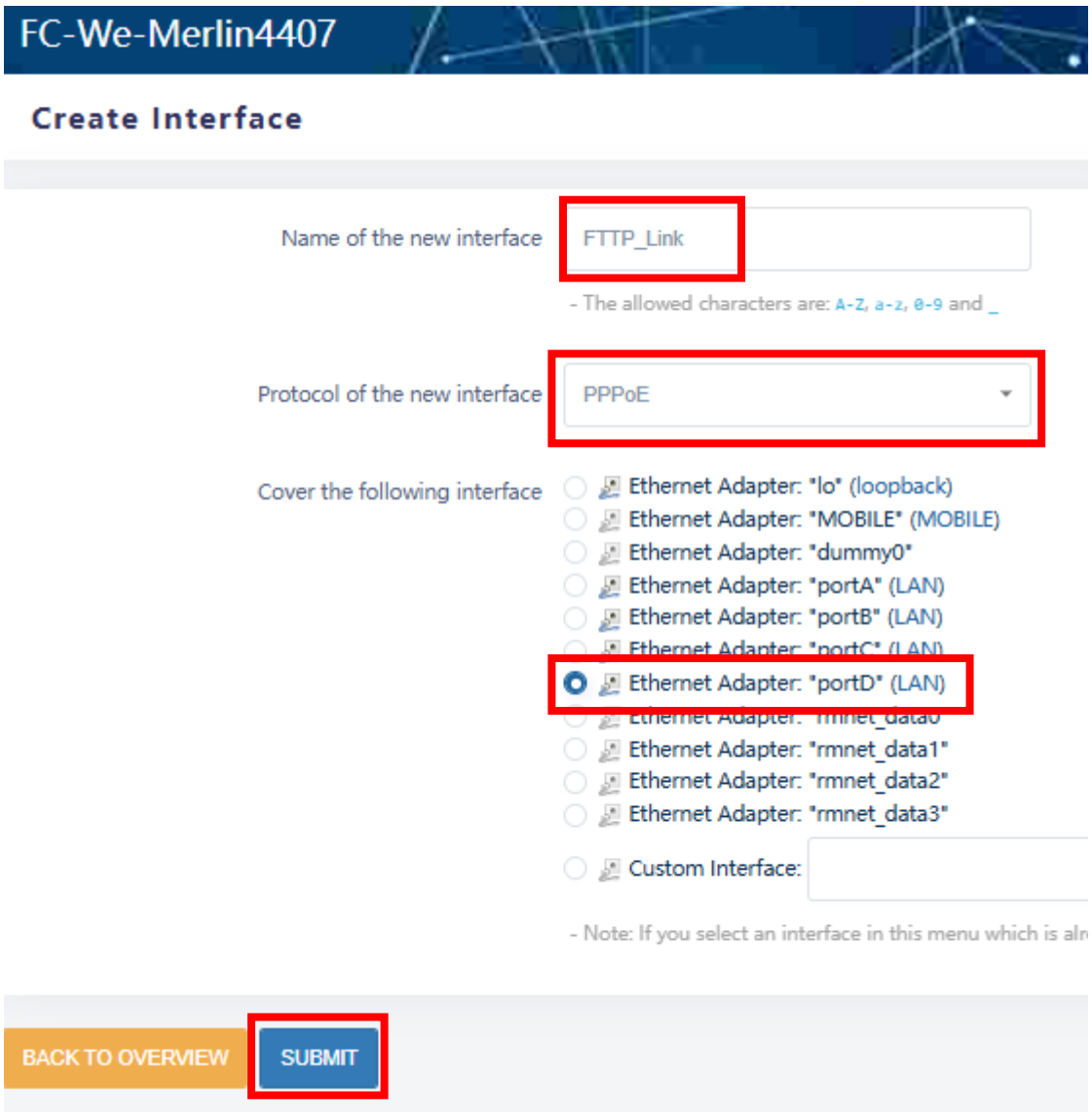
## Creating a new WAN Interface

Scroll down to the bottom of the **Interfaces** page and click on the “ADD NEW INTERFACE” button:


Give the new interface a text description such as “FTTP_Link”

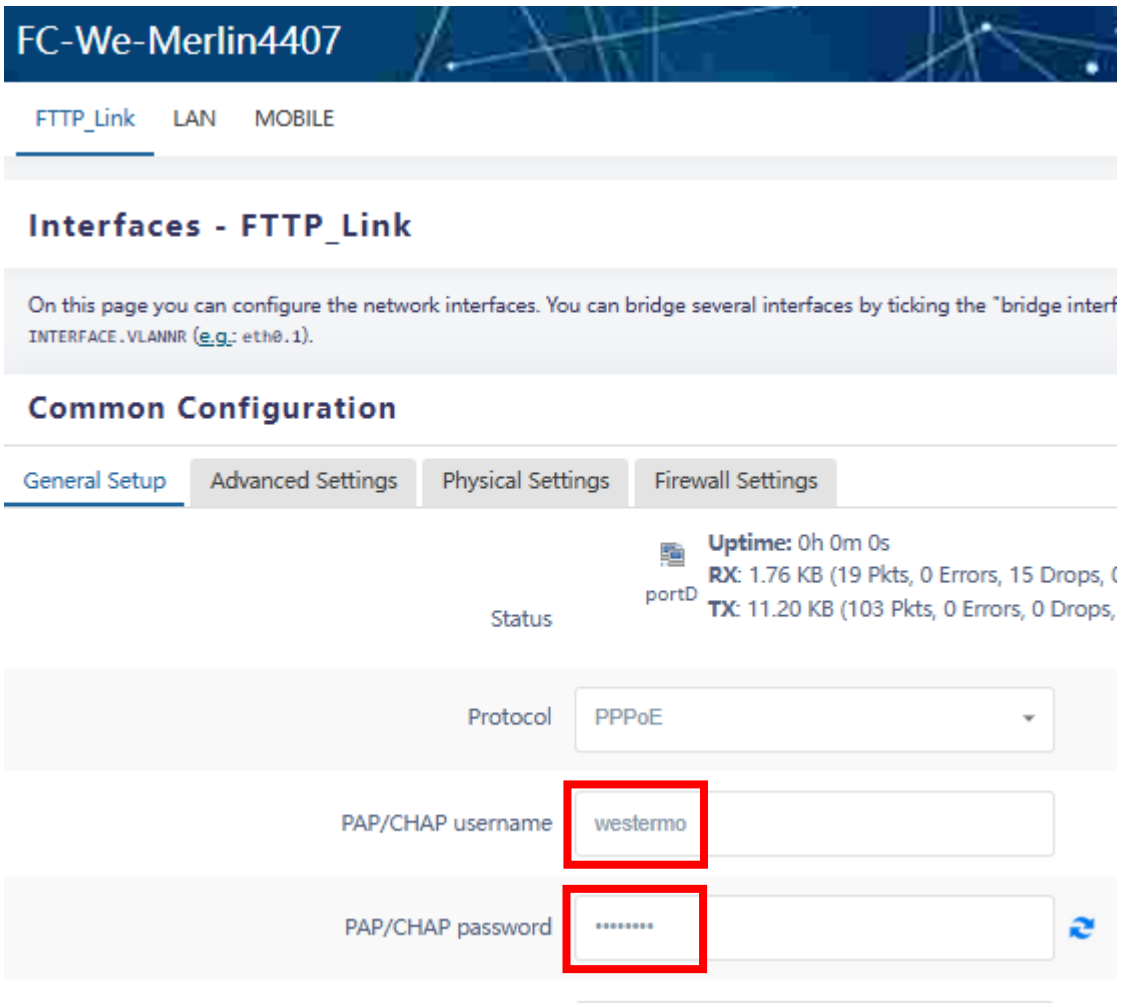
Set the “Protocol of the new interface” to: PPPoE

Now select the ethernet port you want to use for the WAN connection (in this example we will use “portD”) and click on the “SUBMIT” button.



You should now be at the ‘General Setup’ page for this interface.

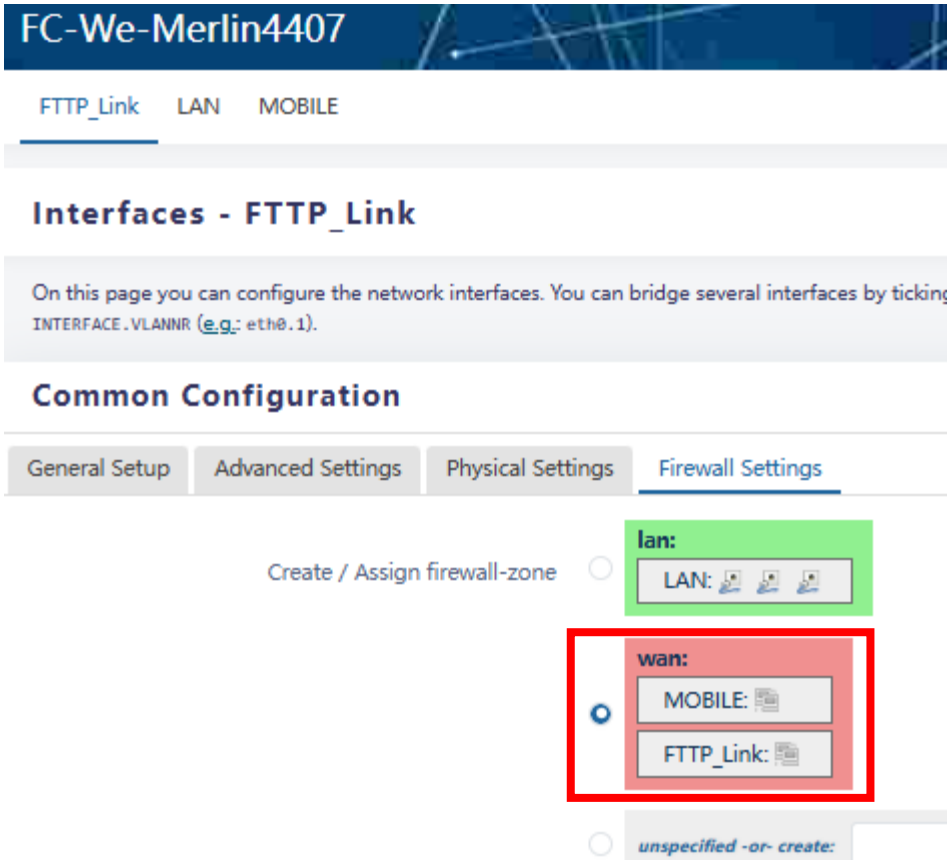
Enter the “PAP/CHAP username” & “PAP/CHAP password” for this interface. These will be the credentials that the ISP supplied. The username may take the form of an email address or just a word. Both the settings must be typed in exactly, as they will be used to authenticate the connection with your ISP.



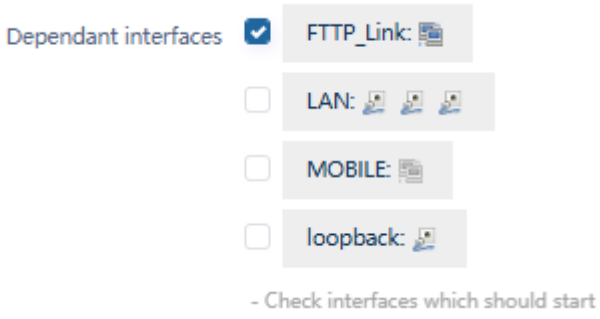

Go to the “Advanced Settings” tab and check that the “Bring up on boot” checkbox is ticked.

Finally, go to the “Firewall Settings“ tab and assign this interface to the WAN firewall-zone, which should already contain the MOBILE interface.

Now click on the “SAVE & APPLY” button. Click on the “Edit” button for the newly created FTTP_Link interface and double-check the firewall setting now has both interfaces listed as below, otherwise the firewall will not allow traffic through this WAN connection:

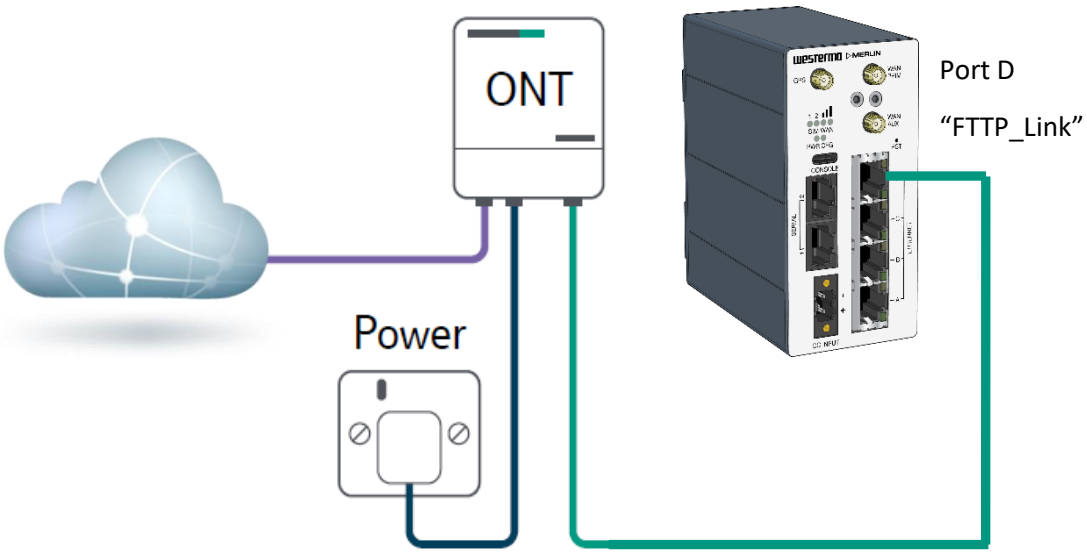



From the **Interfaces** page click on the “EDIT” button for the Loopback Interface and go to Advanced settings tab. Make the FTTP_Link interface dependant by ticking the box and then click on the “SAVE & APPLY” button.




This will make sure that the FTTP interface attempt to connect as soon as the router has finished its boot-up sequence.

Now connect a cable between port D (FTTP WAN port ) and the ethernet port of the ONT supplied by the ISP. An example is shown below, but your specific ONT may be a different size/shape depending on what the ISP has fitted during the fibre installation.



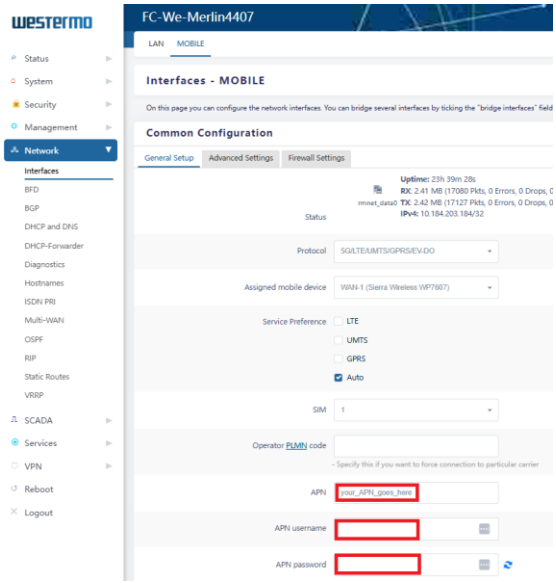

The Merlin will now attempt to authenticate its connection and, if successful, the ISP will issue an IP address to the FTTP_Link interface. The time it takes to complete this will vary depending on how quicky the authentication sequence is completed by the ISP. The internet connection will only be active once the ISP has issued the router with an IP address and it is shown in the status field:

## Mobile Settings

Browse to **Network > Interfaces**.

In the MOBILE section, click the **EDIT** button.


Enter the appropriate APN (Access Point Name) provided by your mobile network provider.




**APN:** Enter your APN here
**APN Username:** Only if applicable
**APN Password:** Only if applicable

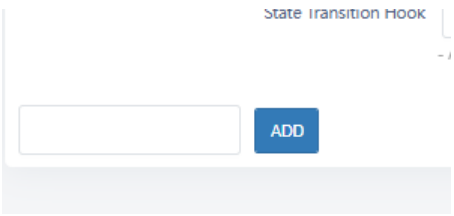
Click on the “Advanced settings” tab and **deselect** the “Bring up on boot” tick box. This will prevent the 4G interface from automatically connecting to the cellular network.

Finally, scroll to the bottom of the page and click the “**SAVE & APPLY”** button.

## Multi-WAN Settings

Browse to **Network > Multi-WAN**

Under the interfaces section there should already be an entry for the MOBILE interface. To add the new FTTP WAN interface scroll down to the bottom of the page and you will see a blank field next to the ADD button:




Enter the name of the FTTP WAN interface EXACTLY as it is shown on the interfaces page (in this example: **FTTP_Link**) and click on the "ADD" button to create the new Multi-WAN interface. The text must match your new FTTP interface name exactly, otherwise the settings will not take effect.

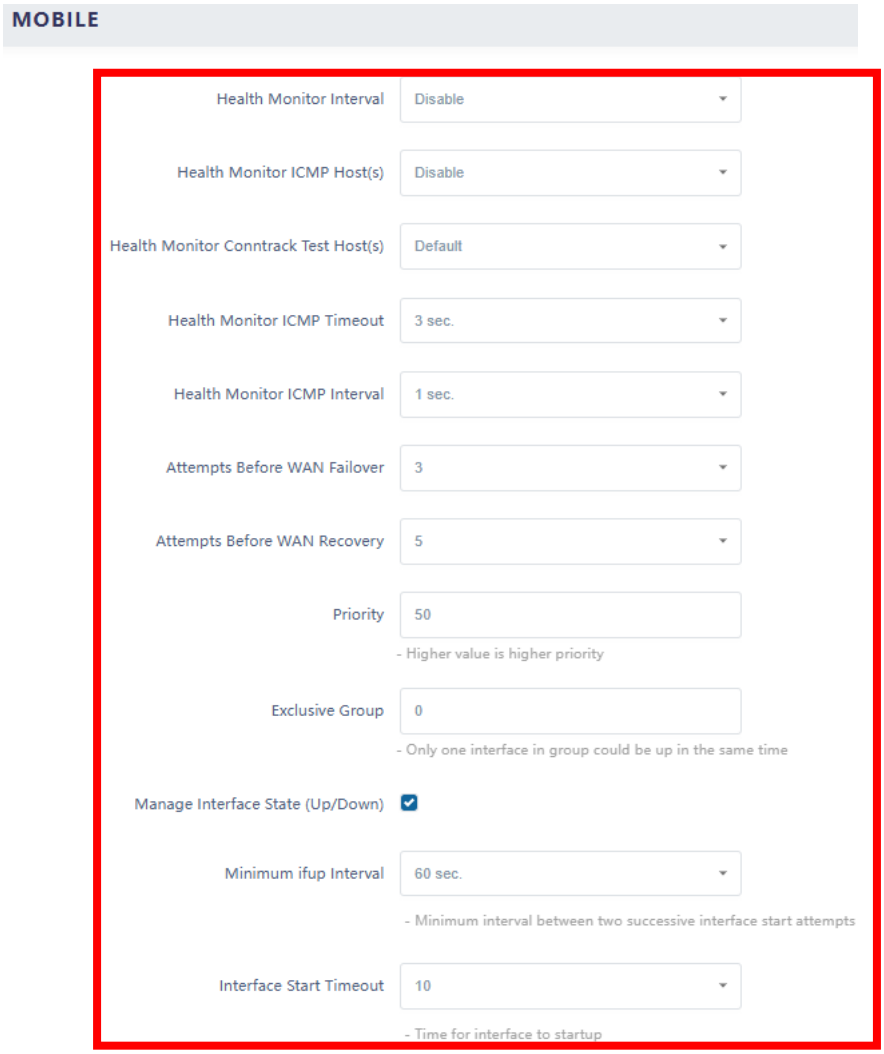
Now click on the "**SAVE & APPLY"** button.

A list of settings for the new interface will now appear and can be edited (refer to next page)


For the FTTP WAN interface configure the following settings:

**Health Monitor Interval:** 10 sec
**Health Monitor ICMP Host(s):** 8.8.8.8
(***Important:*** This is an example IP address only. Choose a reliable, always on IP address that responds to pings on **your FTTP WAN interface**. The condition of this interface is assessed deemed to be UP when the router is receiving ping replies.
**Health Monitor Conntrack Test:** Default
**Health Monitor ICMP Timeout:** 3 sec
**Health Monitor ICMP Interval:** 1 sec
**Attempts Before WAN Failover:** 3
**Attempts Before WAN Recovery:** 5
**Priority:** 100
**Exclusive Group**:0 (Must be the same as the MOBILE Interface Exclusive Group)
**Manage Interface State:** Disabled (**NO** tick)

The MOBILE interface will also needs to have its settings adjusted:




For the MOBILE interface configure the following settings:

**Health Monitor Interval:** Disable
**Health Monitor ICMP Host(s):** Disable
**Health Monitor Conntrack Test:** Default
**Health Monitor ICMP Timeout:** 3 sec
**Health Monitor ICMP Interval:** 1 sec
**Attempts Before WAN Failover:** 3
**Attempts Before WAN Recovery:** 5
**Priority:** 50
**Exclusive Group**:0 (Must be the same as the FTTP_Link Interface Exclusive Group)
**Manage Interface State:** Enabled (**Ticked**)
**Minimum ifup interval:** 60 sec
**Interface start Timeout:** (custom) 10

Click on the "**SAVE AND APPLY**" button.

**Note:** The timers and thresholds set in the FTTP_Link setup shown above may need to be adjusted to suit a particular installation and the values shown in this document should be used as a guide or starting point, rather than the definitive settings for all installations.

Finally, at the top of the page tick the “Enable” and “Preempt” boxes and then click on the “SAVE AND APPLY” button. The preempt setting is used to make sure that if the FTTP connection recovers, the router will fallback to that interface for the primary connection. If this is not selected the router will remain on the 4G connection regardless of the state of the FTTP link.


**Note:** It’s possible that the Mobile interface will come up before any of the above settings have taken effect, as well as the FTTP port also being active. If this happens you can manually disconnect it by using the “STOP” button on the interfaces page: **Network > Interfaces**


Alternatively, performing a reboot of router will make sure the interfaces start up in the correct sequence for the failover mechanism to assume control.

From the main menu, go to the bottom of the page and click on **Reboot**

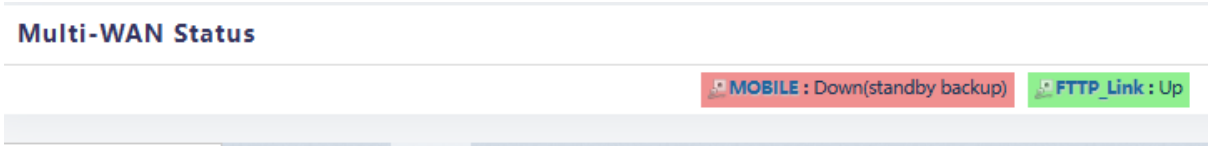
Tick the **“Reboot now”** option and then click on the **“Reboot”** button to commence this action.

## Testing the Failover

Browse to **Network > Interfaces** and check the FTTP link  is up (IP address assigned) and that the mobile interface is down:

## Multi-WAN Web GUI Status

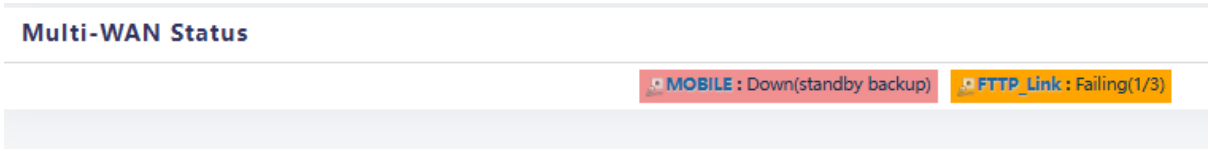
Now browse to **Status > Overview** and scroll to the bottom of the page where the “Multi-WAN Status” is displayed. You should see the FTTP_Link: Up and MOBILE: Down(standby backup)



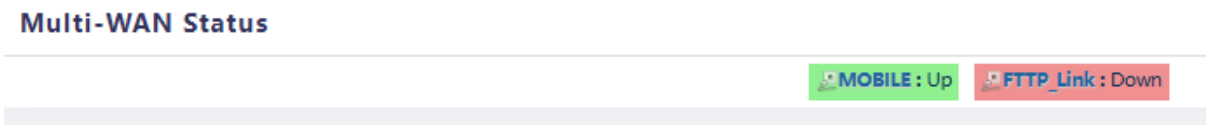

This is the normal state where FTTP is the primary connection and the 4G interface is the backup.

## Failure & Failover Sequence

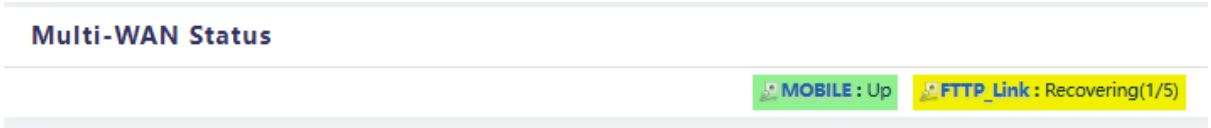
Disconnect the cable to the ONT and continue to watch the Multi- WAN status page. You will see that the FTTP_Link status begins to indicate that the connection is failing:



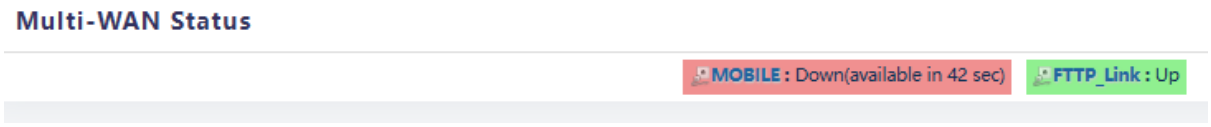

If the host address does not respond after three attempts the FTTP-Link will be marked as down and the Mobile interface will start up and show “Up” when a network connection has been made:




In the background the router will continue to test for connectivity to the host address on the WAN port. If it starts to respond it will show the link is recovering and will need to receive five consecutive replies (configurable setting) before it will return the FTTP_Link to be the primary link and shut down the 4G interface.




Once the FTTP link has been restored the mobile interface will remain unavailable for the programmed amount of time (60 secs in this example). This is done to prevent the router from constantly flipping between the two interfaces if the FTTP link is intermittently working.

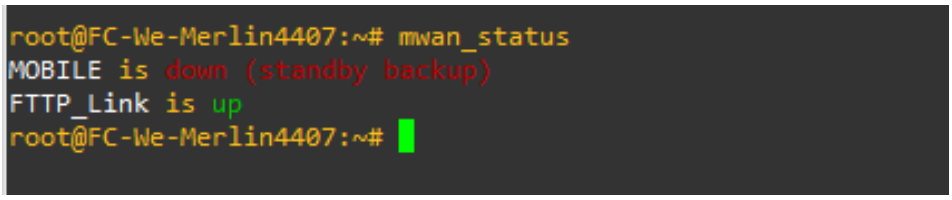


## Multi-WAN CLI Status

The Multi-WAN status on the overview page gives a useful status update, but this page only auto-refreshes every 5 seconds which means you can miss some of the key status changes.

If you want to see a snap shot of the status at any time you can also view it from the command line interface using the following command:

**mwan_status**




If you want to see the status update continuously you can use the CLI command as follows:

**watch -n 1 mwan_status**

This will update every second. Use Ctrl-C to exit this command.

## Understanding the System Log

Browse to System > System Log to see the current status of the router.

The log below shows the sequence of the FTTP_Link interface failing and recovering (key moments are annotated and highlighted):

Jan 29 14:45:14 user.warn 00E0C819412D multiwan-0[6961]: FTTP_Link: ping 8.8.8.8(8.8.8.8) failed **-PING is failing**
Jan 29 14:45:14 daemon.info 00E0C819412D pppd[3265]: pppoe-FTTP_Link: No response to 3 echo-requests **-PING failure threshold reached**
Jan 29 14:45:14 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: Serial link appears to be disconnected.
Jan 29 14:45:15 local0.warn 00E0C819412D iface.20-firewall: conntrack v1.4.6 (conntrack-tools): connection tracking table has been emptied.
Jan 29 14:45:19 user.info 00E0C819412D multiwan-0[6961]: FTTP_Link: up->failed **-FTTP Interface marked as DOWN**
Jan 29 14:45:20 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: Connection pppoe-FTTP_Link terminated.
Jan 29 14:45:20 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: Modem hangup
Jan 29 14:45:21 user.info 00E0C819412D multiwan-0[6961]: MOBILE: down->starting **-4G Interface starting up**
Jan 29 14:45:21 user.info 00E0C819412D mobile[5410]: WAN-1 - Disconnecting MOBILE
Jan 29 14:45:22 user.info 00E0C819412D mobile[5410]: WAN-1 - Interface MOBILE down
Jan 29 14:45:22 user.info 00E0C819412D mobile[5410]: WAN-1 - Already on SIM1
Jan 29 14:45:22 daemon.warn 00E0C819412D dnsmasq[6511]: no servers found in /tmp/resolv.conf.auto, will retry
Jan 29 14:45:23 local0.warn 00E0C819412D iface.20-firewall: conntrack v1.4.6 (conntrack-tools): connection tracking table has been emptied.
Jan 29 14:45:23 user.info 00E0C819412D mobile[5410]: WAN-1 - Interface MOBILE up on SIM 1 in "vodafone" LTE network, signal quality -85 dBm
Jan 29 14:45:24 daemon.info 00E0C819412D dnsmasq[6511]: reading /tmp/resolv.conf.auto
Jan 29 14:45:24 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 10.4.0.240#53
Jan 29 14:45:24 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 10.4.0.230#53
Jan 29 14:45:24 daemon.info 00E0C819412D dnsmasq[6511]: using only locally-known addresses for lan
Jan 29 14:45:24 user.notice 00E0C819412D ifup: Enabling Router Solicitations on MOBILE (rmnet_data0)
Jan 29 14:45:24 user.info 00E0C819412D firewall: removing MOBILE (rmnet_data0) from zone wan
Jan 29 14:45:24 user.info 00E0C819412D firewall: adding MOBILE (rmnet_data0) to zone wan
Jan 29 14:45:25 local0.warn 00E0C819412D iface.20-firewall: conntrack v1.4.6 (conntrack-tools): connection tracking table has been emptied.
Jan 29 14:45:25 daemon.info 00E0C819412D ifplugd(rmnet_data0): started: BusyBox v1.23.2 (long time ago)
Jan 29 14:45:25 daemon.info 00E0C819412D ifplugd(rmnet_data0): using IFF_RUNNING detection mode
Jan 29 14:45:25 daemon.info 00E0C819412D ifplugd(rmnet_data0): link is up
Jan 29 14:45:25 daemon.info 00E0C819412D chronyd[2664]: Selected source 150.254.65.61
Jan 29 14:45:28 user.info 00E0C819412D multiwan-0[6961]: MOBILE: starting->up **4G interface is now UP**
Jan 29 14:45:50 daemon.info 00E0C819412D pppd[3265]: pppoe-FTTP_Link: PPP session is 7615
Jan 29 14:45:50 daemon.warn 00E0C819412D pppd[3265]: pppoe-FTTP_Link: Connected to 00:04:2D:E3:A7:B6 via interface portD **FTTP Comms restoring**
Jan 29 14:45:50 daemon.info 00E0C819412D pppd[3265]: pppoe-FTTP_Link: Using interface pppoe-FTTP_Link
Jan 29 14:45:50 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: Connect: pppoe-FTTP_Link <--> portD
Jan 29 14:45:50 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: CHAP authentication succeeded
Jan 29 14:45:50 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: peer from calling number 00:04:2D:E3:A7:B6 authorized
Jan 29 14:45:50 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: local  IP address 81.1.2.3
Jan 29 14:45:50 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: remote IP address 1.2.3.4
Jan 29 14:45:50 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: primary   DNS address 8.8.8.8
Jan 29 14:45:50 daemon.notice 00E0C819412D pppd[3265]: pppoe-FTTP_Link: secondary DNS address 8.8.4.4
Jan 29 14:45:51 daemon.notice 00E0C819412D ppp: connection "pppoe-FTTP_Link" established with ip "81.1.2.3"/"1.2.3.4"
Jan 29 14:45:52 daemon.info 00E0C819412D dnsmasq[6511]: reading /tmp/resolv.conf.auto
Jan 29 14:45:52 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 10.4.0.240#53
Jan 29 14:45:52 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 10.4.0.230#53
Jan 29 14:45:52 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 8.8.8.8#53
Jan 29 14:45:52 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 8.8.4.4#53
Jan 29 14:45:52 daemon.info 00E0C819412D dnsmasq[6511]: using only locally-known addresses for lan
Jan 29 14:45:52 user.notice 00E0C819412D ifup: Enabling Router Solicitations on FTTP_Link (pppoe-FTTP_Link)
Jan 29 14:45:52 user.info 00E0C819412D firewall: removing FTTP_Link (pppoe-FTTP_Link) from zone wan
Jan 29 14:45:52 user.info 00E0C819412D firewall: adding FTTP_Link (pppoe-FTTP_Link) to zone wan
Jan 29 14:45:53 local0.warn 00E0C819412D iface.20-firewall: conntrack v1.4.6 (conntrack-tools): connection tracking table has been emptied.
Jan 29 14:45:53 kern.err 00E0C819412D kernel: [ 3369.079656] misc nmea: sz 31 > avail 0
Jan 29 14:46:34 user.info 00E0C819412D multiwan-0[6961]: FTTP_Link: interface recovered
Jan 29 14:46:34 user.info 00E0C819412D multiwan-0[6961]: MOBILE goes down: preempted by FTTP_Link
Jan 29 14:46:34 user.info 00E0C819412D multiwan-0[6961]: MOBILE: up->down **4G Interface goes back to standy mode**
Jan 29 14:46:35 daemon.err 00E0C819412D ifplugd(rmnet_data0): exiting
Jan 29 14:46:35 user.info 00E0C819412D mobile[5410]: WAN-1 - Disconnecting MOBILE
Jan 29 14:46:36 daemon.info 00E0C819412D dnsmasq[6511]: reading /tmp/resolv.conf.auto
Jan 29 14:46:36 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 8.8.8.8#53
Jan 29 14:46:36 daemon.info 00E0C819412D dnsmasq[6511]: using nameserver 8.8.4.4#53
Jan 29 14:46:36 daemon.info 00E0C819412D dnsmasq[6511]: using only locally-known addresses for lan
Jan 29 14:46:36 user.info 00E0C819412D multiwan-0[6961]: FTTP_Link: failed->up **FTTP_Link is primary connection again**
Jan 29 14:46:36 user.info 00E0C819412D mobile[5410]: WAN-1 - Interface MOBILE down
Jan 29 14:46:36 local0.warn 00E0C819412D iface.20-firewall: conntrack v1.4.6 (conntrack-tools): connection tracking table has been emptied.
Jan 29 14:46:46 user.info 00E0C819412D multiwan-0[6961]: FTTP_Link: Interface recovered after 3 health check failures

**Revision History**

| Revision | Rev by | Revision Notes | Date |
|---|---|---|---|
| 00 | RM | | 31/01/2025 |
| 01 | | | |
| 02 | | | |
| 03 | | | |
| 04 | | | |
| 05 | | | |
| 06 | | | |
| 07 | | | |