Application Note 7

Wireless WAN Problem Detection and Recovery

UK Support

September 2014

1 CONTENTS

2 INTRODUCTION

2.1 Outline

W-WAN technologies such as GPRS, EDGE and HSPA have proven to be extremely reliable. However the consequences of losing contact with a remote unit are so severe in terms of recovery costs (site visits etc.) that it warrants extra precautions.
Such a problem might on very rare occasions occur due to power spikes, interference or the network blocking the current connection due to some error or failure.
There are a number of features built into Digi Transport routers that are designed to recover from any W-WAN module or network problems that may occur without user intervention if this is possible.
Some of these options are **passive**

- They work simply by monitoring traffic on the W-WAN network and spotting problems.

Some of them are **active**

- They work by actually generating traffic on the W-WAN network. The active options have the advantage of working even when the hosts on the Digi Transport's Ethernet network are not sending packets to the W-WAN network. The disadvantage is that data charges will be incurred if your W-WAN network provider charges you for data.

NB If a speedy recovery from the problem is not required then the amount of traffic generated for the active options can be set so low as to be of negligible cost.

2.2 Assumptions

This guide has been written for use by technically competent personnel with a good understanding of the communications technologies used in the product, and of the requirements for their specific application.

Configuration: This application note assumes that the WR41V2 will be connecting to a cellular network (i.e. GPRS, EDGE, 3G, HSDPA, HSUPA or CDMA).

This application note applies to;
Models shown: Digi Transport WR41V2

Other Compatible Models: All other Digi Transport products with Wireless WAN connectivity.

Firmware versions: All Versions

Configuration: This Application Note assumes the devices are set to their factory default configurations. Most configuration commands are only shown if they differ from the factory default.

2.3 Corrections

Requests for corrections or amendments to this application note are welcome and should be addressed to: uksupport@digi.com
Requests for new application notes can be sent to the same address.

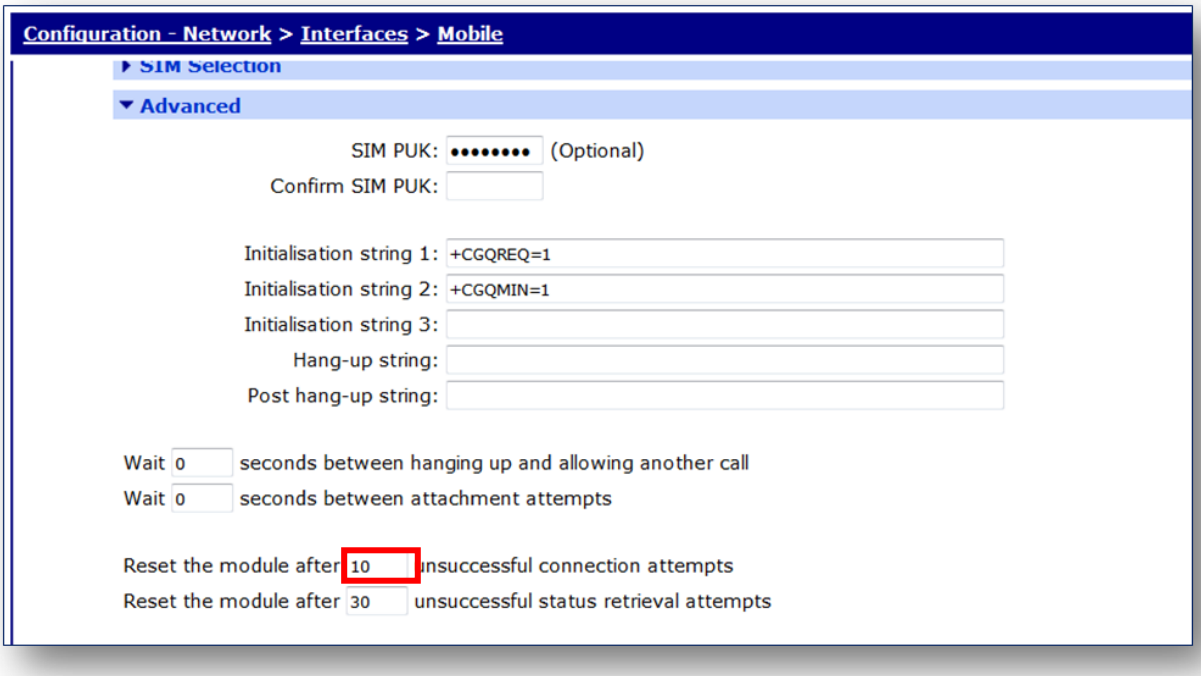
2.4 Version

Version Number	Status
1.0	Published
1.1	Changed over to new App Note format
1.2	Removed LCP Echo configuration
1.3	Updated from GPRS to W-WAN and included “Unanswered TX packets” technique
1.4	Re-branded to Digi Transport
1.5	Checked and added SureLink Wizard section
1.6	Added screenshots for Transport Configuration steps, testing logs, adjusted format

3 CONFIGURATION

3.1 W-WAN Module Power Cycle

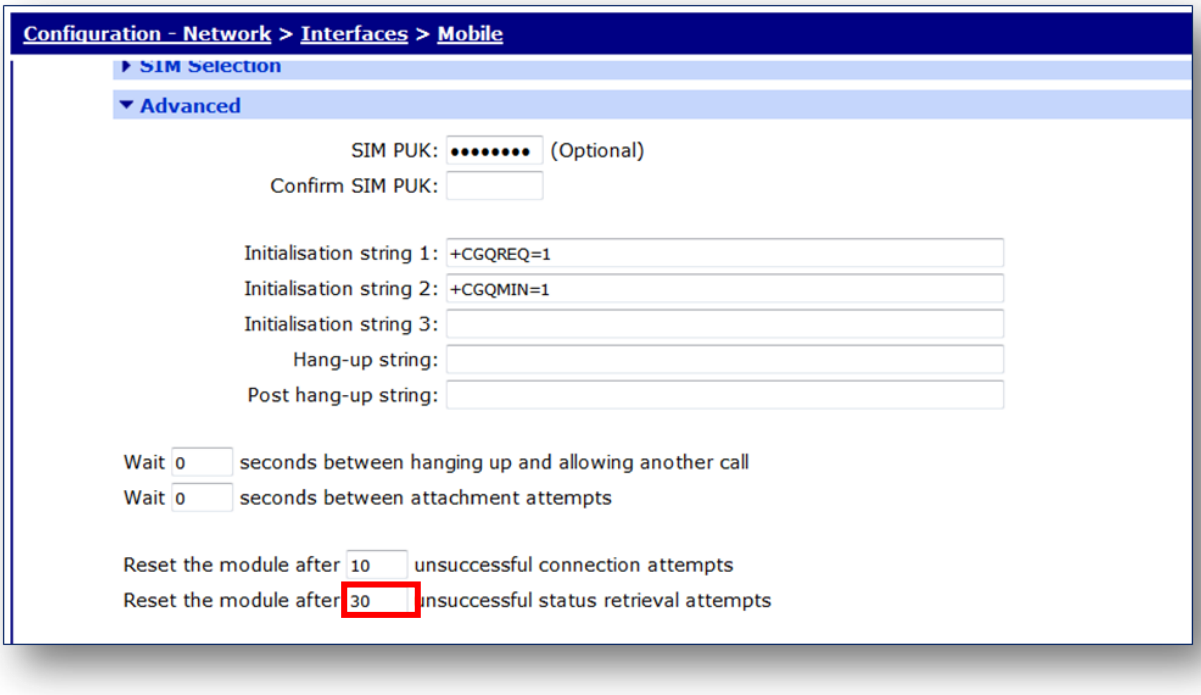
By default all Digi Transport routers are shipped with a configuration that will power cycle the W-WAN module if 10 attempts at a Mobile connection in a row fail. This is useful not only because it can recover from an error condition in the module itself, but because it causes the W-WAN module to re-register with the network. Re-registering with the network is sometimes required to recover from a connection problem.
You can check this feature is enabled by navigating to **Configuration - Network > Interfaces > Mobile > Advanced** and checking the "**Reset the module after n unsuccessful connection attempts**" parameter is set to a non-zero value such as 10:



This means that after 10 unsuccessful attempts at activating a Mobile link, the W-WAN module will be power cycled. This feature can be tested by deliberately "sabotaging" the Digi Transport's attempts to connect to the W-WAN network (for example, by programming in an incorrect APN). Next deactivate the Mobile connection and then inspect the Digi Transport's event log.
Check for an entry like the "`GPRS Link Failed → power cycle`" entry below which will occur after 10 failed attempts at connecting.

```
15:30:30,04 Nov 2009,LAPB 5 up
15:30:30,04 Nov 2009,LAPB 4 up
15:30:30,04 Nov 2009,LAPB 3 up
15:30:18,04 Nov 2009,LAPB 5 down,Lower deactivated
15:30:18,04 Nov 2009,LAPB 4 down,Lower deactivated
15:30:18,04 Nov 2009,LAPB 3 down,Lower deactivated
15:30:17,04 Nov 2009,PPP 1 down,LL disconnect
15:30:17,04 Nov 2009,GPRS link failed -> power cycle
15:29:11,04 Nov 2009,PPP 1 down,LL disconnect
15:28:06,04 Nov 2009,PPP 1 down,LL disconnect
15:27:00,04 Nov 2009,PPP 1 down,LL disconnect
15:25:55,04 Nov 2009,PPP 1 down,LL disconnect
15:24:49,04 Nov 2009,PPP 1 down,LL disconnect
```

Additionally all Digi Transport routers are shipped with a "**Reset the module after n unsuccessful status retrieval attempts**" value of 30:



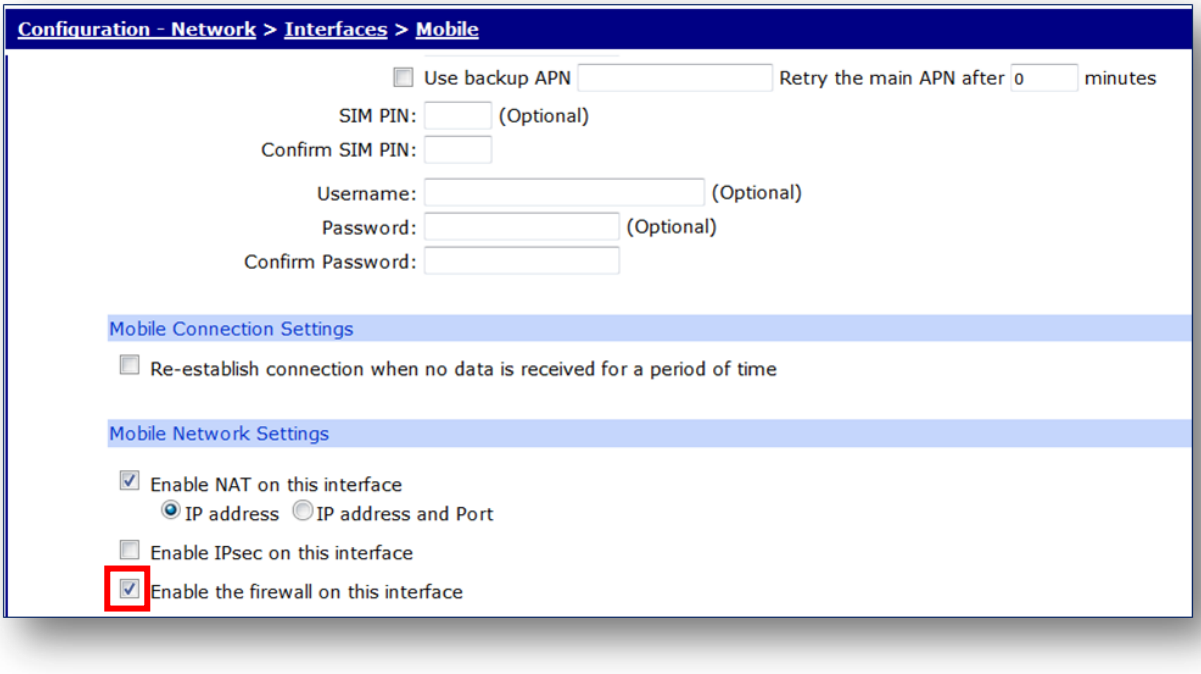
This will cause the Digi Transport to power cycle the W-WAN module if 30 attempts at checking the status of the module (e.g. reading the signal strength) fail.

NB These features by themselves are NOT sufficient; they MUST be used in conjunction with one of the three techniques below which are responsible for deactivating the Mobile link if it stops working.

3.2 *Deactivate Mobile link via Stateful Route Inspection*

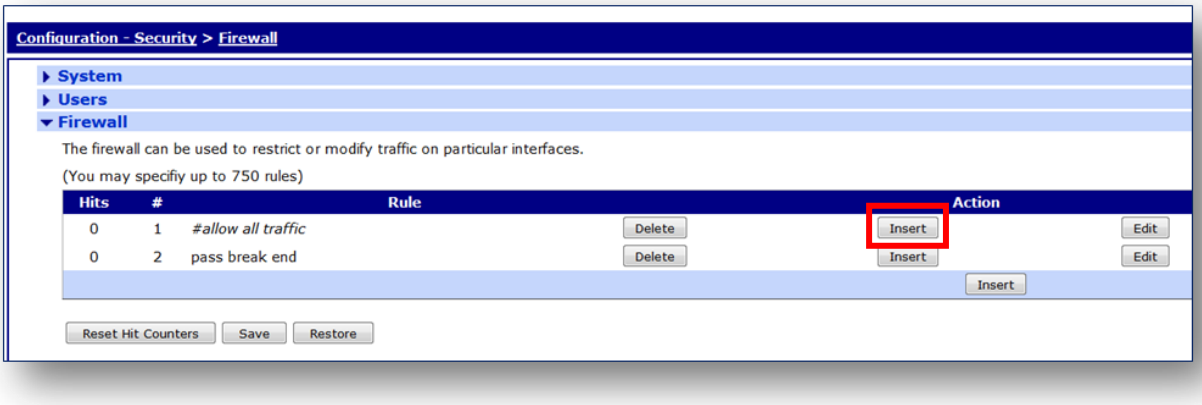
SRI or Stateful Route Inspection is a passive error detection technique. All Digi Transport routers contain a powerful stateful firewall facility. In addition to blocking un-authorised traffic the firewall can be used to monitor traffic on a particular interface and flag routes as OOS (out of service) or even deactivate Mobile links. In the context of W-WAN problem detection this facility can be used to deactivate the Mobile link to the W-WAN network (usually PPP instance 1) and cause it to re-negotiate thus potentially fixing the problem identified. It can also be used to cause the Digi Transport to send the data through a backup interface but this will not be detailed in this application note.

This technique is only useful if some equipment routing through the Digi Transport to the W-WAN initiates traffic on a regular basis. i.e. something local to the Digi Transport is required to generate the traffic in the first place.
To enable SRI for the W-WAN interface, take the following steps.
On the Digi Transport's web server navigate to the **Configuration - Network > Interfaces > Mobile > Mobile Settings > Mobile Network Settings** web page and tick the "**Enable the firewall on this interface**" parameter.

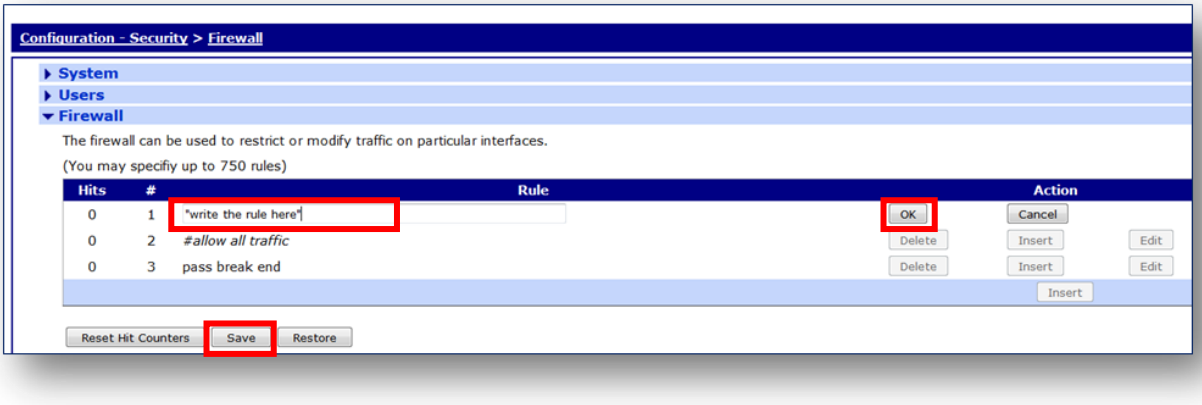


Then, click the '**Apply**' button at the bottom of the section

On the Digi Transport's web server navigate to the **Configuration - Security > Firewall** web page. This page allows multiple entries to be made in the Digi Transport's firewall by first clicking the "Insert" button:



filling out the text box and then clicking the “OK” button. Click the “**Save**” button at the bottom of the Firewall to save your firewall settings permanently.



Most simple SRI firewalls can be achieved in just two lines.
Three examples follow. The syntax of the firewall commands will not be explained in detail, for a detailed explanation of the syntax please see the latest Digi Transport User Guide. Adjust one of these examples to match your requirements and enter it into two lines of the firewall.

TCP:

```
Line 1: pass out break end on ppp 1 proto tcp from any to 192.168.20.1 flags S!A
inspect-state oos 1 t=5 c=5 d=5
Line 2: pass break end
```

The above firewall will cause PPP 1 (usually the Mobile PPP interface) to be deactivated if 5 TCP connection attempts to the IP address 192.168.20.1 fail.

UDP:

```
Line 1:     pass out break end on ppp 1 proto udp from any to 192.168.0.0/16
port=1001 inspect-state oos ppp 1 1 t=10 c=5 d=5
Line 2: pass break end
```

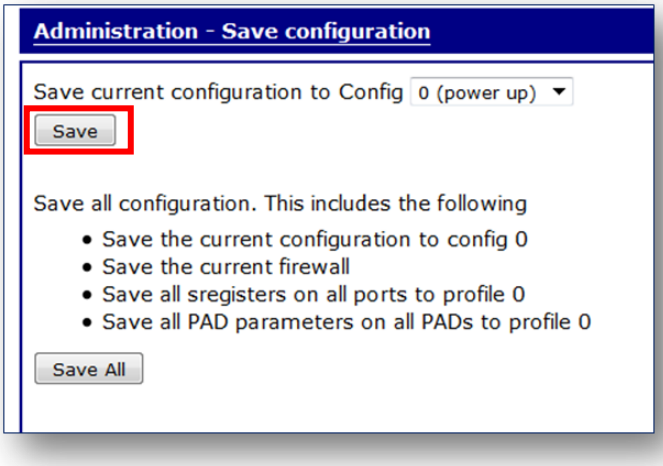
The above firewall will cause PPP 1 (usually the Mobile PPP interface) to be deactivated if five (c = 5 & d = 5) UDP packets are sent to IP subnet 192.168.0.0/16 on port number 1001 and no UDP packet is received back from the 192.168.0.0/16 subnet. NB It can be completely OK for some protocols that use UDP not to receive a reply, this rule should only be used for UDP based protocols that expect a reply.

ICMP PING:

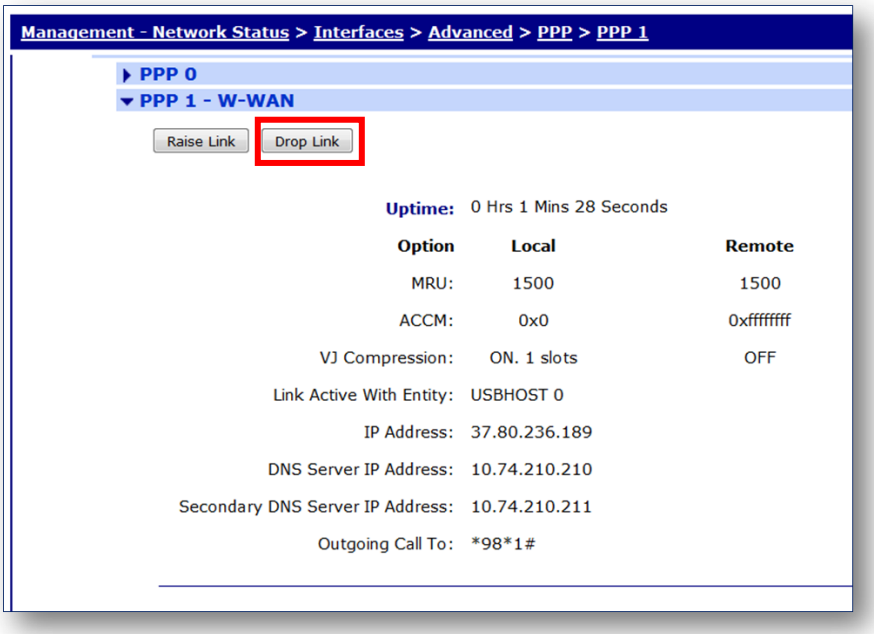
```
Line 1:     pass out break end on ppp 1 proto icmp from any to
192.168.99.99 icmp-type echo inspect-state  oos 1 t=10 c = 2 d = 2
Line 2: pass break end
```

The above example will cause PPP 1 (usually the Mobile PPP interface) to be deactivated if two (c = 2 & d = 2) ICMP PING (echo request) packets are sent to the 192.168.99.99 IP address and no ICMP PING (echo response) is received back within 20 seconds (d=2 x t=10 = 20 seconds).

On the Digi Transport's web server menu click on **Administration - Save configuration** and then click the "**Save**" button to save the running configuration to the current power up profile. (I.e. the config.da0 file):



Finally to activate the configuration changes navigate to **Management – Network Status > Interfaces > Advanced > PPP > PPP 1** and click on "**Drop Link**". The Mobile link will automatically re-activate (subject to the unit containing a default configuration) and the new SRI feature activated:



3.2.1 Testing – Stateful Route Inspection

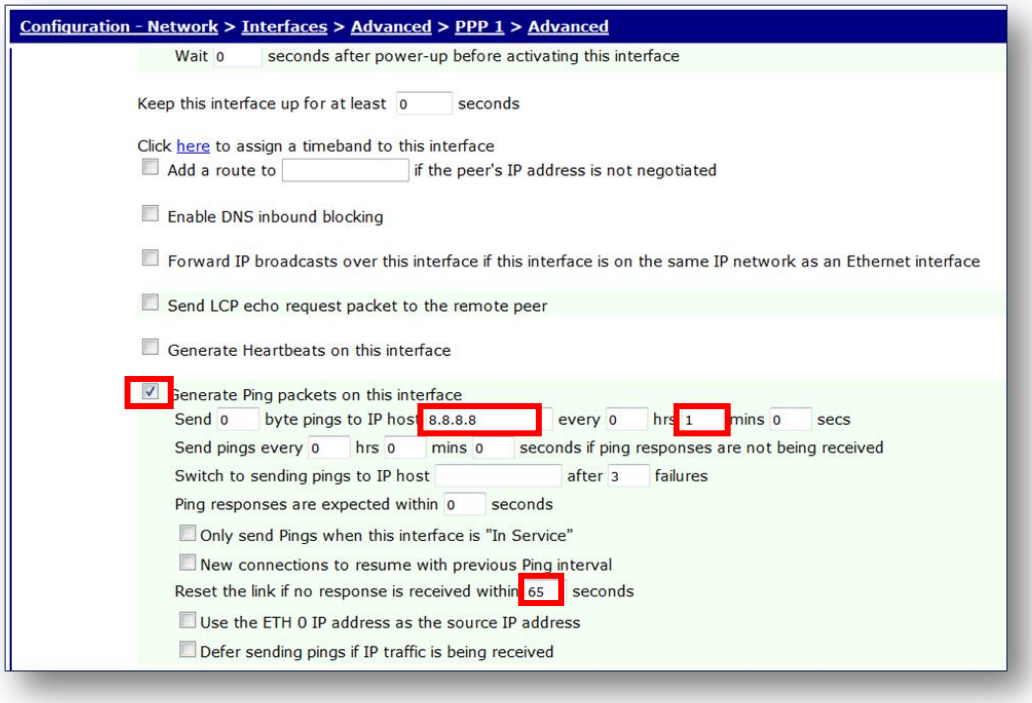
You should test the new feature by deliberately generating traffic to trigger the firewall and checking that Mobile link deactivates itself and re-activates itself as expected. This can be easily seen in the Digi Transport's event log. **Management - Event Log**.
In the following example, a ping to 192.168.99.99 has been generated from a laptop connected to the ETH interface of the transport. For the purpose of the test an host that doesn't exist has been chosen, in order to have the ping fails and the SRI working:

```
00:08:41, 01 Jan 2000,GOBI 3000 running QCN D3200-STSUGN-1575
00:08:41, 01 Jan 2000,GOBI 3000 running FW D3200-STSUGN-1575
00:08:41, 01 Jan 2000,Event delay,Logger busy
00:08:39, 01 Jan 2000,PPP 1 up
00:08:39, 01 Jan 2000,Default Route 0 Available,Activation
00:08:39, 01 Jan 2000,PPP 1 Available,Activation
00:08:38, 01 Jan 2000,PPP 1 Start
00:08:38, 01 Jan 2000,Modem connected on asy 4
00:08:38, 01 Jan 2000,Event delay,Logger busy
00:08:32, 01 Jan 2000,Modem dialing on asy 4 #:*98*1#
00:08:32, 01 Jan 2000,Event delay,Logger busy
00:08:29, 01 Jan 2000,Modem disconnected on asy 4,1
00:08:29, 01 Jan 2000,Event delay,Logger busy
00:08:27, 01 Jan 2000,PPP 1 down,Firewall Request
00:08:27, 01 Jan 2000,Default Route 0 Out Of Service,Firewall
00:08:27, 01 Jan 2000,PPP 1 Out Of Service,Firewall
```

3.3 Deactivate Mobile link via PING failure detection

This is an active error detection technique. This technique will work whether or not any equipment is configured to route through the Digi Transport to the Mobile link.
The Digi Transport can be configured to automatically generate pings at a specified interval and send them to a destination IP address. If the Digi Transport receives no reply to these pings in a specified amount of time then the unit will deactivate the Mobile link.
NB: On some mobile networks, PING packets are blocked so this technique cannot be used in this case.

To enable automatic PING failure detection, on the Digi Transport's web server navigate to the **Configuration - Network > Interfaces > Advanced > PPP 1 > Advanced** web page and follow the picture and table below for the settings:

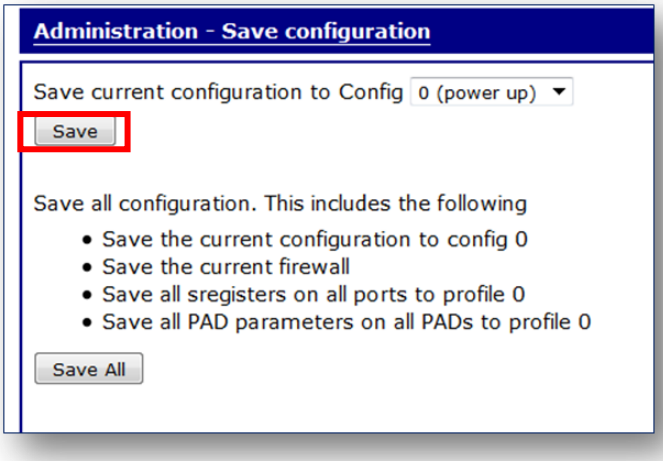


Parameter	Setting	Description
Generate Ping packets on this interface	Ticked	Enable the ping failure detection and reveal options
To IP host	8.8.8.8	IP address of the host that the TransPort should be able to ping over the mobile network
Every x hrs y mins z secs	0-1-0	Frequency at which the ping are sent. In this AN the router will send pings at 1 minute intervals
Reset the link if no response is received within x seconds	65	Time in seconds that the Digi TransPort will wait for a reply to one of the pings – in this example the router will wait for 65 seconds for a response.

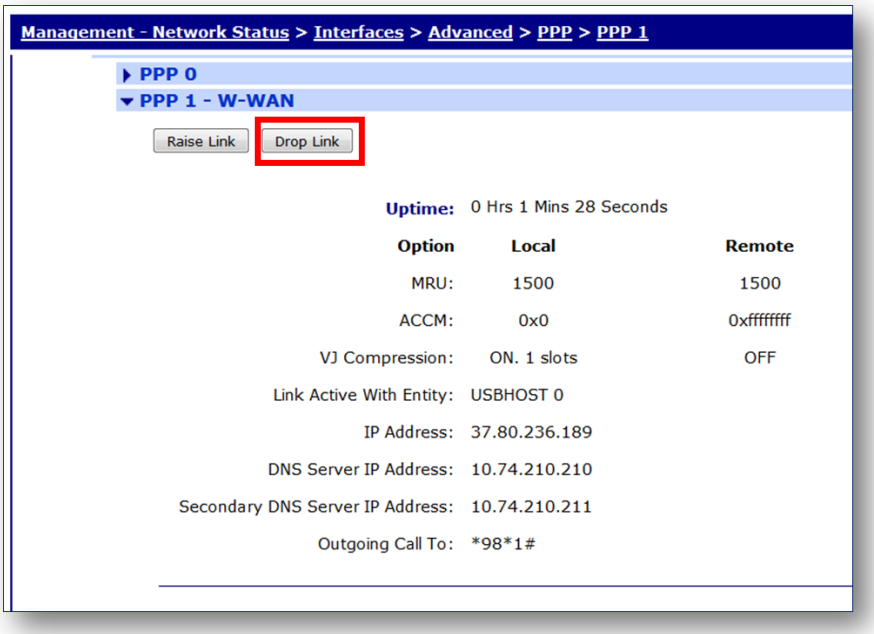
The above example means that the router will send test pings at 60 second intervals and wait 65 seconds for a response. (In effect which means wait 60 seconds after sending the first ping and an extra 5 seconds in

case we receive a reply to the second ping within five seconds). Therefore with this configuration, if the Digi Transport does not receive a reply to 2 consecutive pings then the Mobile link will be deactivated.

On the Digi Transport's web server menu click on **Administration - Save configuration** and then click the "**Save**" button to save the running configuration to the current power up profile. (I.e. the config.da0 file).



Finally to activate the configuration changes navigate to **Management – Network Status > Interfaces > Advanced > PPP > PPP 1** and click on "**Drop Link**". The Mobile link will automatically re-activate (subject to the unit containing a default configuration) and the new SRI feature activated:



3.3.1 Testing – Ping Failure Detection

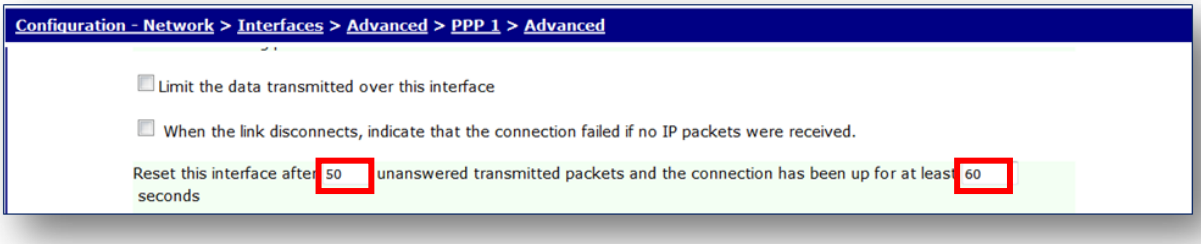
You should test the new feature by deliberately ensuring that the IP address the Digi Transport is pinging cannot reply and then checking that PPP 1 deactivates itself and re-activates itself as expected. This can be easily seen in the Digi Transport's event log. **Diagnostics - Event Log**. You should see an entry similar to the following; "PPP 1 PING failure."
In the following example, the IP address to which the ping are sent is set to a not existent one in order to trigger the automatic ping failure detection:

```
03:35:48, 01 Jan 2000,PPP 1 up
03:35:48, 01 Jan 2000,Default Route 0 Available,Activation
03:35:48, 01 Jan 2000,PPP 1 Available,Activation
03:35:48, 01 Jan 2000,PPP 1 Start
03:35:48, 01 Jan 2000,Modem connected on asy 4
03:35:48, 01 Jan 2000,Event delay,Logger busy
03:35:42, 01 Jan 2000,Modem dialing on asy 4 #:*98*1#
03:35:38, 01 Jan 2000,Modem disconnected on asy 4,1
03:35:38, 01 Jan 2000,Event delay,Logger busy
03:35:37, 01 Jan 2000,Default Route 0 Out Of Service,Activation
03:35:37, 01 Jan 2000,PPP 1 Out Of Service,Activation
03:35:37, 01 Jan 2000,PPP 1 down,PPP PING Failure
```

3.4 Deactivate PPP via Unanswered TX packets

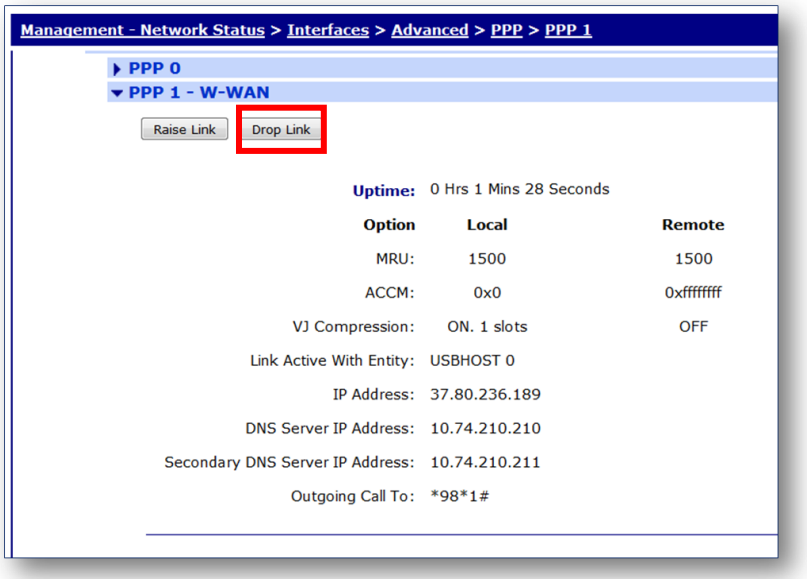
This is a passive error detection technique. The Digi Transport can be configured to deactivate an interface if a number of packets are transmitted consecutively with no packets received. This is not suitable for all situations because sometimes there are legitimate cases where a large number of packets will be sent and no reply is expected. (e.g. streaming audio or video). Additionally, this is only suitable for situations where some device is configured to route through the Digi Transport to the mobile network – i.e. some device local to the Digi Transport is needed to generate traffic in the first place.

Browse to **Configuration - Network > Interfaces > Advanced > PPP 1 > Advanced** and follow the picture and the table below for the settings:



Parameter	Setting	Description
Reset this interface if x packets are transmitted	50	Number of packets with no answer to wait before trigger the reactivation of PPP
and the connection has been up for at least y seconds	60	Number of seconds that the connection need to be UP for at least, in order to trigger the reactivation of PPP via Unanswered TX packets

Finally to activate the configuration changes navigate to **Management – Network Status > Interfaces > Advanced > PPP > PPP 1** and click on "**Drop Link**". The Mobile link will automatically re-activate (subject to the unit containing a default configuration) and the new SRI feature activated:



NB: A "large" value such as 50 unanswered packets is required because it is quite normal for a number of packets to be transmitted without any reply being received. It is reasonably unlikely that in most cases (e.g. any cases where TCP is used) 50 packets will be sent in a row without a reply.

3.4.1 Testing – Deactivate PPP via Unanswered TX packets

You should test the new feature by deliberately generating traffic from an equipment configured to route through the Digi Transport to the Mobile link, in order that this traffic has no answer and checking that Mobile link deactivates itself and re-activates itself as expected. This can be easily seen in the Digi Transport's event log. **Management - Event Log**.
In the example below, traffic has been generated from a laptop connected to the ETH interface of the TransPort, generating traffic that not receive answer:

```
03:59:23, 01 Jan 2000,PPP 1 up
03:59:23, 01 Jan 2000,Default Route 0 Available,Activation
03:59:23, 01 Jan 2000,PPP 1 Available,Activation
03:59:23, 01 Jan 2000,PPP 1 Start
03:59:23, 01 Jan 2000,Modem connected on asy 4
03:59:19, 01 Jan 2000,Modem dialing on asy 4 #:*98*1#
03:59:15, 01 Jan 2000,Modem disconnected on asy 4,1
03:59:14, 01 Jan 2000,Default Route 0 Out Of Service,Activation
03:59:14, 01 Jan 2000,PPP 1 Out Of Service,Activation
03:59:14, 01 Jan 2000,PPP 1 down,PPP TX Link Failure
```

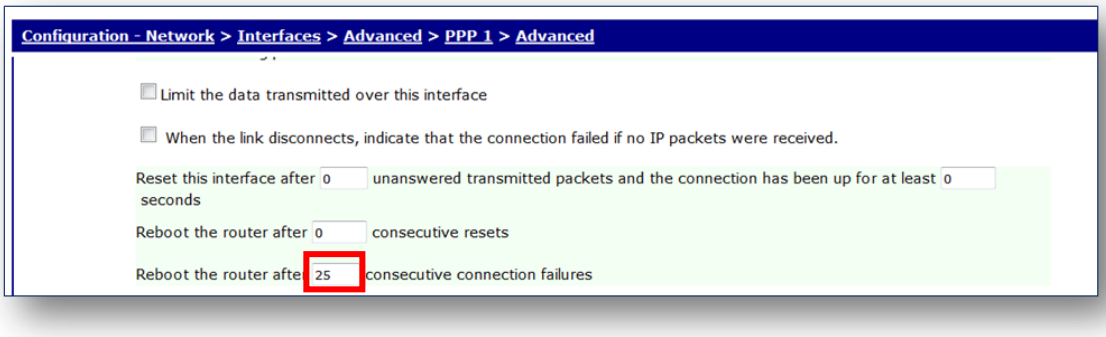
4 ROUTER REBOOT DUE TO CONNECTION FAILURES

This is a passive error detection technique designed to be used if the automatic W-WAN module power cycle technique fails. IT IS NOT NORMALLY REQUIRED AND NOT NORMALLY RECOMMENDED. It is included only for the sake of completeness.

Under some very rare circumstances it may be necessary to reboot the entire Digi Transport to recover from a serious W-WAN error. This has been shown to help in situations where:

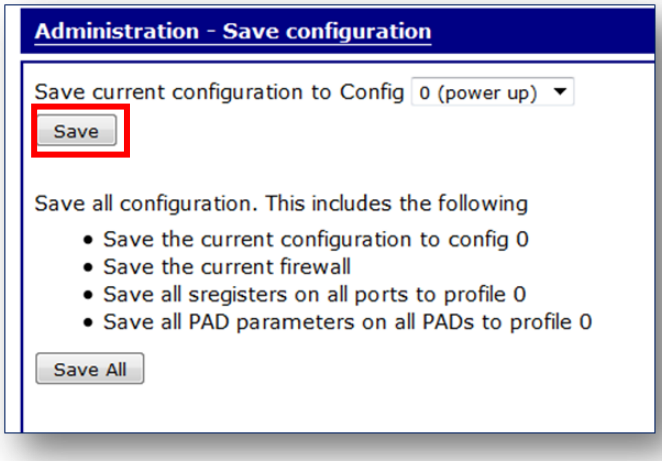
- There is a bug in the firmware (we are not aware of any at the time of writing)
- The extra time required to reboot the router can help the mobile operator to recover from a problem in their network. (i.e. the network "objects" to rapid re-registrations)

On the Digi Transport's web server navigate to the **Configuration - Network > Interfaces > Advanced > PPP 1 > Advanced** web page and set as follows:

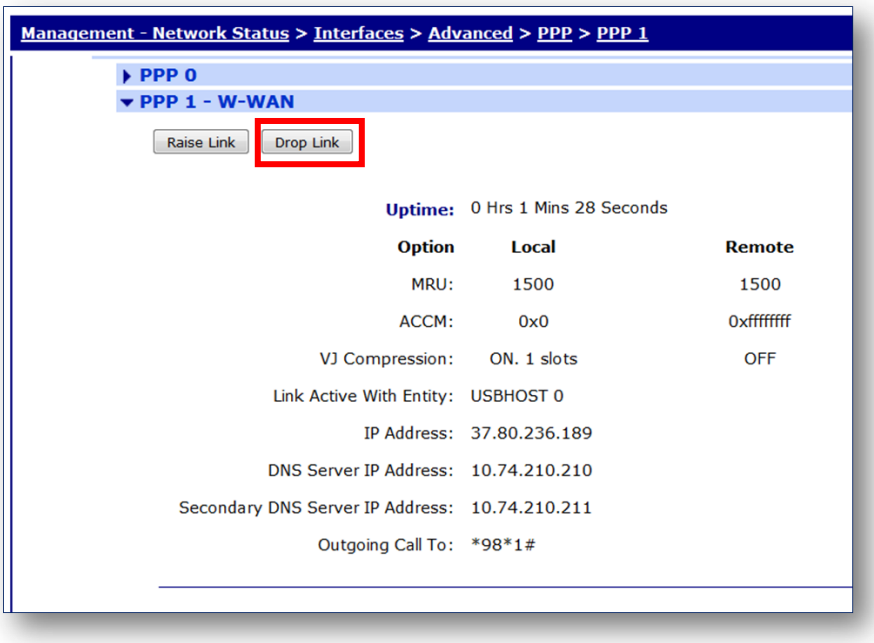


Click the "Apply" button at the bottom of the page.

On the Digi Transport's web server menu click on **Administration - Save configuration** and then click the "**Save**" button to save the running configuration to the current power up profile. (I.e. the config.da0 file).



Finally to activate the configuration changes navigate to **Management – Network Status > Interfaces > Advanced > PPP > PPP 1** and click on "**Drop Link**". The Mobile link will automatically re-activate (subject to the unit containing a default configuration) and the new SRI feature activated:



NB: The "Reboot after this many consecutive failed connections" MUST ALWAYS be set to a value significantly larger than the W-WAN Module Power Cycle "Link Retries". The correct functioning of this facility can be tested by entering an incorrect APN into the Digi Transport, saving this change, then dropping the PPP link and inspecting the event log. The event log below shows the Digi Transport power cycling the W-WAN module after 15 attempts to connect and then rebooting the Digi Transport after a further 15 attempts:

```
15:41:46,04 Nov 2009,PPP 1 down,LL disconnect
15:40:40,04 Nov 2009,PPP 1 down,LL disconnect
15:40:24,04 Nov 2009,LAPB 5 up
15:40:24,04 Nov 2009,LAPB 4 up
15:40:24,04 Nov 2009,LAPB 3 up
15:40:15,04 Nov 2009,PPP 1 down,LL disconnect
15:39:56,04 Nov 2009,PPP 1 down,LL disconnect
15:39:41,04 Nov 2009,ETH 0 up
15:39:40,04 Nov 2009,ETH 1 up
15:39:38,04 Nov 2009,Power-up
15:39:38,04 Nov 2009,Eventlog Counters Reset
15:39:30,04 Nov 2009,Reboot
15:39:30,04 Nov 2009,PPP 1 failed -> reboot
15:39:30,04 Nov 2009,PPP 1 down,LL disconnect
15:38:24,04 Nov 2009,PPP 1 down,LL disconnect
15:37:19,04 Nov 2009,PPP 1 down,LL disconnect
15:36:13,04 Nov 2009,PPP 1 down,LL disconnect
15:35:08,04 Nov 2009,PPP 1 down,LL disconnect
15:34:02,04 Nov 2009,PPP 1 down,LL disconnect
15:32:57,04 Nov 2009,PPP 1 down,LL disconnect
15:31:51,04 Nov 2009,PPP 1 down,LL disconnect
15:30:46,04 Nov 2009,PPP 1 down,LL disconnect
15:30:30,04 Nov 2009,LAPB 5 up
15:30:30,04 Nov 2009,LAPB 4 up
15:30:30,04 Nov 2009,LAPB 3 up
15:30:18,04 Nov 2009,LAPB 5 down,Lower deactivated
15:30:18,04 Nov 2009,LAPB 4 down,Lower deactivated
15:30:18,04 Nov 2009,LAPB 3 down,Lower deactivated
15:30:17,04 Nov 2009,PPP 1 down,LL disconnect
15:30:17,04 Nov 2009,GPRS link failed -> power cycle
15:29:11,04 Nov 2009,PPP 1 down,LL disconnect
15:28:06,04 Nov 2009,PPP 1 down,LL disconnect
15:27:00,04 Nov 2009,PPP 1 down,LL disconnect
```

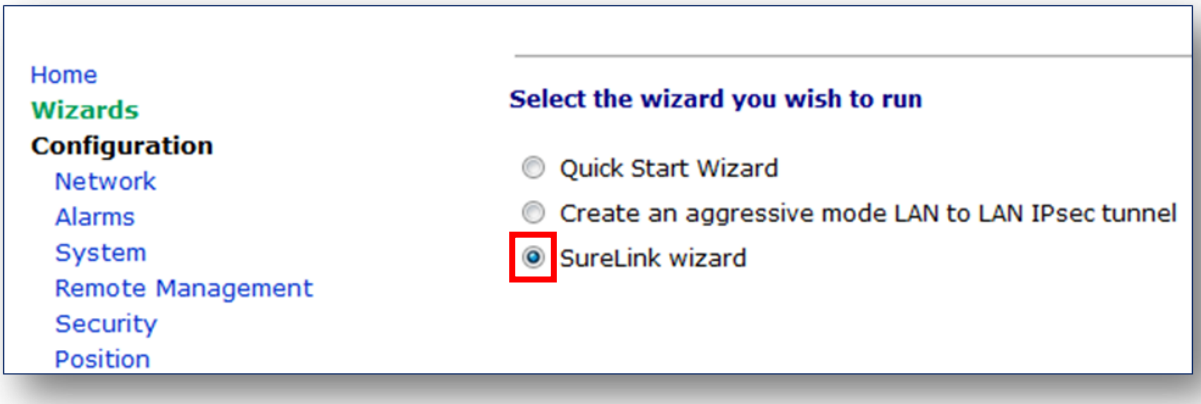
```
15:25:55,04 Nov 2009,PPP 1 down,LL disconnect
15:24:49,04 Nov 2009,PPP 1 down,LL disconnect
15:23:44,04 Nov 2009,PPP 1 down,LL disconnect
15:22:38,04 Nov 2009,PPP 1 down,LL disconnect
15:21:33,04 Nov 2009,PPP 1 down,LL disconnect
15:20:27,04 Nov 2009,PPP 1 down,LL disconnect
15:19:22,04 Nov 2009,PPP 1 down,LL disconnect
15:18:16,04 Nov 2009,PPP 1 down,LL disconnect
15:17:11,04 Nov 2009,PPP 1 down,LL disconnect
15:16:05,04 Nov 2009,PPP 1 down,LL disconnect
15:15:00,04 Nov 2009,PPP 1 down,LL disconnect
15:13:54,04 Nov 2009,PPP 1 down,LL disconnect
15:13:38,04 Nov 2009,LAPB 5 up
15:13:38,04 Nov 2009,LAPB 4 up
15:13:38,04 Nov 2009,LAPB 3 up
15:13:29,04 Nov 2009,WEB Login OK by username lvl 0
15:13:25,04 Nov 2009,ETH 0 up
15:13:24,04 Nov 2009,ETH 1 up
15:13:22,04 Nov 2009,Power-up
```

5 USING THE SURELINK WIZARD

Note: The SureLink Wizard is only included with Digi TransPort routers that run Python, such as the WR21, WR41 & WR44.

There is also a wizard to help with configuration of link failure detection. The wizard can be executed multiple times to configure the link checking and testing methods to run simultaneously as they would for a manual configuration as described in the previous sections of this document.

To run the SureLink wizard, browse to **Wizards > SureLink wizard** and click **Next**



The first 3 pages displayed after selecting the SureLink wizrad are for information only and explain what the SureLink wizard is used for and the differences between the Active and Passive link failure detection methods.

The Active options are:

- Generate pings (ICMP echo requests) on a regular basis and detect a problem when no replies are received. It is possible to ping either a single IP address or two IP addresses. The firewall is not used with this method.

- Generate UDP echo requests and send them to an UDP echo server. The firewall is used to detect a problem when a specified number of packets go unanswered. Hourly statistics will be collected on these UDP packets and optionally RemoteMANAGER can produce reports based on this data.

- Generate pings (ICMP echo requests) to a single IP address and monitor by firewall. The firewall is used to detect a problem when a specified number of packets go unanswered. Hourly statistics will be collected on these pings and optionally RemoteMANAGER can produce reports based on this data.

- IPsec tunnel down. If you have an always on IPsec tunnel with DPD (Dead Peer Detection) enabled (DPD is enabled by default), then make this selection. If a specified number of attempts at re-establishing the tunnel fail a dead link will be detected. The firewall is not used for this. This active technique does not generate extra IP traffic if you already have an always on IPsec tunnel.

The Passive options are:

- Monitor TCP connection by firewall. If equipment routing through the Digi TransPort uses TCP connections on a regular basis choose this option.

- Monitor UDP packets by firewall. If equipment routing through the Digi TransPort regularly sends UDP traffic for which there should always be a reply UDP packet, choose this option. (e.g. Lottery) Hourly statistics will be collected on these UDP packets and optionally RemoteMANAGER can produce reports based on this data.

- Monitor PING (ICMP echo requests) by firewall. If equipment routing through the Digi TransPort regularly sends pings, choose this option.

- Detect the case when no replies are received when a specified number of IP packets are sent. Useful for generate Internet or network access when data is not normally sent to a reliable IP address that is known beforehand.

- Detect when no IP traffic has been received for a period of time.

When an option is selected, the wizard will prompt for configuration parameters that relate to the chosen option.