Application Note 055

WiFi to Cellular Failover

July 2015

Contents

1 INTRODUCTION

1.1 Outline

This Application Note gives a guide on configuring a TransPort router to have a WAN connection through WiFi with a failover to a Cellular/Mobile connectivity using a monitoring on the link via Firewall rules.

This method can be very useful to detect some kind of failures on the Access Point to which the TransPort is connected to, as for example, a failure on the WAN connectivity of the AP. Without the monitoring method, this failure cannot be detected on the Client as the WiFi connection to the AP wil still be UP, but the client has effectively not access to the outside network as the AP cannot provide it in this situation. With the monitoring via firewall rules, this kind of failure can be easily detected allowing the TransPort to use the Backup link until the failure on the AP is recovered.

Obviously, using this method, it will always be possible to detect failure on the WiFi itself. In that case, the primary route will go Out Of Service/back online due to the failure/rollback of WiFi itself and not due to firewall monitoring.

1.2 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.

Preconditions: This guide assumes that a Digi TransPort can be connected working Access Point that can provide Internet access.

Models shown: Digi TransPort WR44

Other Compatible Models: All other Digi TransPort products with WIFi features.

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.

1.3 Corrections

Requests for corrections or amendments to this application note are welcome and should be addressed to: tech.support@digi.com

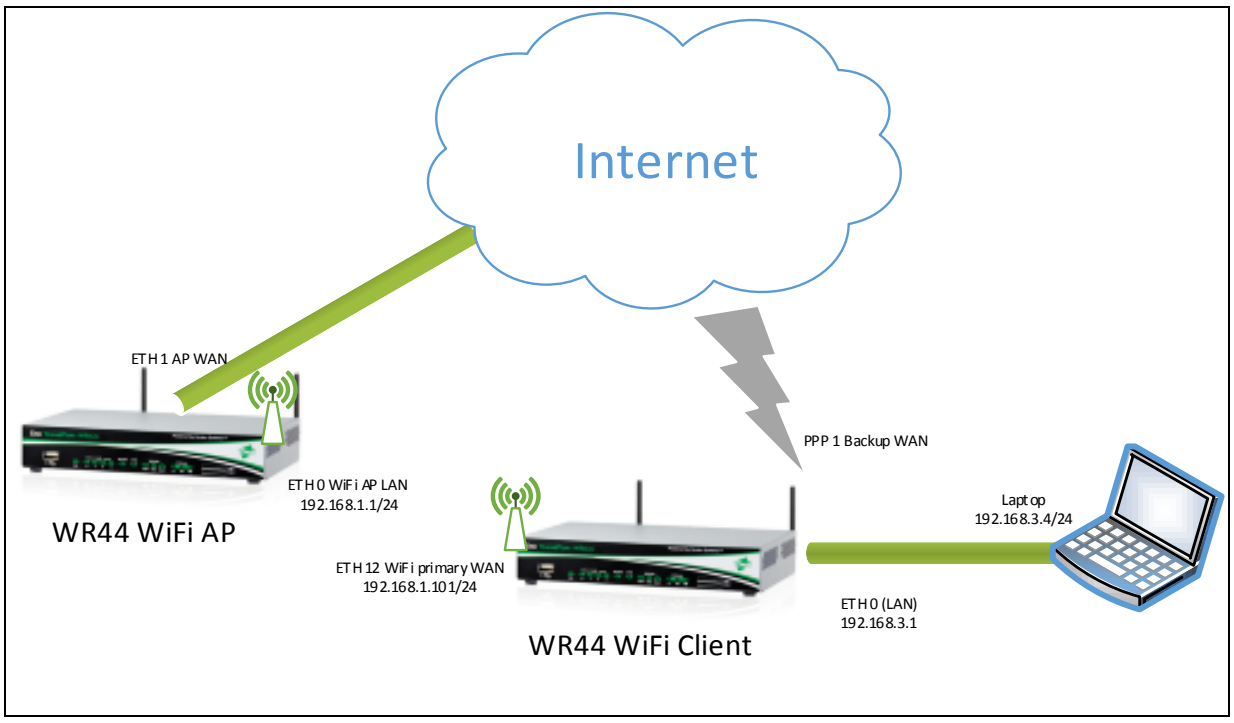
Requests for new application notes can be sent to the same address.

1.4 Version

Version Number	Status
0.1	Draft
1.0	Completed 7/2015

2 SCENARIO

This application note will consider the following scenario:



The failure and rollback will be simulated disconnecting/reconnecting the ETH cable on the AP and also disabling/enabling the WiFi on the AP.

3 DIGI TRANSPORT ROUTER CONFIGURATION

In order to configure the Digi TransPort, connect a PC to the ETH0 of the TransPort and log into the Web User Interface (WebUI) with a browser at the default address **192.168.1.1**. Then follow the sections below.

3.1 LAN Settings

In this AN the LAN interface of the Transport is configured on ETH 0 and for setup purpose is set as 192.168.3.1/24 as IP address/Mask. The configuration can be changed going to the WEB UI at the section **Configuration – Network > Interfaces > Ethernet > ETH 0** following the picture/table below:

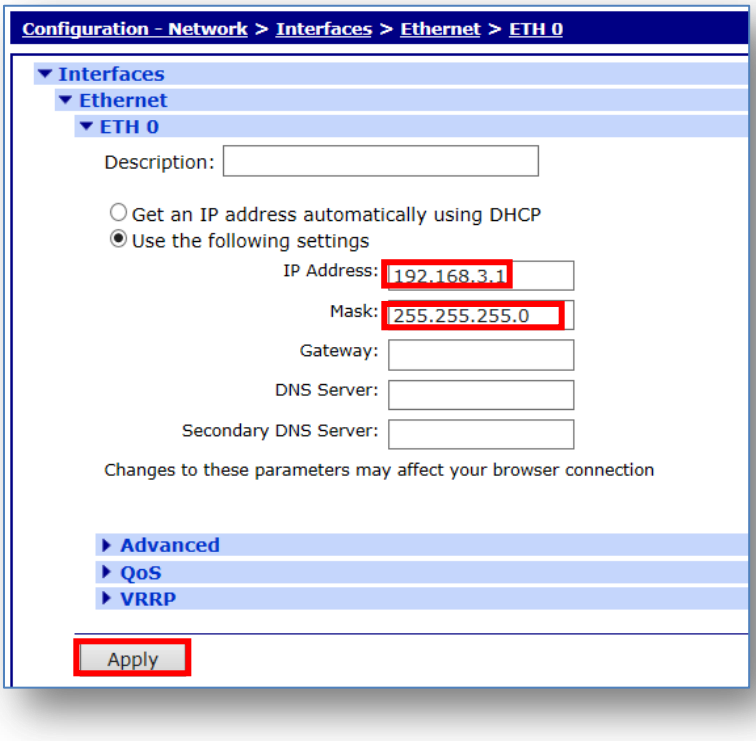


Figure 3.1-1: LAN settings

Parameter	Setting	Description	CLI command
IP Address	192.168.3.1	Specifies the IP address of this Ethernet port	*eth 0 ipaddr 192.168.3.1*
Mask	255.255.255.0	Specifies the subnet mask of the IP subnet to which the unit is attached via this Ethernet port	*eth 0 mask 255.255.255.0*

Having changed the ETH 0 configuration respect to the default, also the DHCP server should be changed as follows:

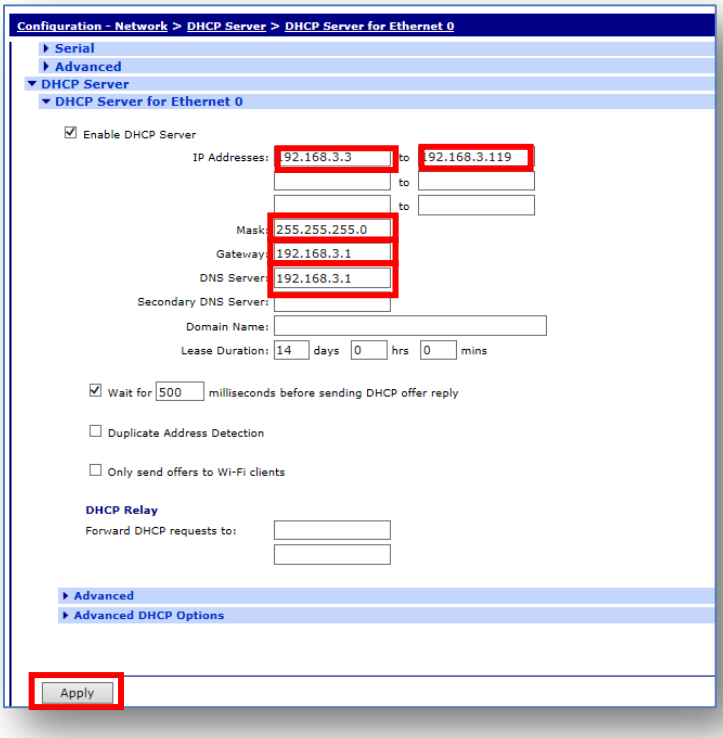


Figure 3.1-2: DHCP Server settings

Parameter	Setting	Description	CLI command
IP Addresses <> to <>	192.168.3.3 to 192.168.3.119	The values in these specify the starting and ending addresses for the range of IP addresses that will be handed out by the DHCP server. Each of the three rows can be used to specify a different IP address pool, all pools should be within the same subnet	*dhcp 0 IPmin "192.168.3.3"* *dhcp 0 IPrange 117*
Mask	255.255.255.0	specifies the subnet mask used to on the network to which the router is connected	*dhcp 0 mask "255.255.255.0"*
Gateway	192.168.3.1	The value in this text box specifies the IP address of the gateway (which is usually the IP address of the router itself as configured by the IP address of the Ethernet interface associated with this DHCP instance).	*dhcp 0 gateway "192.168.3.1"*
DNS Server	192.168.3.1	The value in this text box specifies the IP address of the primary DNS server to be used by clients on the LAN. This will usually be the IP address of the route itself.	*dhcp 0 DNS "192.168.3.1"*

3.2 Primary WAN Settings: WiFi

In this Application note the primary WAN connection is the WiFi. In order to configure it, an ETH interface needs to be configured with DCHP client enabled and linked to the WiFi interface set as Client mode. The following sub-sections will explains how to do this configuration.

3.2.1 Logical Ethernet Settings

In this AN Logical Ethernet 12 has been used for the WiFi connection. Basically, The ETH 12 interface will be configured in order to get the IP configuration via DHCP through the WiFi client connection and to generate a periodic ping that will be used for the firewall monitoring of the link. In order to configure it, browse to Configuration - Network > Interfaces > Ethernet > Logical Ethernet Interfaces > ETH 12 and then > Advanced, and follow the picture and table below, then click Apply.

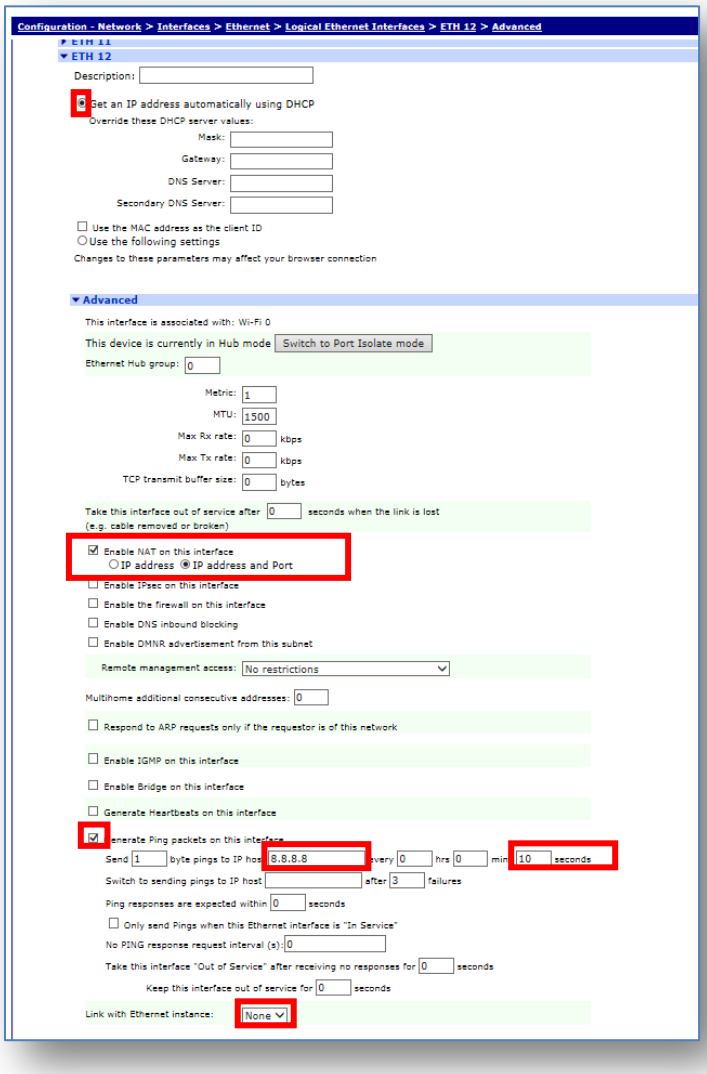


Figure 3.2-1: WAN settings – Logical Eth 12

Parameter	Setting	Description	CLI command
Get an IP address automatically using DHCP	Selected	Selecting this option enables the DHCP client on this interface. In this AN is selected as the TransPort will get the IP configuration from the DHCP server through the WiFi connection	*eth 12 dhcpcli on*
Enable NAT on this interface	Selected / IP address and Port	As this Logical Eth will be the WAN interface, NAPT needs to be enabled on it	*eth 12 do_nat 2*
Link with Ethernet instance	None	This logical interface will be linked to the WiFi node, so it should not be linked to an ETH instance	*eth 12 physadd -1*
Generate Ping packets on this interface	Ticked	This option will reveal the settings for ping generation on this interface. This ping will be used for the firewall monitoring	*eth 12 pingis ON*
Send <n> byte pings	1	Size of ICMP packet to send	*eth 12 pingsiz 1*
to IP host	<IP to ping>	Valid IP address to ping for link up/down testing.	*eth 12 pingip "8.8.8.8"*
Every	10	Interval in hours, minutes and seconds for the test pings to be sent	*eth 12 pingint 10*

3.2.2 Global Wi-Fi Settings

Browse to Configuration - Network > Interfaces > Wi-Fi > Global Wi-Fi Settings and follow the picture and table below to configure the general settings for the WiFi Module, then click Apply.

Basically, only the “Country” field needs to be configured, the other settings can be left as default.

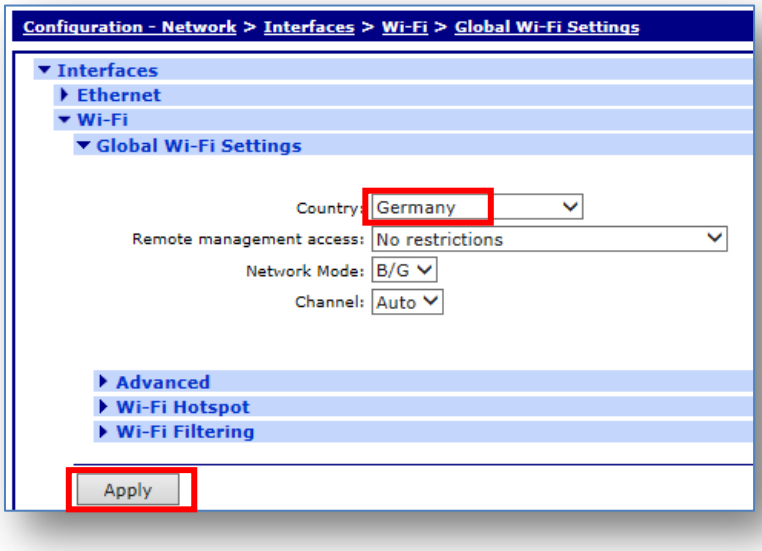


Figure 3.2-2: WAN settings – WiFi Global Settings

Parameter	Setting	Description	CLI command
Country	Germany	Selecting a country from the drop down list will restrict the channels that the router will use. See table on page 51 on the User Manual (http://ftp1.digi.com/support/documentation/90001019_K.pdf) for more info on licensed channels.	*wifi 0 country "Germany"*

3.2.3 WiFi Node 0 Settings

In order to configure the WiFi client settings, browse to Configuration - Network > Interfaces > Wi-Fi > Wi-Fi Node 0 and refer to the following picture and table, then click Apply:

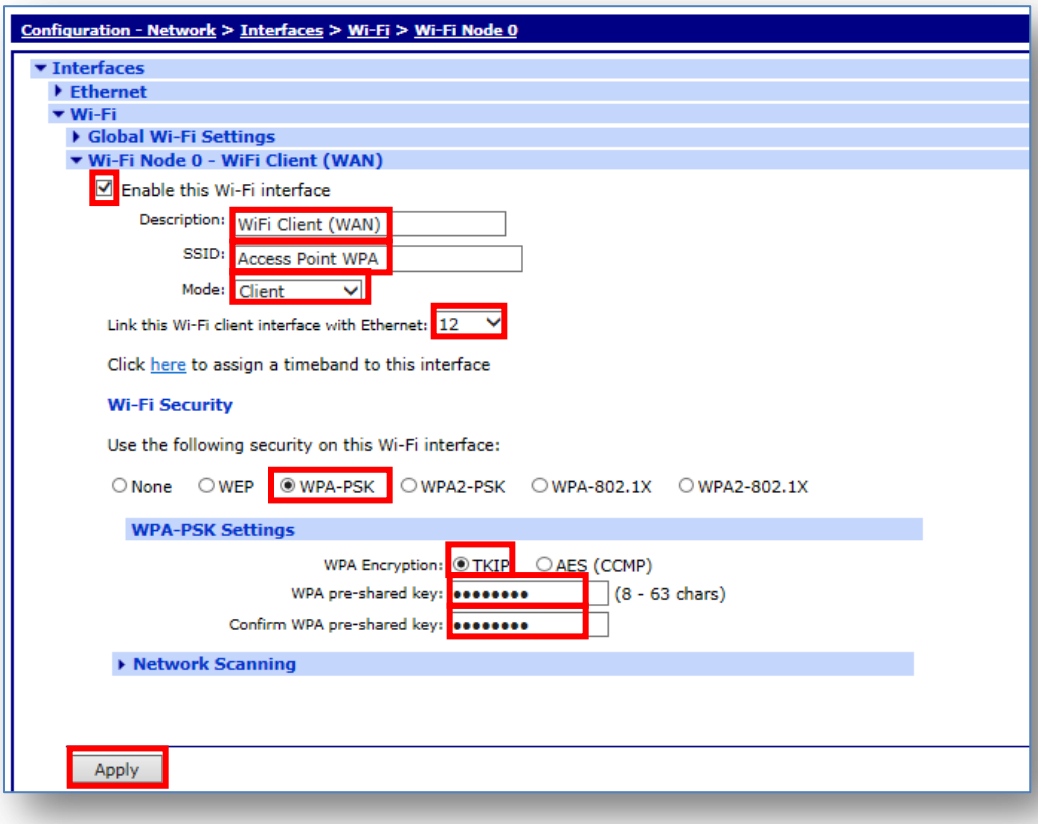


Figure 3.2-3: WAN settings – WiFi Client Settings

Parameter	Setting	Description	CLI command
Enable	Selected	Enable the WiFi interface and reveals the options	---
Description	WiFi Client (WAN)	A descriptive name for the Wi-Fi interface to make it easier to identify [optional]	*wifinode 0 descr "WiFi Client (WAN)"*
SSID		When the Wi-Fi interface is configured to be a Client, this is the SSID of the Access Point you wish to connect to	*wifinode 0 ssid "Access Point WPA"*
Mode	Client	Select the “Client” mode from the drop-down menu	*wifinode 0 mode "client"*
Link this Wi-Fi client interface with Ethernet <n>	12	When the Wi-Fi interface is configured to be a client, it must be bridged to a particular Ethernet interface. In this AN ETH12 is the Ethernet interface used for the WiFi Client.	*eth 12 wificli ON*
Use the following security on this Wi-Fi interface	WPA-PSK	Selects the security that is used on this Wi-Fi interface. In this AN the AP to which the TransPort is connecting uses WPA-PSK Security type	*wifinode 0 security "wpapsk"*
WPA Encryption	TKIP	The encryption algorithm to use. The AP for this AN uses TKIP algorithm	*wifinode 0 wpatype “tkip”*
WPA Pre-Shared Key / Confirm	********	The pre-shared key (PSK) to use. It must be between 8 and 63 characters long.	*wifinode 0 esharedkey "PDZxU0FFQFU="*

3.3 Backup WAN Settings: Cellular

In order to configure the PPP interface that will act as Backup connection, browse to Configuration - Network > Interfaces > Mobile and go in the Mobile Settings section, then follow the picture/table below:

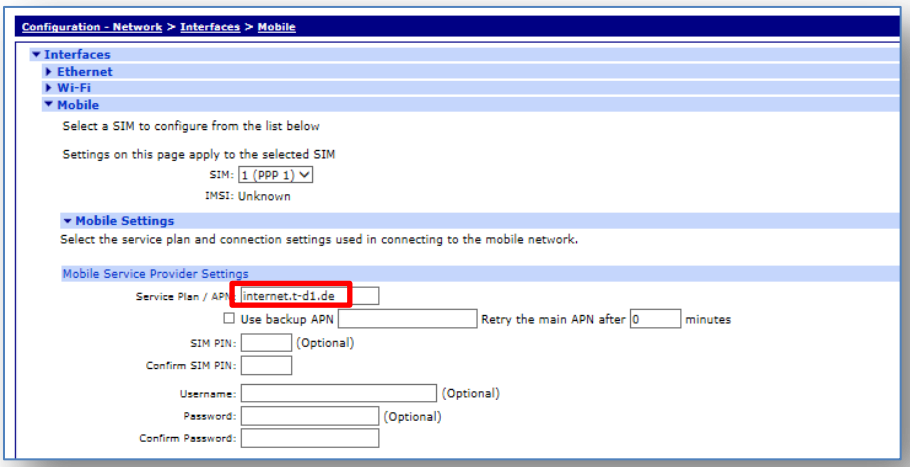


Figure 3-1: Backup WAN settings – Mobile

Parameter	Setting	Description	CLI command
Service Plan/APN	internet.t-d1.de	Enter the APN (Access Point Name) given by the service provider.	*modemcc 0 apn "internet.t-d1.de"*

3.4 Primary Default Route via WiFi

Browse to Configuration - Network > IP Routing/Forwarding > Static Routes > Default Route 0 and set the primary route to point at ETH 12 as follows:

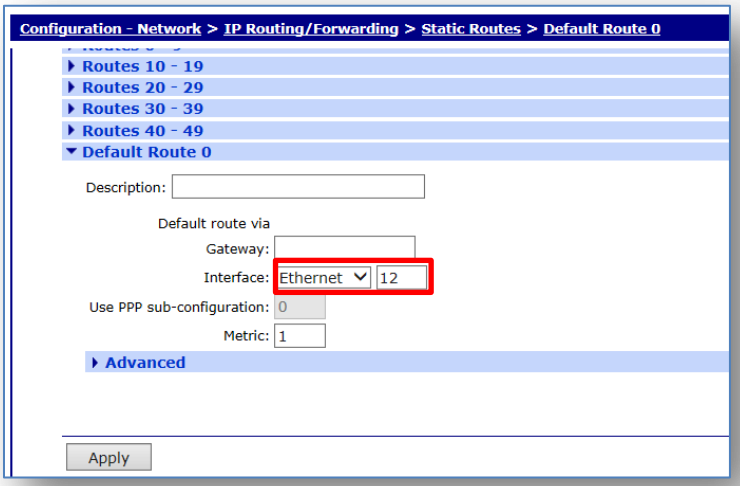


Figure 3.4-1: Primary Route via WiFi ETH 12

Parameter	Setting	Description	CLI command
Interface	Ethernet 12	The interface used to route the packets is selected from the drop-down list and the interface instance number is entered into the adjacent text box	*def_route 0 ll_ent "ETH"* *def_route 0 ll_add 12*

3.5 Backup default Route via Cellular

Browse to Configuration - Network > IP Routing/Forwarding > Static Routes > Default Route 1 and set the primary route to point at ETH 12 as follows:

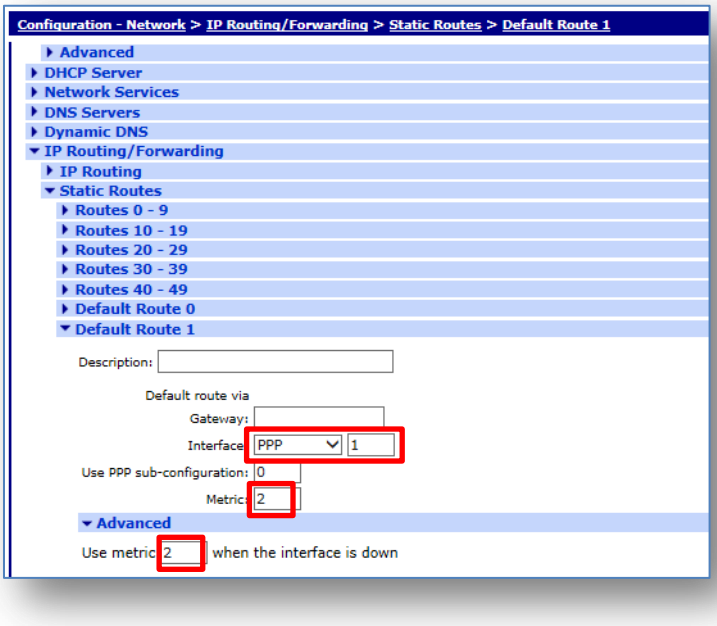


Figure 3.5-2: Backup Route via PPP 1

Parameter	Setting	Description	CLI command
Interface	PPP 1	The interface used to route the packets is selected from the drop-down list and the interface instance number is entered into the adjacent text box. This route is the backup via PPP 1.	*def_route 1 ll_ent "PPP" def_route 1 ll_add 1*
Metric	2	The value in this text box is the routing metric to use when the interface is connected (connected metric). This should have a value between 1 and 16 and is used to select which route should be used when the subnet for a packet matches more than one of the IP route entries. As the route via PPP 1 is the backup, the metric needs to be higher than the primary, so set to 2.	*def_route 1 upmetric 2*
Advanced > Use metric <> when the interface is down	2	The value in this text box specifies the routing metric to use when the interface is not active (disconnected metric). Usually is set equal to the connected metric.	*def_route 1 metric 2*

3.6 Firewall Configuration

In order to enable the firewall monitoring on the primary link, a rule needs to be configured on the firewall. This rule has to match the periodic ping configured on the ETH 12, this will allow the firewall to detect the failure and put the ETH12 and the route as OOS and also to detect the recovery, putting the ETH and route back in the UP state.

Please note that if the firewall is enabled just for this purpose, as in this example, it may be better add first of all the following rule in order to not lost the connection to the device when enabling the firewall on the interfaces, Navigate to: Configuration - Security > Firewall**,** click on "insert" and type/paste in the rule:

pass break end

then click OK.

After that, click on "insert" again and type the rule for the monitoring. In this AN is used the following rule:

pass out break end on eth 12 proto icmp from addr-eth 12 to 8.8.8.8 icmp-type echo inspect-state oos 10 t=3 c=3 d=3 r=ping,3,3

Click OK and the FW rule should look like the following picture. Click "Save" in order to save the fw file:

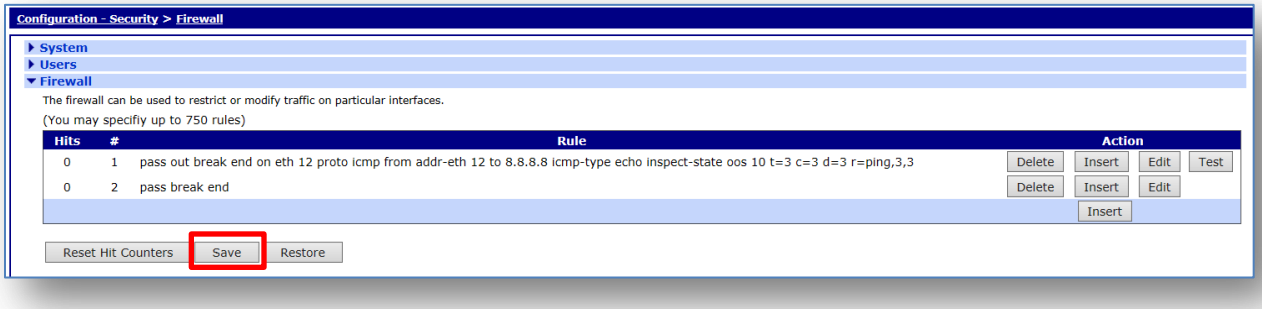


Figure 3.6-1: Firewall Rules

Please note: The IP address that is used in this AN for sending test pings to is not guaranteed to reply so it should be chosen an IP address within the ISP's or a public IP address that can be controlled.

In order to have this effectively applied, the FW needs to be then enabled on the ETH 12 interface, to do this, Scroll down to the Firewall configuration page to the Interface list and tick the boxes to enable the firewall on ETH 12, the click Apply:

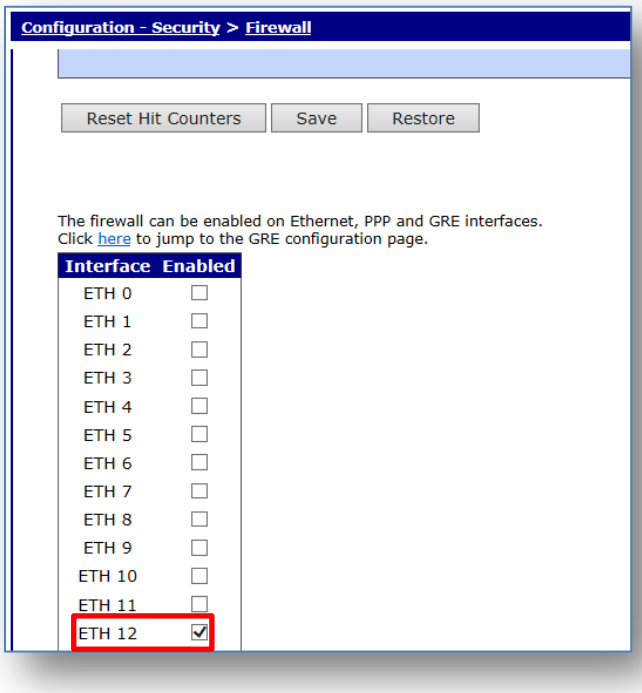


Figure 3.6-2: Enabling Firewall

4 TESTING

4.1 Debug settings on TransPort

In many cases is very useful configure the device in order to have a debug trace for the IKE negotiation in case of issues of setting up the VPN and for check that the traffic is correctly tunnelled.

On the TransPort, go to **Management - Analyser > Settings** and change the settings as shown below (uncheck everything else):

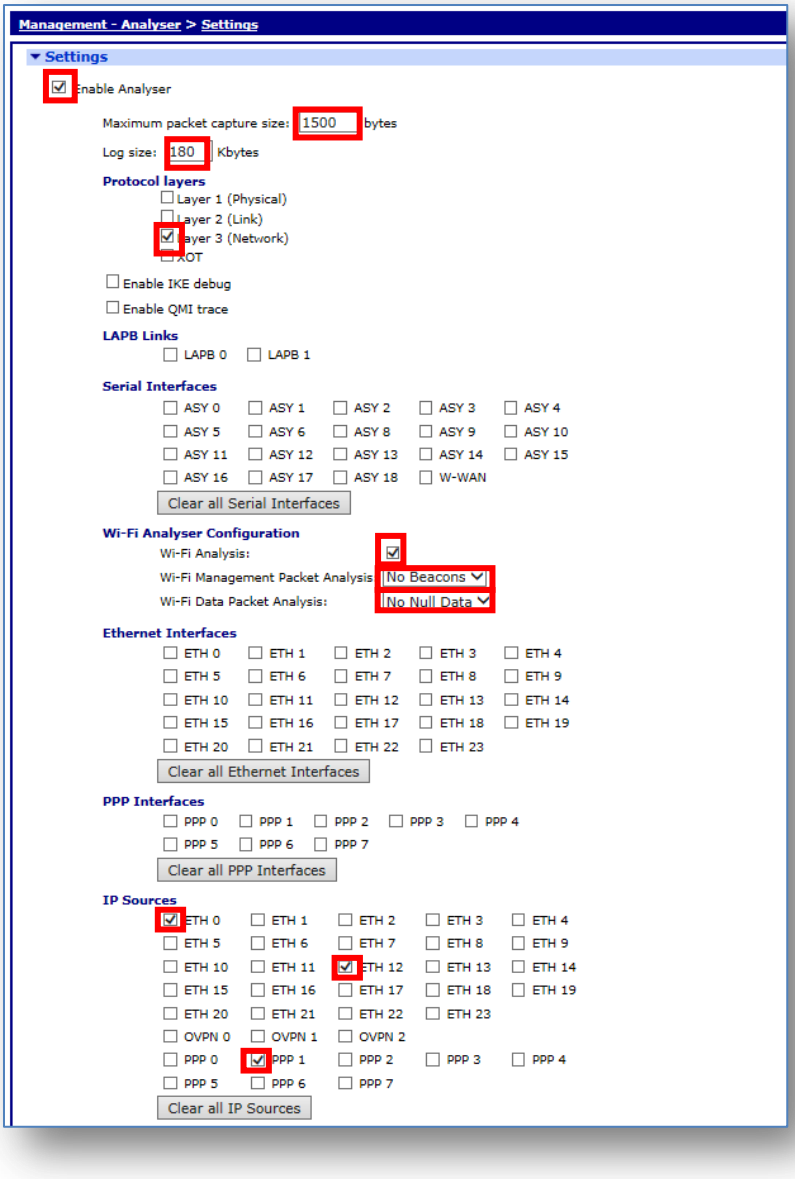


Figure 4.1-1: Analyser settings

Parameter	Setting	Description	CLI command
Enable Analyser	Selected	This checkbox is used to enable or disable the analyser.	*ana 0 anon ON*
Maximum packet capture size	1500	The number of bytes that are captured and stored for each packet. If the packet is bigger than the configured size, the packet is truncated. Common practice is to set it to 1500	*ana 0 maxdata 1500*
Log Size	180	The maximum size of the pseudo file “ana.txt” that is used to store the captured data packets. Common practice is to set at this maximum (180). Notice that the data is compressed so more than 180Kb of trace data will be captured.	*ana 0 logsize 180*
Protocol layers	Layer 3 (Network)	Specify which protocol layers are captured and included in the analyser trace. For the purpose of this AN the Network Layer (Layer 3) is chosen	*ana 0 l3on*
Wi-Fi analysis	Ticked	Enable the WiFi trace on the module	*wifi 0 wifianon ON*
Wi-Fi management packer analysis	No beacons	Select the level of management packet analysis, in that case we need the trace only to check the routing of the data so we can avoid t have beacon frames in the trace	*wifi 0 anamgmt "nobeacons"*
Wi-Fi data packet analysis	No Null data	Select the level of datapacket analysis, in that case we need the trace only to check the routing of the data (Ping) so we can avoid t have null data frames in the trace	*wifi 0 anadata "nonull"*
IP Sources	ETH 0 ETH 12 PPP 1	Select the IP sources over which packets will be captured and included in the analyser trace	*eth 0 ipanon on* *eth 12 ipanon on* *ppp 1 ipanon on*

4.2 Testing Failover with Firewall Monitoring: AP's WAN failure

In this section a simple test of the failover mechanism and rollback using the firewall monitoring will be provided. In order to perform it, a laptop connected to the LAN interface of the TransPort is needed.

4.2.1 Normal condition: Primary Route active

Once the WiFi client is connected to the AP, the routing table should looks like the following, showing that the primary route is the one pointing to ETH 12. In the routing table is also shown the backup route to PPP 1 (as UP), that will be not used while the primary is UP due to metric priority. The routing table can be checked browsing to Management - Network Status > IP Routing Table:

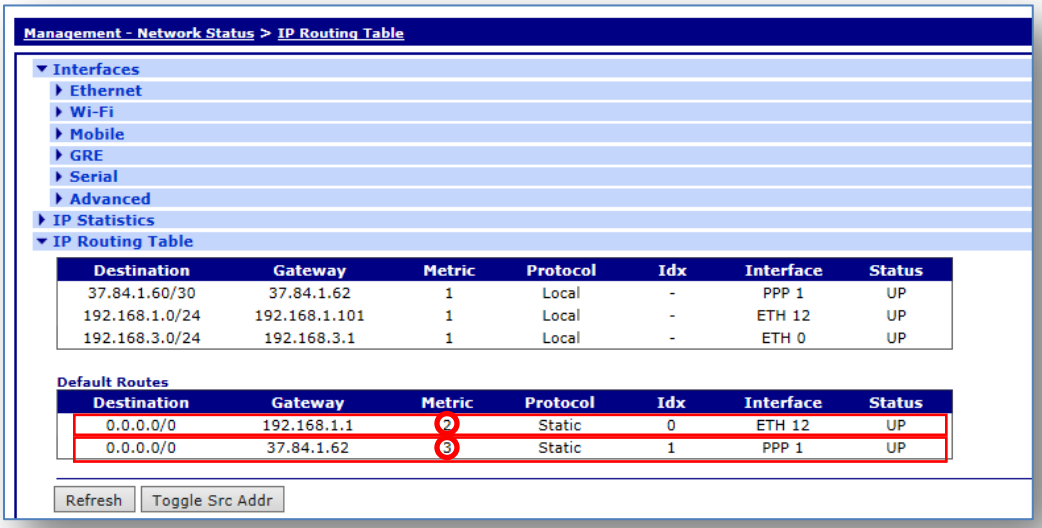


Figure 4.2-1: Routing Table in Normal Condition

In order to check if the traffic is effectively routed through the primary route via WiFi, an easy method is to make a ping to an Internet address from a laptop connected to the LAN interface of the TransPort and then check the analyser trace browsing to: Management - Analyser > Trace.

The trace will show that the ICMP ECHO REQ is received on ETH 0, routed to ETH 12, correctly natted and then finally transmitted via the WiFi module:

```
-----   11-12-2014  12:39:13.690   -----
   45 00 00 3C 0B 2C 00 00 80 01 5F DD C0 A8 03 04     E..<.,.... .....
   08 08 04 04 08 00 4D 41 00 01 00 1A 61 62 63 64     ......MA....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi
```

```
   IP (In) From REM TO LOC        IFACE: ETH 0
   45             IP Ver:         4
                  Hdr Len:        20
   00             TOS:            Routine
                  Delay:          Normal
                  Throughput:     Normal
                  Reliability:    Normal
   00 3C          Length:         60
   0B 2C          ID:             2860
   00 00          Frag Offset:    0
                  Congestion:     Normal
                                  May Fragment
                                  Last Fragment
   80             TTL:            128
   01             Proto:          ICMP
   5F DD          Checksum:       24541
   C0 A8 03 04    Src IP:         192.168.3.4
   08 08 04 04    Dst IP:         8.8.4.4
   ICMP:
   08             Type:           ECHO REQ
   00             Code:           0
   4D 41          Checksum:       19777
   ----------
-----   11-12-2014  12:39:13.690   -----
45 00 00 3C 0B 2C 00 00 7F 01 62 7C C0 A8 01 65     E..<.,....b|...e
08 08 04 04 08 00 4D 41 00 01 00 1A 61 62 63 64     ......MA....abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

IP (Final) From LOC TO REM    IFACE: ETH 12
45             IP Ver:         4
               Hdr Len:        20
00             TOS:            Routine
               Delay:          Normal
               Throughput:     Normal
               Reliability:    Normal
00 3C          Length:         60
0B 2C          ID:             2860
00 00          Frag Offset:    0
               Congestion:     Normal
                               May Fragment
                               Last Fragment
7F             TTL:            127
01             Proto:          ICMP
62 7C          Checksum:       25212
C0 A8 01 65    Src IP:         192.168.1.101
08 08 04 04    Dst IP:         8.8.4.4
ICMP:
08             Type:           ECHO REQ
00             Code:           0
4D 41          Checksum:       19777
----------
-----   11-12-2014  12:39:13.690   -----
08 41 28 00 04 F0 21 0C 9B 18 00 0E 8E 23 14 85     .A(...!......#..
00 04 2D 04 B4 4C E0 05 00 20 5B 20 00 00 00 00     ..-..L... [ ....
AA AA 03 00 00 00 08 00 45 00 00 3C 0B 2C 00 00     ........E..<.,..
7F 01 62 7C C0 A8 01 65 08 08 04 04 08 00 4D 41     ..b|...e......MA
00 01 00 1A 61 62 63 64 65 66 67 68 69 6A 6B 6C     ....abcdefghijkl
6D 6E 6F 70 71 72 73 74 75 76 77 61 62 63 64 65     mnopqrstuvwabcde
66 67 68 69                                         fghi

Wi-Fi From LOC To REM                  IFACE: Wi-Fi Module 0
08 41                  Version:        0
                       Type:           Data
                       Subtype:        Data
                       Flags:          STA -> AP, Protected
28 00                  Duration:       40
04 F0 21 0C 9B 18      BSS ID
00 0E 8E 23 14 85      Src. MAC
```

```
00 04 2D 04 B4 4C        Dst. MAC
05 E0                    Fragment:            0
                         Sequence:            94
00 20 5B 20 00 00 00 00  TKIP Security Param
AA AA 03 00 00 00        LLC SNAP
08 00                    Type:                IP
IP:
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 3C          Length:        60
0B 2C          ID:            2860
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
7F             TTL:           127
01             Proto:         ICMP
62 7C          Checksum:      25212
C0 A8 01 65    Src IP:        192.168.1.101
08 08 04 04    Dst IP:        8.8.4.4
----------
```

Then, the ECHO REPLY is received via the WiFi module on ETH 12 and routed back to ETH 0:

```
   -----   11-12-2014  12:39:13.700   -----
   08 02 2C 00 00 0E 8E 23 14 85 04 F0 21 0C 9B 18     ..,....#....!...
   00 04 2D 04 B4 4C 10 10 AA AA 03 00 00 00 08 00     ..-..L..........
   45 00 00 3C 3D AB 00 00 34 01 7A FD 08 08 04 04     E..<=...4.z.....
   C0 A8 01 65 00 00 55 41 00 01 00 1A 61 62 63 64     ...e..UA....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69 B1 29 06 80     uvwabcdefghi.)..
   15 AF D0 9B                                         ....

   Wi-Fi From REM To LOC                          IFACE: Wi-Fi Module 0
   08 02                    Version:              0
                            Type:                 Data
                            Subtype:              Data
                            Flags:                AP -> STA
   2C 00                    Duration:             44
   00 0E 8E 23 14 85        Dst. MAC
   04 F0 21 0C 9B 18        BSS ID
   00 04 2D 04 B4 4C        Src. MAC
   10 10                    Fragment:             0
                            Sequence:             257
   AA AA 03 00 00 00        LLC SNAP
   08 00                    Type:                 IP
   IP:
   45             IP Ver:        4
                  Hdr Len:       20
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 3C          Length:        60
   3D AB          ID:            15787
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   34             TTL:           52
   01             Proto:         ICMP
   7A FD          Checksum:      31485
```

```
   08 08 04 04    Src IP:         8.8.4.4
   C0 A8 01 65    Dst IP:         192.168.1.101
   ----------
   -----   11-12-2014  12:39:13.700   -----
   45 00 00 3C 3D AB 00 00 34 01 7A FD 08 08 04 04     E..<=...4.z.....
   C0 A8 01 65 00 00 55 41 00 01 00 1A 61 62 63 64     ...e..UA....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69 B1 29 06 80     uvwabcdefghi.)..
   15 AF D0 9B                                         ....

   IP (In) From REM TO LOC        IFACE: ETH 12
   45             IP Ver:         4
                  Hdr Len:        20
   00             TOS:            Routine
                  Delay:          Normal
                  Throughput:     Normal
                  Reliability:    Normal
   00 3C          Length:         60
   3D AB          ID:             15787
   00 00          Frag Offset:    0
                  Congestion:     Normal
                                  May Fragment
                                  Last Fragment
   34             TTL:            52
   01             Proto:          ICMP
   7A FD          Checksum:       31485
   08 08 04 04    Src IP:         8.8.4.4
   C0 A8 01 65    Dst IP:         192.168.1.101
   ICMP:
   00             Type:           ECHO REPLY
   00             Code:           0
   55 41          Checksum:       21825
   ----------
-----   11-12-2014  12:39:13.700   -----
45 00 00 3C 3D AB 00 00 32 01 7B 5E 08 08 04 04     E..<=...2.{^....
C0 A8 03 04 00 00 55 41 00 01 00 1A 61 62 63 64     ......UA....abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

IP (Final) From LOC TO REM     IFACE: ETH 0
45             IP Ver:         4
               Hdr Len:        20
00             TOS:            Routine
               Delay:          Normal
               Throughput:     Normal
               Reliability:    Normal
00 3C          Length:         60
3D AB          ID:             15787
00 00          Frag Offset:    0
               Congestion:     Normal
                               May Fragment
                               Last Fragment
32             TTL:            50
01             Proto:          ICMP
7B 5E          Checksum:       31582
08 08 04 04    Src IP:         8.8.4.4
C0 A8 03 04    Dst IP:         192.168.3.4
ICMP:
00             Type:           ECHO REPLY
00             Code:           0
55 41          Checksum:       21825
----------
```

4.2.2 Failure on Access Point WAN connection

In order to test the failover to Cellular using FW monitoring, an easy way is to simulate the failure of the AP for example disconnecting the WAN connection of it.
In this AN the AP is a Digi TransPort with an ETH WAN connectivity, so disconnecting the ETH cable will simulate the failure as the Client will be not able to reach the outside network. As already explained, this kind of failure cannot be detected without the FW monitoring, as, for the client, the WiFi connection to the AP is still UP (and so the primary route on the routing table), but actually it has no more connection to Internet.
To do the test, disconnect the ETH cable on the AP and after a while check the evenlog on the TransPort going to Management - Event Log:

```
12:40:24, 11 Dec 2014,Default Route 0 Out Of Service,Firewall
12:40:24, 11 Dec 2014,ETH 12 Out Of Service,Firewall
```

The eventlog shows that the Firewall monitoring fails and so the ETH12 and the Primary route are set to OOS. Checking also the routing table going to Management - Network Status > IP Routing Table, it shows that the primary route is now OOS, and so the default route that wil be used now is the PPP one:

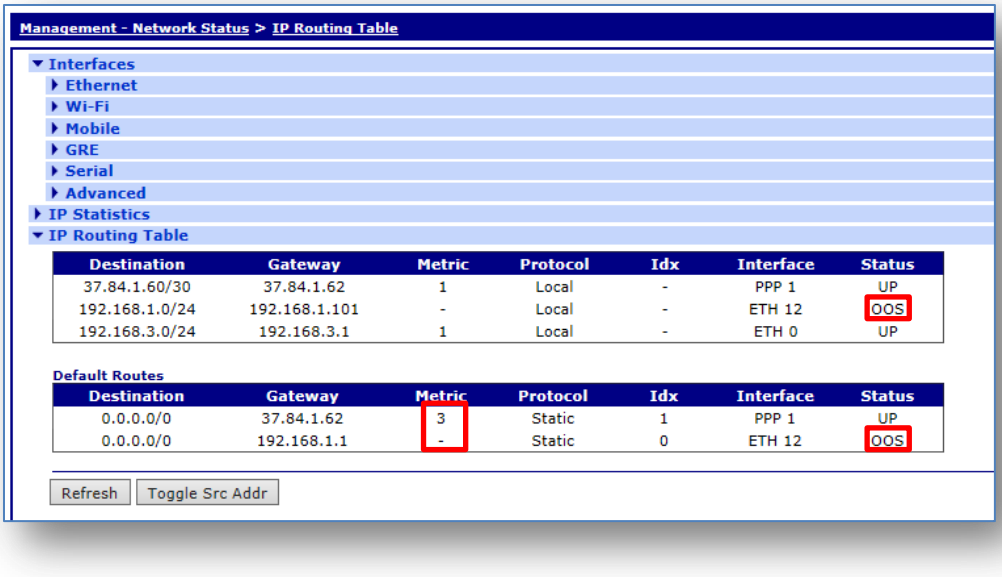


Figure 4.2-2: Routing Table after a failure on AP

To check that the traffic is been routed via the backup Cellular connection, make, as before, a ping from a laptop connected to the LAN interface of the TransPort to an Internet address and check the analyser trace browsing to Management - Analyser > Trace.
The trace will show that the ICMP ECHO REQ is received on ETH 0, routed and transmitted through PPP 1, correctly natted:

```
  -----   11-12-2014  12:40:41.000   -----
   45 00 00 3C 13 ED 00 00 80 01 57 1C C0 A8 03 04     E..<......W.....
   08 08 04 04 08 00 4D 3F 00 01 00 1C 61 62 63 64     ......M?....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

   IP (In) From REM TO LOC       IFACE: ETH 0
   45             IP Ver:        4
                  Hdr Len:       20
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 3C          Length:        60
   13 ED          ID:            5101
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   80             TTL:           128
   01             Proto:         ICMP
   57 1C          Checksum:      22300
   C0 A8 03 04    Src IP:        192.168.3.4
   08 08 04 04    Dst IP:        8.8.4.4
   ICMP:
   08             Type:          ECHO REQ
   00             Code:          0
   4D 3F          Checksum:      19775
   ----------
-----   11-12-2014  12:40:41.000   -----
45 00 00 3C 13 ED 00 00 7F 01 F5 36 25 54 01 3E     E..<.......6%T.>
08 08 04 04 08 00 4D 3F 00 01 00 1C 61 62 63 64     ......M?....abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

IP (Final) From LOC TO REM    IFACE: PPP 1
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 3C          Length:        60
13 ED          ID:            5101
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
7F             TTL:           127
01             Proto:         ICMP
F5 36          Checksum:      62774
25 54 01 3E    Src IP:        37.84.1.62
08 08 04 04    Dst IP:        8.8.4.4
ICMP:
08             Type:          ECHO REQ
00             Code:          0
4D 3F          Checksum:      19775
----------
```

Then, the ECHO REPLY is received via PPP 1 and routed back to ETH 0:

```
   -----   11-12-2014  12:40:41.060   -----
   45 00 00 3C 56 EA 00 00 2E 01 03 3A 08 08 04 04     E..<V......:....
   25 54 01 3E 00 00 55 3F 00 01 00 1C 61 62 63 64     %T.>..U?....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

   IP (In) From REM TO LOC       IFACE: PPP 1
   45             IP Ver:        4
                  Hdr Len:       20
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 3C          Length:        60
   56 EA          ID:            22250
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   2E             TTL:           46
   01             Proto:         ICMP
   03 3A          Checksum:      826
   08 08 04 04    Src IP:        8.8.4.4
   25 54 01 3E    Dst IP:        37.84.1.62
   ICMP:
   00             Type:          ECHO REPLY
   00             Code:          0
   55 3F          Checksum:      21823
   ----------
-----   11-12-2014  12:40:41.060   -----
45 00 00 3C 56 EA 00 00 2C 01 68 1F 08 08 04 04     E..<V...,.h.....
C0 A8 03 04 00 00 55 3F 00 01 00 1C 61 62 63 64     ......U?....abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

IP (Final) From LOC TO REM    IFACE: ETH 0
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 3C          Length:        60
56 EA          ID:            22250
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
2C             TTL:           44
01             Proto:         ICMP
68 1F          Checksum:      26655
08 08 04 04    Src IP:        8.8.4.4
C0 A8 03 04    Dst IP:        192.168.3.4
ICMP:
00             Type:          ECHO REPLY
00             Code:          0
55 3F          Checksum:      21823
----------
```

4.2.3 Recovery and rollback to WiFi

In order to simulate the recovery of the fault, reconnect the ETH cable on the AP and check the eventlog again.

```
12:42:05, 11 Dec 2014,Default Route 0 Available,Recovery
12:42:04, 11 Dec 2014,ETH 12 Available,Recovery
12:42:04, 11 Dec 2014,ETH 12 Recovery Completed,PING
12:40:57, 11 Dec 2014,Network technology changed to WCDMA
12:40:37, 11 Dec 2014,Network technology changed to HSDPA/HSUPA
```

The eventlog will show that the PING recovery is performed by the firewall and that the ETH 12 and the Primary Route go back UP. It can also be checked looking at the routing table:

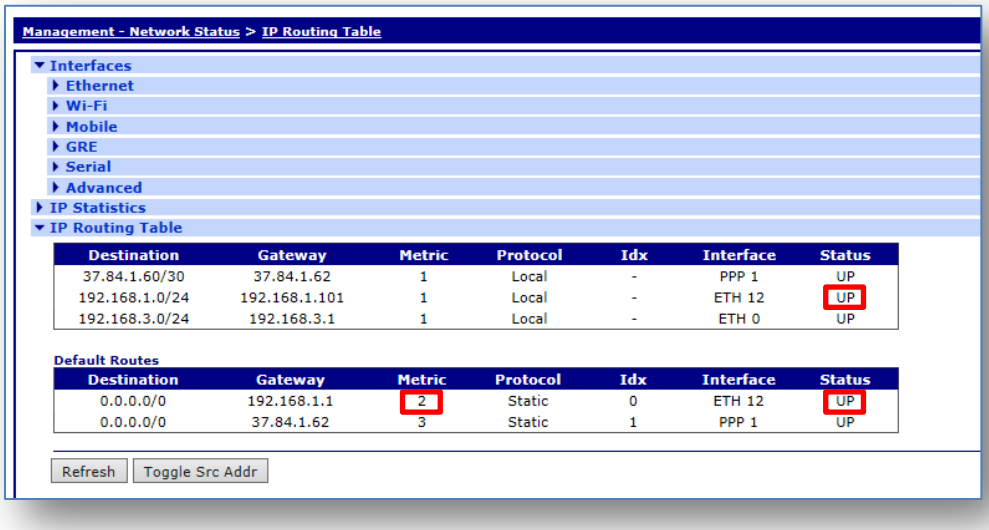


Figure 4.2-3: Routing Table after Rollback to WiFi

Performing again the ping from the laptop on the LAN, the trace will show that the traffic is now routed again on the Primary Link:

```
-----   11-12-2014  12:43:32.510   -----
   45 00 00 3C 16 4B 00 00 80 01 54 BE C0 A8 03 04     E..<.K....T.....
   08 08 04 04 08 00 4D 3E 00 01 00 1D 61 62 63 64     ......M>....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

   IP (In) From REM TO LOC        IFACE: ETH 0
   45              IP Ver:        4
                   Hdr Len:       20
```

```
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 3C          Length:        60
   16 4B          ID:            5707
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   80             TTL:           128
   01             Proto:         ICMP
   54 BE          Checksum:      21694
   C0 A8 03 04    Src IP:        192.168.3.4
   08 08 04 04    Dst IP:        8.8.4.4
   ICMP:
   08             Type:          ECHO REQ
   00             Code:          0
   4D 3E          Checksum:      19774
   ----------
-----   11-12-2014  12:43:32.510   -----
45 00 00 3C 16 4B 00 00 7F 01 57 5D C0 A8 01 65     E..<.K....W]...e
08 08 04 04 08 00 4D 3E 00 01 00 1D 61 62 63 64     ......M>....abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

IP (Final) From LOC TO REM    IFACE: ETH 12
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 3C          Length:        60
16 4B          ID:            5707
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
7F             TTL:           127
01             Proto:         ICMP
57 5D          Checksum:      22365
C0 A8 01 65    Src IP:        192.168.1.101
08 08 04 04    Dst IP:        8.8.4.4
ICMP:
08             Type:          ECHO REQ
00             Code:          0
4D 3E          Checksum:      19774
----------
-----   11-12-2014  12:43:32.510   -----
08 41 28 00 04 F0 21 0C 9B 18 00 0E 8E 23 14 85     .A(...!......#..
00 04 2D 04 B4 4C F0 08 00 20 8C 20 00 00 00 00     ..-..L... . ....
AA AA 03 00 00 00 08 00 45 00 00 3C 16 4B 00 00     ........E..<.K..
7F 01 57 5D C0 A8 01 65 08 08 04 04 08 00 4D 3E     ..W]...e......M>
00 01 00 1D 61 62 63 64 65 66 67 68 69 6A 6B 6C     ....abcdefghijkl
6D 6E 6F 70 71 72 73 74 75 76 77 61 62 63 64 65     mnopqrstuvwabcde
66 67 68 69                                         fghi

Wi-Fi From LOC To REM                       IFACE: Wi-Fi Module 0
08 41                  Version:             0
                       Type:                Data
                       Subtype:             Data
                       Flags:               STA -> AP, Protected
28 00                  Duration:            40
04 F0 21 0C 9B 18      BSS ID
00 0E 8E 23 14 85      Src. MAC
00 04 2D 04 B4 4C      Dst. MAC
08 F0                  Fragment:            0
                       Sequence:            143
00 20 8C 20 00 00 00 00  TKIP Security Param
```

```
AA AA 03 00 00 00        LLC SNAP
08 00                    Type:               IP
IP:
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 3C          Length:        60
16 4B          ID:            5707
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
7F             TTL:           127
01             Proto:         ICMP
57 5D          Checksum:      22365
C0 A8 01 65    Src IP:        192.168.1.101
08 08 04 04    Dst IP:        8.8.4.4
----------
```

And also the reply:

```
   -----   11-12-2014  12:43:32.520   -----
   08 02 2C 00 00 0E 8E 23 14 85 04 F0 21 0C 9B 18     ..,....#....!...
   00 04 2D 04 B4 4C 10 11 AA AA 03 00 00 00 08 00     ..-..L..........
   45 00 00 3C 3E 4D 00 00 34 01 7A 5B 08 08 04 04     E..<>M..4.z[....
   C0 A8 01 65 00 00 55 3E 00 01 00 1D 61 62 63 64     ...e..U>....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69 AA 01 A3 09     uvwabcdefghi....
   31 19 A4 2C                                         1..,

   Wi-Fi From REM To LOC                          IFACE: Wi-Fi Module 0
   08 02                    Version:              0
                            Type:                 Data
                            Subtype:              Data
                            Flags:                AP -> STA
   2C 00                    Duration:             44
   00 0E 8E 23 14 85        Dst. MAC
   04 F0 21 0C 9B 18        BSS ID
   00 04 2D 04 B4 4C        Src. MAC
   11 10                    Fragment:             0
                            Sequence:             273
   AA AA 03 00 00 00        LLC SNAP
   08 00                    Type:                 IP
   IP:
   45             IP Ver:        4
                  Hdr Len:       20
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 3C          Length:        60
   3E 4D          ID:            15949
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   34             TTL:           52
   01             Proto:         ICMP
   7A 5B          Checksum:      31323
   08 08 04 04    Src IP:        8.8.4.4
   C0 A8 01 65    Dst IP:        192.168.1.101
   ----------
   -----   11-12-2014  12:43:32.520   -----
   45 00 00 3C 3E 4D 00 00 34 01 7A 5B 08 08 04 04     E..<>M..4.z[....
```

```
   C0 A8 01 65 00 00 55 3E 00 01 00 1D 61 62 63 64     ...e..U>....abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69 AA 01 A3 09     uvwabcdefghi....
   31 19 A4 2C                                         1..,

   IP (In) From REM TO LOC        IFACE: ETH 12
   45             IP Ver:         4
                  Hdr Len:        20
   00             TOS:            Routine
                  Delay:          Normal
                  Throughput:     Normal
                  Reliability:    Normal
   00 3C          Length:         60
   3E 4D          ID:             15949
   00 00          Frag Offset:    0
                  Congestion:     Normal
                                  May Fragment
                                  Last Fragment
   34             TTL:            52
   01             Proto:          ICMP
   7A 5B          Checksum:       31323
   08 08 04 04    Src IP:         8.8.4.4
   C0 A8 01 65    Dst IP:         192.168.1.101
   ICMP:
   00             Type:           ECHO REPLY
   00             Code:           0
   55 3E          Checksum:       21822
   ----------
-----   11-12-2014  12:43:32.520   -----
45 00 00 3C 3E 4D 00 00 32 01 7A BC 08 08 04 04     E..<>M..2.z.....
C0 A8 03 04 00 00 55 3E 00 01 00 1D 61 62 63 64     ......U>....abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

IP (Final) From LOC TO REM     IFACE: ETH 0
45             IP Ver:         4
               Hdr Len:        20
00             TOS:            Routine
               Delay:          Normal
               Throughput:     Normal
               Reliability:    Normal
00 3C          Length:         60
3E 4D          ID:             15949
00 00          Frag Offset:    0
               Congestion:     Normal
                               May Fragment
                               Last Fragment
32             TTL:            50
01             Proto:          ICMP
7A BC          Checksum:       31420
08 08 04 04    Src IP:         8.8.4.4
C0 A8 03 04    Dst IP:         192.168.3.4
ICMP:
00             Type:           ECHO REPLY
00             Code:           0
55 3E          Checksum:       21822
----------
```

4.3 Testing failover without Firewall Monitoring: WiFi link failure

In this section will be provided a quick test on how is performed the failover in case of a failure on the WiFi connection.
This kind of failure will not use the FW monitoring, so in order to have it working the section "3.6 Firewall Configuration" and the "Generate Ping" section of the ETH 12 configuration (see Figure 3.2 1) are optional (but, if present as in this example, don't cause issues).

As shown in section 4.2.1, once the WiFi client is connected to the AP, the routing table should looks like the following, showing that the primary route is the one pointing to ETH 12. In the routing table is also shown the backup route to PPP 1 (as UP), that will be not used while the primary is UP due to metric priority. The routing table can be checked browsing to Management - Network Status > IP Routing Table:

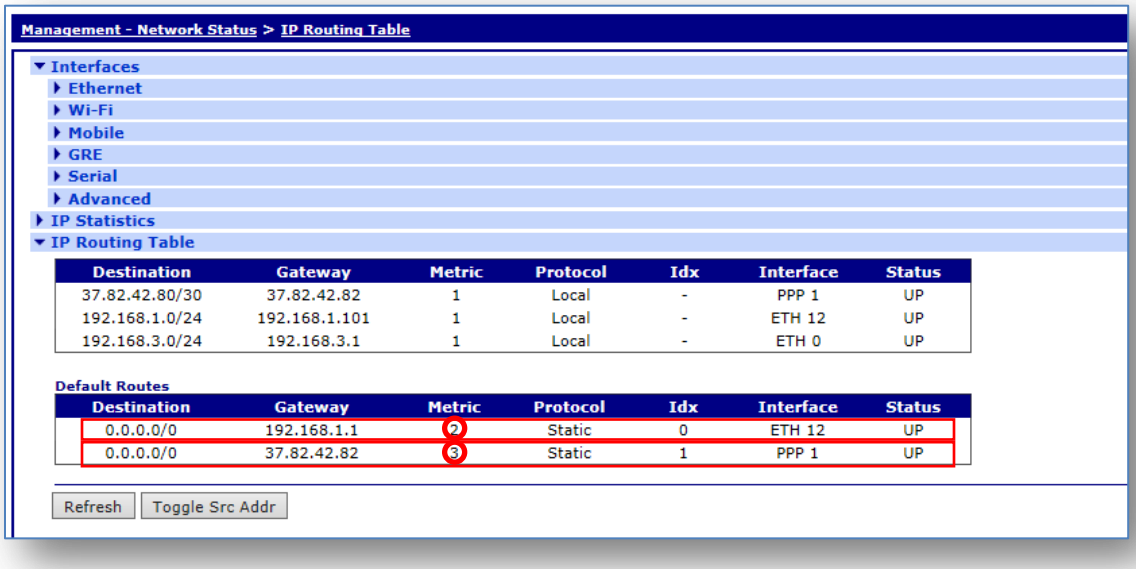


Figure 4.3-1: Routing Table in Normal Condition

In this condition the traffic is routed to the Primary WiFi connection.

When a failure on the WiFi link occurs, for example disabling the WiFi on the AP side, the ETH 12 and the primary route will go immediately OOS (without using the FW monitoring) and the eventlog should look like the following:

```
11:15:54, 11 Dec 2014,Default Route 0 Out Of Service,Activation
11:15:54, 11 Dec 2014,ETH 12 Out Of Service,Activation
11:15:54, 11 Dec 2014,Wi-Fi client 0 probing Access Point WPA
11:15:54, 11 Dec 2014,Wi-Fi Node 0 disconnected from Access Point WPA,Remote
out of range
```

```
11:15:50, 11 Dec 2014,Wi-Fi Node 0 reassociating with Access Point WPA,
RSSI:36
11:15:27, 11 Dec 2014,Clear Event Log
```

The routing table will be then:

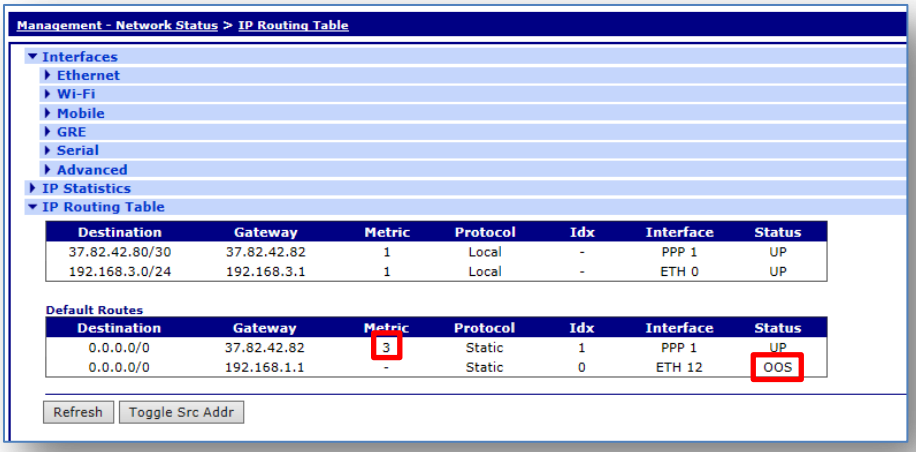


Figure 4.3-2: Routing Table after failure on WiFi link

And so the traffic will pass through the PPP link.

Enabling again the WIFi on the AP side will bring UP ETH 12 and the primary route. In this case the eventlog and the routing table will look like the following:

```
11:17:15, 11 Dec 2014,ETH 12 up
11:17:15, 11 Dec 2014,Default Route 0 Available,Activation
11:17:15, 11 Dec 2014,ETH 12 Available,Activation
11:17:15, 11 Dec 2014,Wi-Fi Node 0 connected to Access Point WPA, RSSI:42
11:17:12, 11 Dec 2014,Wi-Fi client 0 probing Access Point WPA
11:17:10, 11 Dec 2014,Wi-Fi client 0 probing Access Point WPA
11:17:07, 11 Dec 2014,Wi-Fi client 0 probing Access Point WPA
```

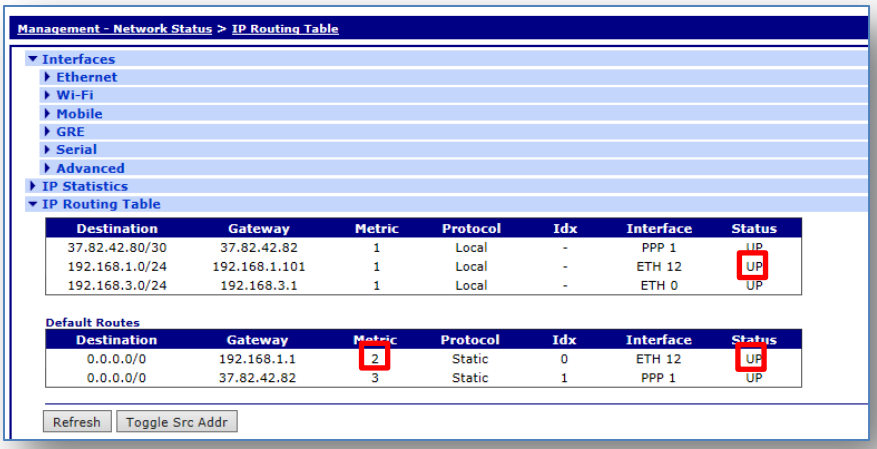


Figure 4.3-3: Routing Table after Rollback to WiFi

5 TRANSPORT CONFIGURATION FILES

5.1 Configuration File

This is the configuration used on the TransPort in this Application Note, relevant CLI lines are highlighted:

```
'config c show'

wifi 0 country "Germany"
wifi 0 wifianon ON
wifi 0 anamgmt "nobeacons"
wifi 0 anadata "nonull"
wifinode 0 descr "WiFi Client (WAN)"
wifinode 0 ssid "Access Point WPA"
wifinode 0 mode "client"
wifinode 0 security "wpapsk"
wifinode 0 esharedkey "PDZxU0FFQFU="
eth 0 IPaddr "192.168.3.1"
eth 0 ipanon ON
eth 1 pingip "8.8.8.8"
eth 1 pingsiz 1
eth 1 pingis ON
eth 12 dhcpcli ON
eth 12 mask ""
eth 12 do_nat 1
eth 12 firewall ON
eth 12 ipanon ON
eth 12 pingip "8.8.8.8"
eth 12 pingint 10
eth 12 pingsiz 1
eth 12 pingis ON
eth 12 wificli ON
eth 12 physadd -1
addp 0 enable ON
lapb 0 ans OFF
lapb 0 tinact 120
lapb 1 tinact 120
lapb 3 dtemode 0
lapb 4 dtemode 0
lapb 5 dtemode 0
lapb 6 dtemode 0
gps 0 asy_add 1
gps 0 gpson ON
ip 0 cidr ON
def_route 0 ll_ent "ETH"
def_route 0 ll_add 12
def_route 1 ll_ent "PPP"
def_route 1 ll_add 1
def_route 1 upmetric 2
def_route 1 metric 2
dhcp 0 IPmin "192.168.3.3"
dhcp 0 IPrange 117
dhcp 0 respdelms 500
```

```
dhcp 0 mask "255.255.255.0"
dhcp 0 gateway "192.168.3.1"
dhcp 0 DNS "192.168.3.1"
sntp 0 server "time.etherios.com"
ppp 0 timeout 300
ppp 1 name "W-WAN"
ppp 1 phonenum "*98*1#"
ppp 1 IPaddr "0.0.0.0"
ppp 1 timeout 0
ppp 1 use_modem 1
ppp 1 aodion 1
ppp 1 autoassert 1
ppp 1 ipanon ON
ppp 1 r_chap OFF
ppp 3 defpak 16
ppp 4 defpak 16
web 0 prelogin_info ON
modemcc 0 asy_add 7
modemcc 0 info_asy_add 5
modemcc 0 init_str "+CGQREQ=1"
modemcc 0 init_str1 "+CGQMIN=1"
modemcc 0 apn "internet.t-d1.de"
modemcc 0 link_retries 10
modemcc 0 stat_retries 30
modemcc 0 sms_access 1
modemcc 0 sms_concat 0
modemcc 0 init_str_2 "+CGQREQ=1"
modemcc 0 init_str1_2 "+CGQMIN=1"
modemcc 0 apn_2 "Your.APN.goes.here"
modemcc 0 link_retries_2 10
modemcc 0 stat_retries_2 30
ana 0 anon ON
ana 0 l2on OFF
ana 0 xoton OFF
ana 0 lapdon 0
ana 0 lapbon 0
ana 0 maxdata 1500
ana 0 logsize 180
cmd 0 unitid "ss%s>"
cmd 0 cmdnua "99"
cmd 0 hostname "digi.router"
cmd 0 asyled_mode 1
cmd 0 tremto 1200
cmd 0 rcihttp ON
cmd 1 autocmd "ats31=7"
cmd 1 gpson ON
user 0 access 0
user 1 name "username"
user 1 epassword "KD5lSVJDVVg="
user 1 access 0
user 2 access 0
user 3 access 0
user 4 access 0
user 5 access 0
user 6 access 0
user 7 access 0
```

```
user 8 access 0
user 9 access 0
local 0 transaccess 2
sslsvr 0 certfile "cert01.pem"
sslsvr 0 keyfile "privrsa.pem"
ssh 0 hostkey1 "privSSH.pem"
ssh 0 nb_listen 5
ssh 0 v1 OFF
cloud 0 ssl ON

Power Up Profile: 0
OK
```

5.2 Firewall Rules

The firewall rules used in this AN are the following:

```
pass out break end on eth 12 proto icmp from addr-eth 12  to 8.8.8.8  icmp-
type echo inspect-state oos  10 t=3 c=3 d=3 r=ping,3,3

pass break end
```

5.3 Hardware and Firmware

The Hardware and firmware used for this AN are reported below:

```
Digi TransPort WR44-U8G1-WE5-XX Ser#:149353
Software Build Ver5271.  Oct 30 2014 06:10:52  SW
ARM Bios Ver 7.24u v39 400MHz B512-M512-F80-O0,0 MAC:00042d024769
Async Driver              Revision: 1.19  Int clk
Wi-Fi                     Revision: 2.0
IX                        Revision: 1.0
Ethernet Port Isolate Driver Revision: 1.11
Firewall                  Revision: 1.0
EventEdit                 Revision: 1.0
Timer Module              Revision: 1.1
(B)USBHOST                Revision: 1.0
L2TP                      Revision: 1.10
PPTP                      Revision: 1.00
TACPLUS                   Revision: 1.00
MODBUS                    Revision: 0.00
MySQL                     Revision: 0.01
RealPort                  Revision: 0.00
MultiTX                   Revision: 1.00
LAPB                      Revision: 1.12
X25 Layer                 Revision: 1.19
MACRO                     Revision: 1.0
PAD                       Revision: 1.4
X25 Switch                Revision: 1.7
V120                      Revision: 1.16
TPAD Interface            Revision: 1.12
GPS                       Revision: 1.0
```

```
SCRIBATSK                   Revision: 1.0
BASTSK                      Revision: 1.0
PYTHON                      Revision: 1.0
CLOUDSMS                    Revision: 1.0
ARM Sync Driver             Revision: 1.18
TCP                         Revision: 1.14
TCP Utils                   Revision: 1.13
PPP                         Revision: 1.19
WEB                         Revision: 1.5
SMTP                        Revision: 1.1
FTP Client                  Revision: 1.5
FTP                         Revision: 1.4
IKE                         Revision: 1.0
PollANS                     Revision: 1.2
PPPOE                       Revision: 1.0
BRIDGE                      Revision: 1.1
MODEM CC (GOBI UMTS)        Revision: 1.4
FLASH Write                 Revision: 1.2
Command Interpreter         Revision: 1.38
SSLCLI                      Revision: 1.0
OSPF                        Revision: 1.0
BGP                         Revision: 1.0
QOS                         Revision: 1.0
RADIUS Client               Revision: 1.0
SSH Server                  Revision: 1.0
SCP                         Revision: 1.0
SSH Client                  Revision: 1.0
CERT                        Revision: 1.0
LowPrio                     Revision: 1.0
Tunnel                      Revision: 1.2
OVPN                        Revision: 1.2
QDL                         Revision: 1.0
WiMax                       Revision: 1.0
OK
```