

# Virtual Router Redundancy Protocol (VRRP) Technical Support Guide

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DOCUMENT VERSION	DATE
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*Table 1 - Document Revision History*



Note: Before performing the instructions in this guide, please ensure that you have the latest firmware version installed on your router. Visit <http://www.netcommwireless.com> to download the latest firmware.

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# Applicable devices

This document is applicable to the following NetComm Wireless devices:

- 📶 NTC-6908
- 📶 NTC-6908-02
- 📶 NTC-6520
- 📶 NTC-6200
- 📶 NTC-30WV
- 📶 NTC-30WV-02
- 📶 NTC-40WV
- 📶 NTC-140W
- 📶 NWL-11
- 📶 NWL-15

## Introduction

### What is VRRP?

VRRP (Virtual Router Redundancy Protocol) is a non-proprietary redundancy protocol designed to increase the availability of the default gateway servicing hosts on the same subnet. The Virtual Router Redundancy Protocol is a standards-based alternative to Cisco's proprietary Hot Standby Router Protocol (HSRP) concept defined in IETF standard RFC 3768. The two technologies are similar in concept, but are not compatible. The advantage of using VRRP is that you gain a higher availability for the default path without requiring configuration of dynamic routing or router discovery protocols on every end host.

VRRP routers, viewed as a "redundancy group", share the responsibility for forwarding packets as if they "owned" the IP address corresponding to the default gateway configured on the hosts. At any time, one of the VRRP routers acts as the master, and other VRRP routers act as backups. If the master router fails, a backup router becomes the new master. In this way, router redundancy is always provided, allowing traffic on the LAN to be routed without relying on a single router.

The physical router that is currently forwarding data on behalf of the virtual router is called the master router. There is always a master for the shared IP address. If the master goes down, the remaining VRRP routers elect a new master VRRP router. The new master forwards packets on behalf of the owner by taking over the virtual MAC address used by the owner.

Master routers have a priority of 255 and backup router(s) can have priority between 1 and 254. A virtual router must use 00-00-5E-00-01-XX as its (MAC) address. The last byte of the address (XX) is the Virtual Router Identifier (VRID), which is different for each virtual router in the network. This address is used by only one physical router at a time, and is the only way that other physical routers can identify the master router within a virtual router.

## VRRP Terminology

### Virtual Router

A single router image created through the operation of one or more routers running VRRP.

### VRRP Instance

A program, implementing VRRP, running on a router. A single VRRP instance can provide VRRP capability for more than one virtual router.

### Virtual Router ID

Also called VRID, this is a numerical identification of a particular virtual router. VRIDs must be unique on a given network segment.

### Virtual Router IP

An IP address associated with a VRID that other hosts can use to obtain network service from. The VRIP is managed by the VRRP instances belonging to a VRID.

### Virtual MAC address

For media that use MAC addressing (such as Ethernet), VRRP instances use predefined MAC addresses for all VRRP actions instead of the real adapter MAC addresses. This isolates the operation of the virtual router from the real router providing the routing function. The VMAC is derived from the VRID.

### Master

The one VRRP instance that performs the routing function for the virtual router at a given time. Only one master is active at a time for a given VRID. Also refers to the state of the VRRP FSM when the VRRP instance is operating as master (that is, "master state").

### Backup

VRRP instances for a VRID that are active but not in the master state. Any number of backups can exist for a VRID. Backups are ready to take on the role of master if the current master fails. Also refers to the state of the VRRP FSM when the VRRP instance is operating as backup (that is, "backup state").

### Priority

Different VRRP instances are assigned a priority value, as a way of determining which router will take on the role of master if the current master fails. *Priority is a number from 1 to 254 (0 and 255 are reserved).* Larger numbers have higher priority.

### Owner

If the virtual IP address is the same as any of the IP addresses configured on an interface of a router, that router is the owner of the virtual IP address. The priority of the VRRP instance when it is the VIP owner is 255, the highest (and reserved) value.

## Router VRRP Configuration Page

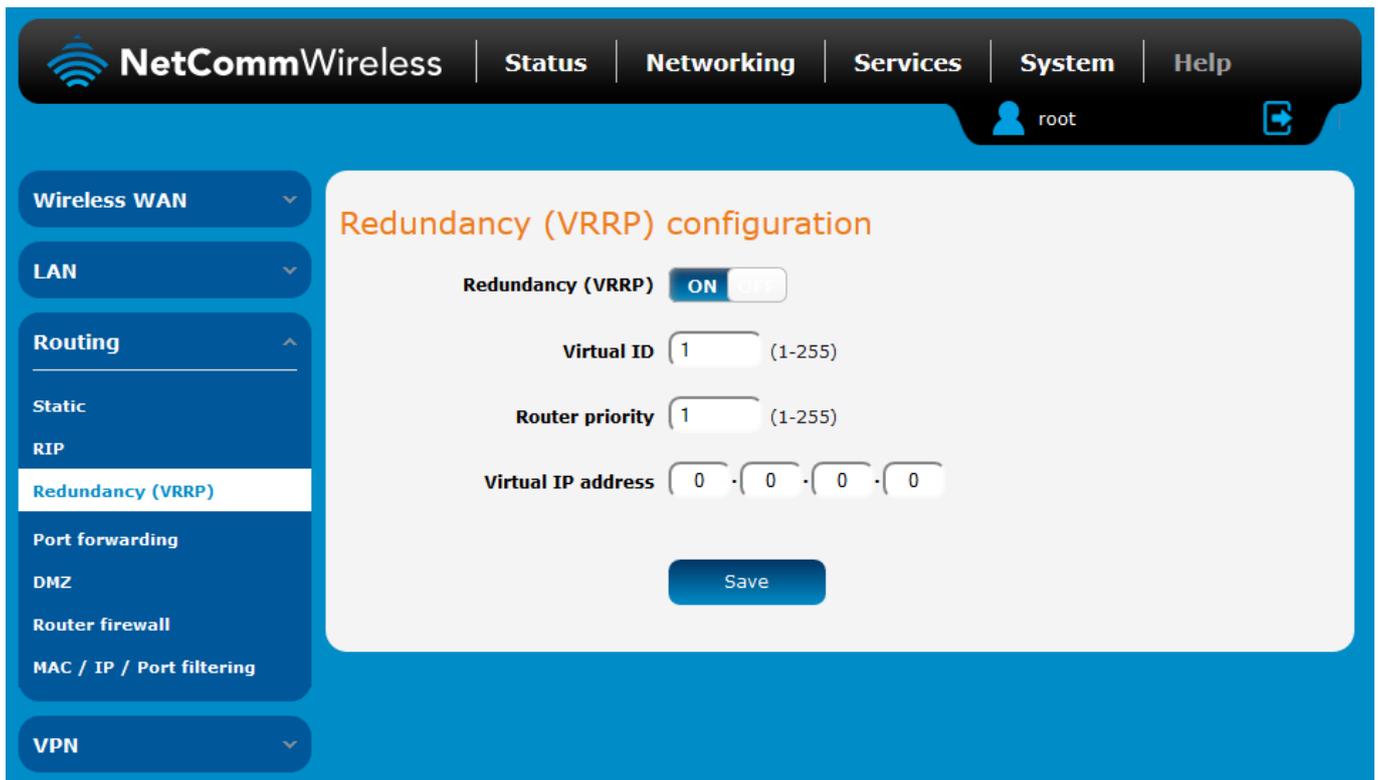


Figure 1 - NetComm M2M Router VRRP configuration page

ITEM	DEFINITION
Redundancy (VRRP)	Enables or disables the VRRP function.
Virtual ID	This is the VRRP ID which is different for each virtual router on the network.
Router Priority	The priority determining which router will take on the role of the master. A higher value has a higher priority.
Virtual IP address	This is the virtual IP address that both virtual routers share.

Table 2 - VRRP configuration items



NOTE: Configuring VRRP changes the MAC address of the Ethernet port and therefore if you want to resume with the web configuration you must use the new IP address (VRRP IP) or on a command prompt type: `arp -d <ip address>` (i.e `arp -d 192.168.1.50`) to clear the arp cache.(old MAC address).

# VRRP in Action – How it operates on Ethernet

## Device Configuration

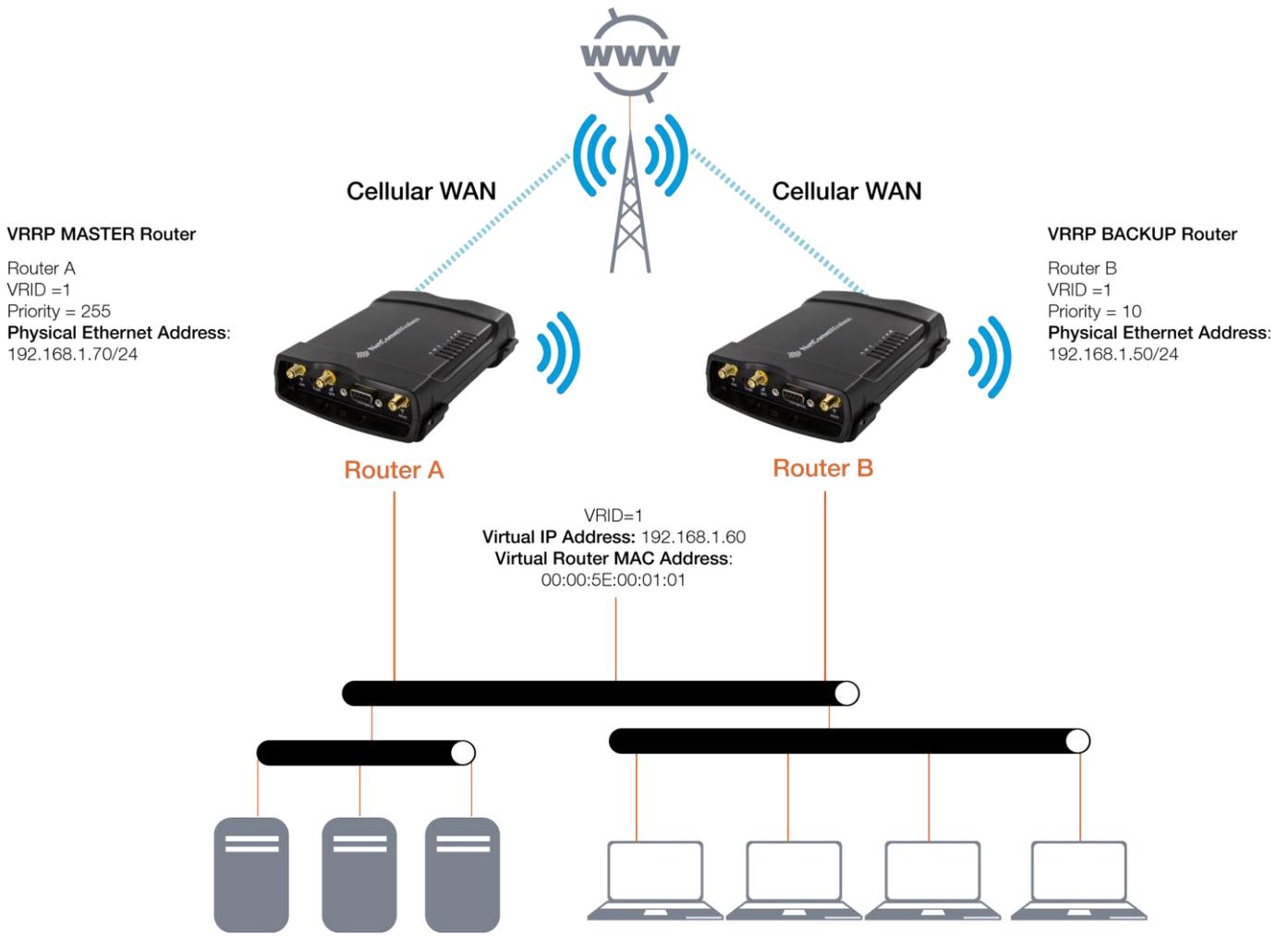


Figure 2 - VRRP in Action - How it operates on Ethernet

Referring to the logical network diagram, in our example, we have configured Router A’s priority to be 255 and Router B’s priority to be 10. If we did not set the priority on the routers, Router A would have become the master because the IP address of its Ethernet interface is higher than that of Router B.

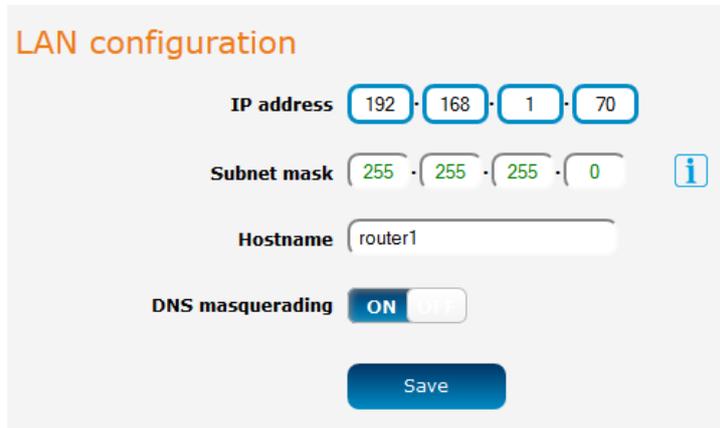


Tips:

- It is a good idea for your priority values to be at extremes, as it helps the protocol make “clean state” transitions.
- When planning your VRRP configuration, we recommended that you decide in advance which instance will be your preferred master with highest priority. Configuring the preferred master’s startup state allows it to transition straight to master when it is started, rather than waiting for advertisements from other instances.

## Router A Configuration

1. Establish a mobile broadband connection. See the device's User Guide for detailed instructions.
2. Click the **Networking** menu from the top of the screen, then select the **LAN** folder on the left and finally, click the **LAN** menu item. Configure the LAN IP address



**LAN configuration**

IP address: 192 · 168 · 1 · 70

Subnet mask: 255 · 255 · 255 · 0 i

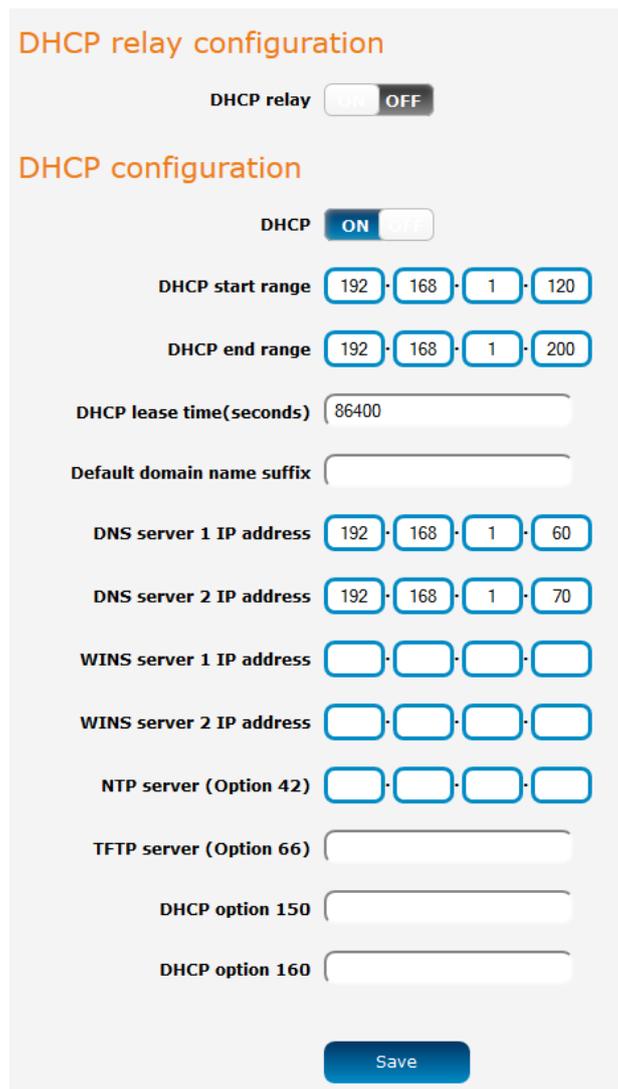
Hostname: router1

DNS masquerading:  ON  OFF

**Save**

Figure 3 – Router A LAN IP Address Configuration

3. Under the LAN folder on the left side of the screen, click the **DHCP** menu item. Configure the DHCP Server settings:



**DHCP relay configuration**

DHCP relay:  ON  OFF

**DHCP configuration**

DHCP:  ON  OFF

DHCP start range: 192 · 168 · 1 · 120

DHCP end range: 192 · 168 · 1 · 200

DHCP lease time(seconds): 86400

Default domain name suffix:

DNS server 1 IP address: 192 · 168 · 1 · 60

DNS server 2 IP address: 192 · 168 · 1 · 70

WINS server 1 IP address:  ·  ·  ·

WINS server 2 IP address:  ·  ·  ·

NTP server (Option 42):  ·  ·  ·

TFTP server (Option 66):

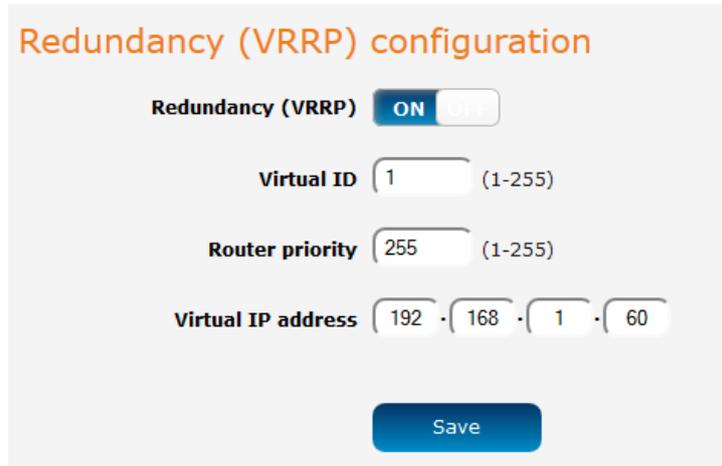
DHCP option 150:

DHCP option 160:

**Save**

Figure 4 – Router A LAN DHCP Server Configuration Settings

- Click the **Routing** menu on the left side of the screen and then click the **Redundancy (VRRP)** menu item. Click the **Redundancy (VRRP)** toggle key to turn VRRP on. Configure the VRRP settings:



**Redundancy (VRRP) configuration**

**Redundancy (VRRP)**  ON  OFF

**Virtual ID**  (1-255)

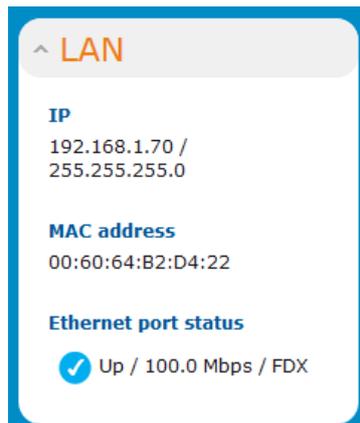
**Router priority**  (1-255)

**Virtual IP address**  .  .  .

**Save**

Figure 5 – Router A VRRP Configuration Settings

- Click **Save** and reboot the router. When it has finished starting up, click the **Status** link to see the LAN settings. The MAC address of Router A changes to the VRRP virtual MAC address 00:00:5E:00:01:01 where the last octet '01' is the Virtual Device ID.



**LAN**

**IP**  
192.168.1.70 /  
255.255.255.0

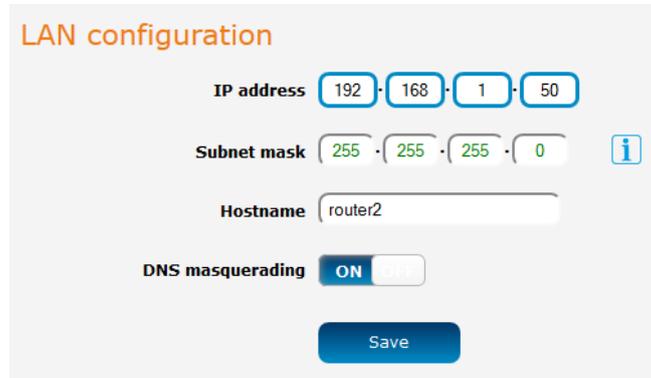
**MAC address**  
00:60:64:B2:D4:22

**Ethernet port status**  
 Up / 100.0 Mbps / FDX

Figure 6 – Router A's VRRP LAN address

## Router B Configuration

1. Establish a mobile broadband connection. See the device's User Guide for detailed instructions.
2. Click the **Networking** menu from the top of the screen, then select the **LAN** folder on the left and finally, click the **LAN** menu item. Configure the LAN IP address



**LAN configuration**

IP address: 192 · 168 · 1 · 50

Subnet mask: 255 · 255 · 255 · 0 i

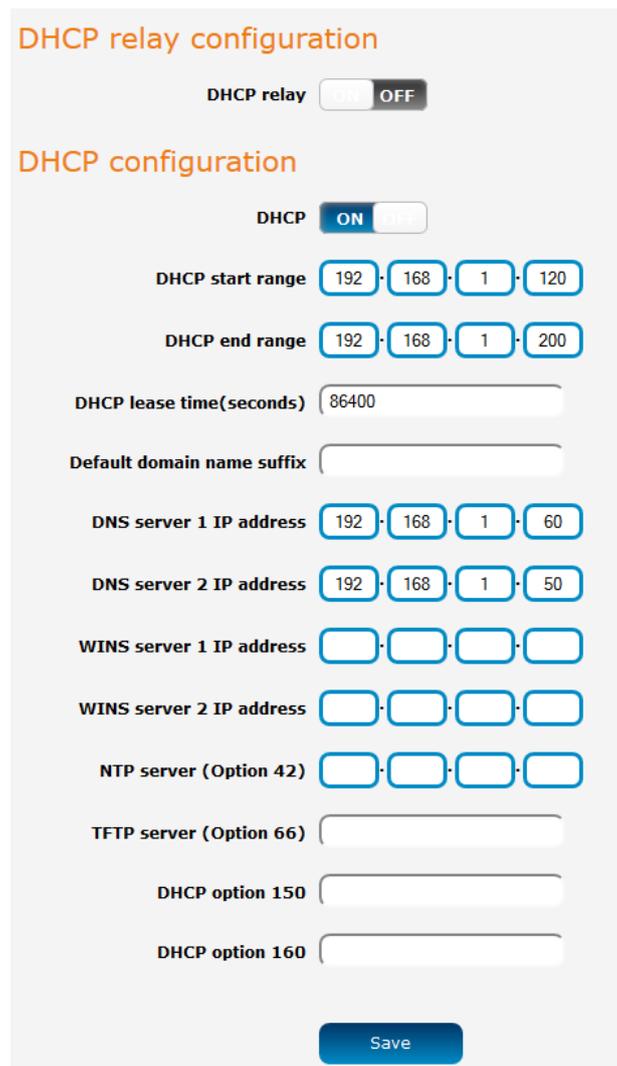
Hostname: router2

DNS masquerading:  ON  OFF

**Save**

Figure 7 – Router B LAN IP Address Configuration

3. Under the LAN folder on the left side of the screen, click the **DHCP** menu item. Configure the DHCP Server settings:



**DHCP relay configuration**

DHCP relay:  ON  OFF

**DHCP configuration**

DHCP:  ON  OFF

DHCP start range: 192 · 168 · 1 · 120

DHCP end range: 192 · 168 · 1 · 200

DHCP lease time(seconds): 86400

Default domain name suffix:

DNS server 1 IP address: 192 · 168 · 1 · 60

DNS server 2 IP address: 192 · 168 · 1 · 50

WINS server 1 IP address:  ·  ·  ·

WINS server 2 IP address:  ·  ·  ·

NTP server (Option 42):  ·  ·  ·

TFTP server (Option 66):

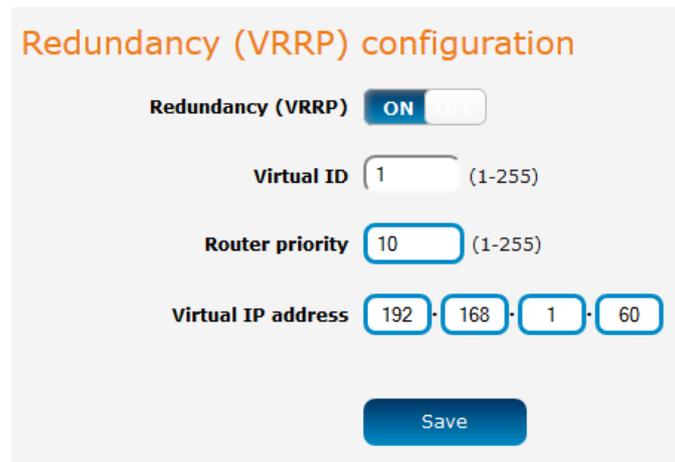
DHCP option 150:

DHCP option 160:

**Save**

Figure 8 – Router B LAN DHCP Server Configuration Settings

- Click the **Routing** menu on the left side of the screen and then click the **Redundancy (VRRP)** menu item. Click the **Redundancy (VRRP)** toggle key to turn VRRP on. Configure the VRRP settings:



**Redundancy (VRRP) configuration**

**Redundancy (VRRP)**  ON  OFF

**Virtual ID**  (1-255)

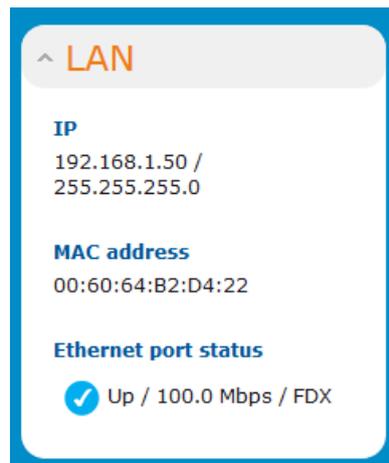
**Router priority**  (1-255)

**Virtual IP address**  ·  ·  ·

**Save**

Figure 9 – Router B VRRP Configuration Settings

- Click **Save** and reboot the router. When it has finished starting up, click the **Status** link to see the LAN settings. The MAC address of Router A changes to the VRRP virtual MAC address 00:60:64:B2:D4:22 where the last octet '01' is the Virtual Device ID.



**LAN**

**IP**  
192.168.1.50 /  
255.255.255.0

**MAC address**  
00:60:64:B2:D4:22

**Ethernet port status**  
 Up / 100.0 Mbps / FDX

Figure 10 – Router B's VRRP LAN address

# VRRP in Action – Test VRRP for 3G Mobile Broadband Failover Internet Connection on Ethernet

VRRP Experience from 'Test PC 1'

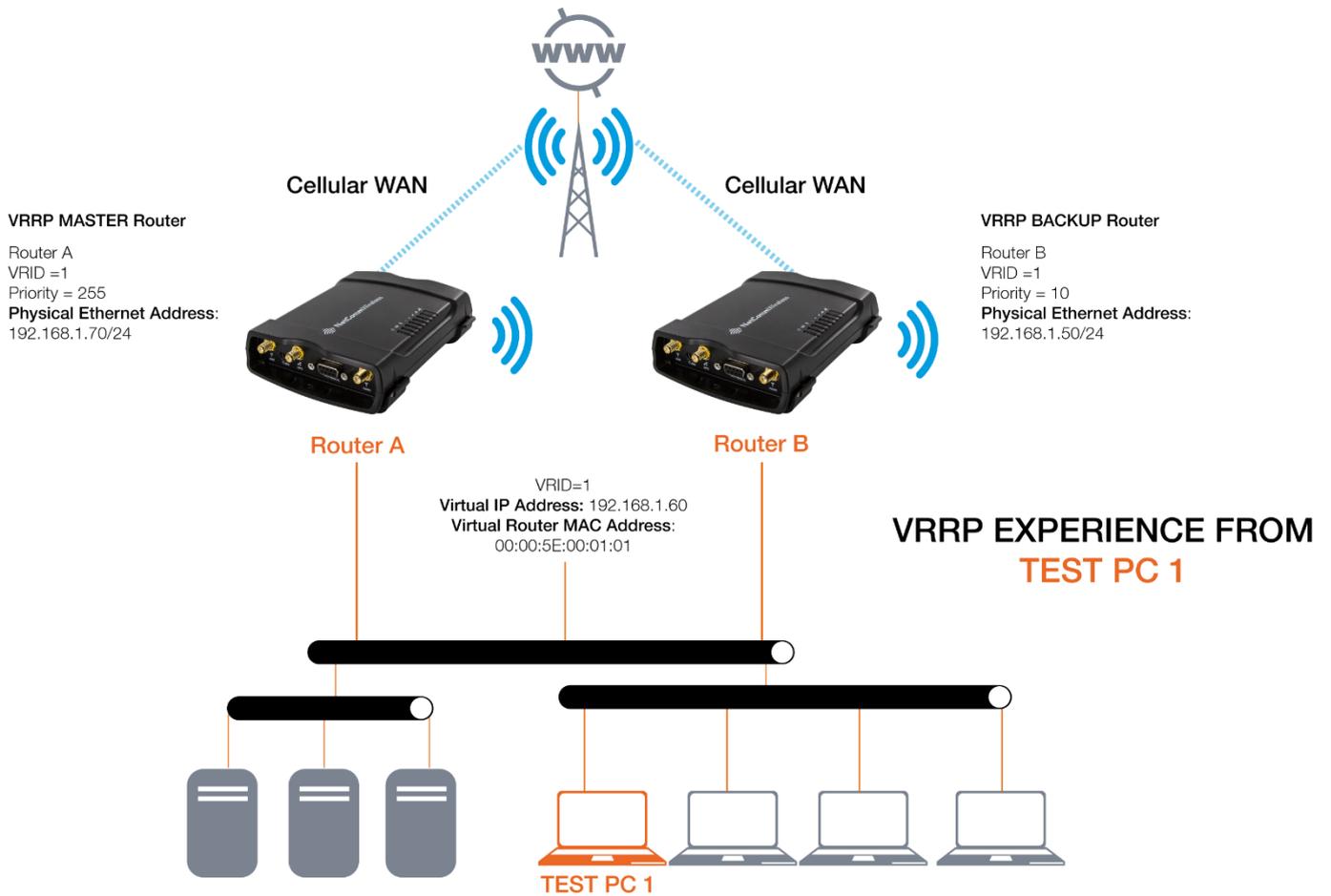
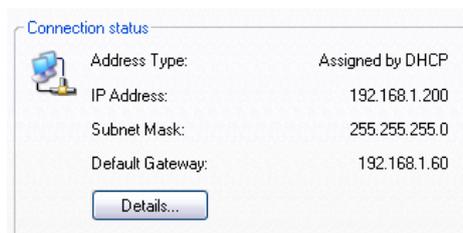


Figure 11 - VRRP concept generic logical network diagram

## Test PC 1



```

C:\Documents and Settings\carmen\ipconfig
Windows IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : 
    IP Address . . . . . : 192.168.1.200
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.60

C:\Documents and Settings\carmen>arp -a

Interface: 192.168.1.200 --- 0x2
 Internet Address      Physical Address      Type
 192.168.1.50         00-00-5e-00-01-01    dynamic
 192.168.1.60         00-00-5e-00-01-01    dynamic
 192.168.1.70         00-00-5e-00-01-01    dynamic
  
```

Figure 12 - Test PC 1 configuration

When both Cellular Routers are up, the master VRRP router, Router A is used as the default internet gateway.

```
C:\Documents and Settings\carmenl>ping www.google.com.au -t
Pinging www.l.google.com [74.125.127.147] with 32 bytes of data:
Reply from 74.125.127.147: bytes=32 time=331ms TTL=237
Reply from 74.125.127.147: bytes=32 time=2365ms TTL=233
Reply from 74.125.127.147: bytes=32 time=258ms TTL=233
Reply from 74.125.127.147: bytes=32 time=430ms TTL=237
Reply from 74.125.127.147: bytes=32 time=439ms TTL=237
Reply from 74.125.127.147: bytes=32 time=417ms TTL=237
Reply from 74.125.127.147: bytes=32 time=395ms TTL=237
Reply from 74.125.127.147: bytes=32 time=404ms TTL=237
Reply from 74.125.127.147: bytes=32 time=432ms TTL=237
Reply from 74.125.127.147: bytes=32 time=420ms TTL=237
Reply from 74.125.127.147: bytes=32 time=418ms TTL=237
Ping statistics for 74.125.127.147:
    Packets: Sent = 11, Received = 11, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 258ms, Maximum = 2365ms, Average = 573ms
Control-C
^C
C:\Documents and Settings\carmenl>tracert -d www.google.com.au
Tracing route to www.l.google.com [74.125.127.147]
over a maximum of 30 hops:
  0  <1 ms    <1 ms    <1 ms    192.168.1.70
  1  381 ms   519 ms   510 ms   10.4.24.194
  2  *        *        *        Request timed out.
  3  *        *        *        Request timed out.
  4  *        284 ms  340 ms   74.125.127.147
  5  309 ms  359 ms  340 ms   74.125.127.147
  6  309 ms  339 ms  389 ms   74.125.127.147
  7  *        *        294 ms   74.125.127.147
  8  272 ms  *        *        74.125.127.147
  9  *        *        *        Request timed out.
 10 *        3149 ms *        74.125.127.147
 11 406 ms  479 ms  500 ms   165.228.103.205
 12 410 ms  469 ms  480 ms   203.50.20.1
 13 397 ms  479 ms  490 ms   203.50.6.29
 14 397 ms  520 ms  500 ms   203.50.13.70
 15 530 ms  599 ms  590 ms   202.84.143.146
 16 509 ms  610 ms  619 ms   202.84.148.142
 17 616 ms  710 ms  710 ms   72.14.216.81
 18 3371 ms 320 ms  *        74.125.127.147
 19 635 ms  700 ms  720 ms   216.239.43.212
 20 506 ms  549 ms  560 ms   74.125.127.147
Trace complete.
```

Figure 13 – Router A as default internet gateway

When Master Router A is down, the backup router, Router B becomes the gateway to the internet.

```
C:\Documents and Settings\carmenl>ping www.google.com.au -t
Pinging www.l.google.com [74.125.127.147] with 32 bytes of data:
Reply from 74.125.127.147: bytes=32 time=332ms TTL=237
Reply from 74.125.127.147: bytes=32 time=389ms TTL=233
Reply from 74.125.127.147: bytes=32 time=287ms TTL=233
Reply from 192.168.1.70: Destination net unreachable.
Reply from 74.125.127.147: bytes=32 time=412ms TTL=237
Reply from 74.125.127.147: bytes=32 time=558ms TTL=237
Reply from 74.125.127.147: bytes=32 time=418ms TTL=237
Reply from 74.125.127.147: bytes=32 time=408ms TTL=237
Reply from 74.125.127.147: bytes=32 time=405ms TTL=237
Reply from 74.125.127.147: bytes=32 time=423ms TTL=237
Reply from 192.168.1.70: Destination net unreachable.
Reply from 192.168.1.70: Destination net unreachable.
Reply from 192.168.1.70: Destination net unreachable.
Reply from 74.125.127.147: bytes=32 time=442ms TTL=237
Reply from 74.125.127.147: bytes=32 time=400ms TTL=237
Reply from 74.125.127.147: bytes=32 time=428ms TTL=237
Reply from 192.168.1.70: Destination net unreachable.
Reply from 192.168.1.70: Destination net unreachable.
Reply from 192.168.1.70: Destination net unreachable.
Reply from 74.125.127.147: bytes=32 time=417ms TTL=237
Reply from 74.125.127.147: bytes=32 time=396ms TTL=237
Reply from 74.125.127.147: bytes=32 time=424ms TTL=237
Reply from 74.125.127.147: bytes=32 time=402ms TTL=237
Reply from 74.125.127.147: bytes=32 time=410ms TTL=237
Reply from 74.125.127.147: bytes=32 time=418ms TTL=237
Reply from 74.125.127.147: bytes=32 time=418ms TTL=237
Reply from 74.125.127.147: bytes=32 time=448ms TTL=237
Reply from 74.125.127.147: bytes=32 time=406ms TTL=237
Reply from 74.125.127.147: bytes=32 time=394ms TTL=237
Reply from 74.125.127.147: bytes=32 time=402ms TTL=237
Reply from 74.125.127.147: bytes=32 time=450ms TTL=237
Reply from 74.125.127.147: bytes=32 time=408ms TTL=237
Reply from 74.125.127.147: bytes=32 time=396ms TTL=237
Reply from 74.125.127.147: bytes=32 time=404ms TTL=237
Reply from 74.125.127.147: bytes=32 time=432ms TTL=237
Reply from 74.125.127.147: bytes=32 time=410ms TTL=237
Reply from 74.125.127.147: bytes=32 time=428ms TTL=237
Reply from 74.125.127.147: bytes=32 time=396ms TTL=237
Reply from 74.125.127.147: bytes=32 time=404ms TTL=237
Reply from 74.125.127.147: bytes=32 time=393ms TTL=237
Reply from 74.125.127.147: bytes=32 time=431ms TTL=237
Ping statistics for 74.125.127.147:
    Packets: Sent = 45, Received = 45, Lost = 0 (0% loss),
```

Figure 14 - Router B becomes the internet gateway

```

C:\Documents and Settings\carmen\>tracert -d www.google.com.au
Tracing route to www.l.google.com [74.125.127.104]
over a maximum of 30 hops:
  0  <1 ms    <1 ms    <1 ms    192.168.1.50
  1  *         *         *         Request timed out.
  2  *         *         *         Request timed out.
  3  *         *         *         Request timed out.
  4  144 ms   89 ms    89 ms    74.125.127.104
  5  138 ms   107 ms   110 ms   74.125.127.104
  6  79 ms    109 ms   109 ms   74.125.127.104
  7  *        135 ms   118 ms   74.125.127.104
  8  *        *        136 ms   74.125.127.104
  9  83 ms    *        *        74.125.127.104
 10 153 ms    *        *        74.125.127.104
 11 153 ms    *        *        74.125.127.104
 12 163 ms    *        *        74.125.127.104
 13 *        *        *        Request timed out.
 14 *        *        *        Request timed out.
 15 *        *        *        Request timed out.
 16 *        *        *        Request timed out.
 17 282 ms   *        *        74.125.127.104
 18 *        *        *        Request timed out.
 19 *        333 ms   *        74.125.127.104
 20 332 ms   290 ms   289 ms   74.125.127.104

Trace complete.

C:\Documents and Settings\carmen\>ping www.google.com.au -t

Pinging www.l.google.com [74.125.127.104] with 32 bytes of data:

Reply from 74.125.127.104: bytes=32 time=442ms TTL=237
Reply from 74.125.127.104: bytes=32 time=420ms TTL=237
Reply from 74.125.127.104: bytes=32 time=439ms TTL=237
Reply from 74.125.127.104: bytes=32 time=417ms TTL=237
Reply from 74.125.127.104: bytes=32 time=407ms TTL=237
Reply from 74.125.127.104: bytes=32 time=415ms TTL=237

Ping statistics for 74.125.127.104:
    Packets: Sent = 6, Received = 6, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 407ms, Maximum = 442ms, Average = 423ms
^C
C:\Documents and Settings\carmen\>arp -a

Interface: 192.168.1.200 --- 0x2
Internet Address      Physical Address      Type
192.168.1.50          00-00-5e-00-01-01    dynamic
192.168.1.60          00-00-5e-00-01-01    dynamic

```

Figure 15 - Router B as internet gateway

When Master Router A's (192.168.1.70) 3G connection is back online, Master Router A becomes the internet gateway.

```

C:\Documents and Settings\carmen\>arp -a

Interface: 192.168.1.200 --- 0x2
Internet Address      Physical Address      Type
192.168.1.50          00-00-5e-00-01-01    dynamic
192.168.1.60          00-00-5e-00-01-01    dynamic
192.168.1.70          00-00-5e-00-01-01    dynamic

C:\Documents and Settings\carmen\>tracert 4.2.2.2

Tracing route to unsc-bak.sys.gtei.net [4.2.2.2]
over a maximum of 30 hops:
  0  <1 ms    <1 ms    <1 ms    192.168.1.70
  1  *         72 ms   89 ms    10.4.85.2
  2  *         *        *        Request timed out.
  3  *         *        *        Request timed out.
  4  *         *        *        Request timed out.
  5  *         *        *        Request timed out.
  6  *         *        *        Request timed out.
  7  *         *        *        Request timed out.
^C

C:\Documents and Settings\carmen\>ping 4.2.2.2

Pinging 4.2.2.2 with 32 bytes of data:

Reply from 4.2.2.2: bytes=32 time=227ms TTL=44
Reply from 4.2.2.2: bytes=32 time=214ms TTL=44
Reply from 4.2.2.2: bytes=32 time=2103ms TTL=49
Reply from 4.2.2.2: bytes=32 time=258ms TTL=49

Ping statistics for 4.2.2.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 214ms, Maximum = 2103ms, Average = 700ms

```

Figure 16 - Router A as internet gateway after connection is restored