

# Virtual Router Redundancy Protocol (VRRP) Configuration Whitepaper

## Table of Contents

|   |           |
|---|-----------|
| What is VRRP? .....   | 3         |
| <b>VRRP Terminology .....</b>   | <b>3</b>  |
| Virtual Router.....   | 3         |
| VRRP Instance.....  | 3         |
| Virtual Router ID.....  | 3         |
| Virtual Router IP.....  | 3         |
| Virtual MAC address .....   | 3         |
| Master.....   | 3         |
| Backup.....   | 3         |
| Priority.....   | 4         |
| Owner .....   | 4         |
| <b>Router VRRP Configuration Page.....</b>  | <b>4</b>  |
| <b>VRRP in Action – How it operates on Ethernet .....</b>   | <b>5</b>  |
| Device Configuration.....   | 5         |
| NTC-6908_A Configuration .....  | 6         |
| NTC-6908_B Configuration.....   | 9         |
| <b>VRRP in Action – Test VRRP for 3G Mobile Broadband Failover Internet Connection on Ethernet.....</b> | <b>12</b> |
| VRRP Experience from 'Test PC 1'.....   | 12        |
| Test PC 1 .....   | 12        |

| DOCUMENT VERSION           | DATE         |
|----------------------------|--------------|
| - Initial document release | January 2013 |

*Table 1 - Document Revision History*



Note: Before performing the instructions in this guide, please ensure that you have the latest firmware version on your router. Visit <http://www.netcommwireless.com/products/m2m-wireless> to find your device and download the latest firmware.

## 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 1-254. 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

| VRRP Configuration                  |   |
|-------------------------------------|---|
| VRRP Enable                         | <input checked="" type="radio"/> Enable <input type="radio"/> Disable   |
| Virtual Device ID                   | <input type="text" value="1"/> (1-255)  |
| Router Priority                     | <input type="text" value="1"/> (1-255)  |
| Virtual IP Address                  | <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> |
| <input type="button" value="Save"/> |   |

Figure 1 - NetComm M2M Router VRRP configuration page

| ITEM               | DEFINITION   |
|--------------------|--|
| VRRP Enable        | Enables or disables the VRRP function.   |
| Virtual Device 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

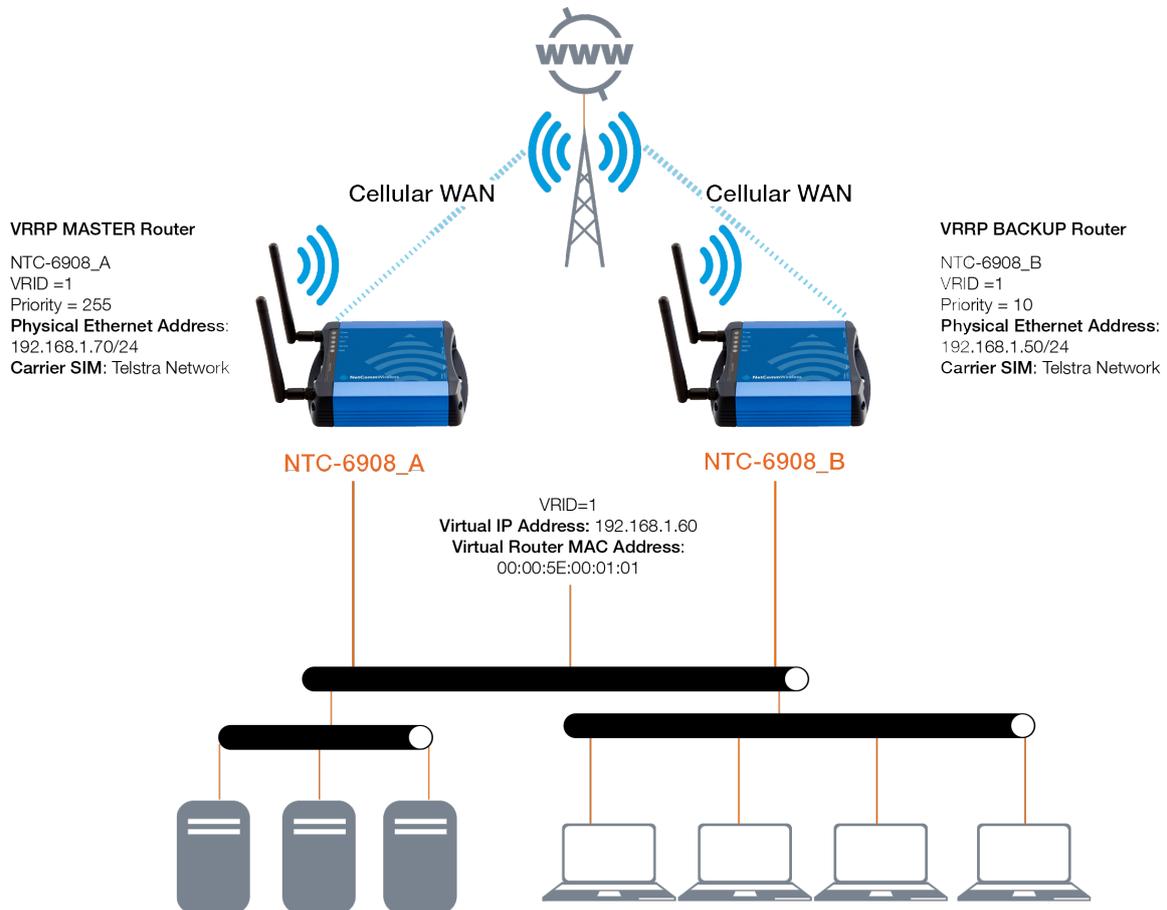


Figure 2 - VRRP in Action - How it operates on Ethernet

Referring to the logical network diagram, in our example, we have configured NTC-6908\_A's priority to be 255 and NTC-6908\_B's priority to be 10. If we did not set the priority on the routers, NTC-6908\_A would have become the master because the IP address of its Ethernet interface is higher than that of NTC-6908\_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.

## NTC-6908\_A Configuration

1. Configure the 3G Mobile Broadband settings

Status > Internet Settings > Wireless Settings > Services > System

Internet Settings > Mobile Broadband > Connection

**Mobile Broadband Profile Settings**

Profile Name:   Automatically configure my mobile broadband

APN Name:

Mobile Broadband Connection:  Enable  Disable

Username:

Password:

Authentication Type:  CHAP  PAP

Reconnect Delay:  (30-65535) secs

Reconnect Retries:  (1-65535, 0=Unlimited)

Metric:  (1-65535)

MTU:  (1-1500)

NAT Masquerading:  Enable  Disable

| Profile Name | Enabled | APN              | User |
|--------------|---------|------------------|------|
| Profile1     | Yes     | telstra.internet |      |
| Profile2     | No      |                  |      |
| Profile3     | No      |                  |      |
| Profile4     | No      |                  |      |
| Profile5     | No      |                  |      |
| Profile6     | No      |                  |      |

Figure 3 - NTC-6908\_A Mobile Broadband Configuration

2. Configure the LAN IP address

Status > Internet Settings > Wireless Settings > Services > System

Internet Settings > LAN > IP Setup

**LAN Configuration**

IP Address:  .  .  .

Subnet Mask:  .  .  .

Hostname:

**DNS Masquerade**

DNS Masquerade:  Enable  Disable

Figure 4 - NTC-6908\_A LAN IP Address Configuration

## 3. Configure the LAN DHCP Server

Status ▶ Internet Settings ▶ Wireless Settings ▶ Services ▶ System

[Internet Settings](#) > [LAN](#) > [DHCP](#)

| DHCP Configuration                  |   |              |                                       |
|-------------------------------------|---|--------------|---------------------------------------|
| DHCP                                | <input checked="" type="radio"/> Enable <input type="radio"/> Disable   |              |                                       |
| DHCP Start Range                    | <input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="120"/> |              |                                       |
| DHCP End Range                      | <input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="200"/> |              |                                       |
| DHCP Lease Time                     | <input type="text" value="86400"/> (seconds)  |              |                                       |
| Default Domain Name Suffix          | <input type="text"/>  |              |                                       |
| DNS Server 1 IP Address             | <input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="60"/>  |              |                                       |
| DNS Server 2 IP Address             | <input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="70"/>  |              |                                       |
| WINS Server 1 IP Address            | <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/>       |              |                                       |
| WINS Server 2 IP Address            | <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/>       |              |                                       |
| NTP Server (Option 42)              | <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/>       |              |                                       |
| TFTP Server (Option 66)             | <input type="text"/>  |              |                                       |
| Option 150                          | <input type="text"/>  |              |                                       |
| Option 160                          | <input type="text"/>  |              |                                       |
| DHCP Relay Configuration            |   |              |                                       |
| DHCP Relay                          | <input type="radio"/> Enable <input checked="" type="radio"/> Disable   |              |                                       |
| DHCP Server Address                 | <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/>       |              |                                       |
| Address Reservation List            |   |              |                                       |
| Computer Name                       | MAC Address   | IP Address   | <input type="button" value="Add"/>    |
| DHCP Client List                    |   |              |                                       |
| Computer Name                       | MAC Address   | IP Address   | Expire Time                           |
| computer1                           | 00:40:f4:ce:fa:1e   | 192.168.1.92 | Wednesday, 30 January 2013 11:01:22AM |
|                                     |   |              | <input type="button" value="Clone"/>  |
| <input type="button" value="Save"/> |   |              |                                       |

Figure 5 - NTC-6908\_A LAN DHCP Server Configuration Settings

## 4. Configure the VRRP settings

Status ▶ Internet Settings ▶ Wireless Settings ▶ Services ▶ System

[Internet Settings](#) > [Routing](#) > [VRRP](#)

| VRRP Configuration                  |  |
|-------------------------------------|--|
| VRRP Enable                         | <input checked="" type="radio"/> Enable <input type="radio"/> Disable  |
| Virtual Device ID                   | <input type="text" value="1"/> (1-255)   |
| Router Priority                     | <input type="text" value="255"/> (1-255)   |
| Virtual IP Address                  | <input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="60"/> |
| <input type="button" value="Save"/> |  |

Figure 6 - NTC-6908\_A VRRP Configuration Settings

- Click **Save** and reboot the router. When it has finished starting up, click the **Status** link and then click the **LAN** link to see the LAN settings. The MAC address of NTC-6908\_A changes to the VRRP virtual MAC address 00:00:5E:00:01:01 where the last octet '01' is the Virtual Device ID.

[Status](#)      [Login](#)

[All Status](#)   [PPPoE](#)   [PPTP](#)   [IPsec](#)   [Call-Forwarding](#)

 **System Information**

|                |   |
|----------------|---|
| System Up Time | 00:02:30  |
| Router Version | Hardware: 1.0   Software: V1.10.12.1                  |
| Phone Module   | Model: MC8704   Hardware: 1.0   Firmware: T3_0_0_2BAP |
| MAC Address    | 00:00:5E:00:01:01                                     |

 **LAN**

|             |                              |
|-------------|------------------------------|
| IP          | 192.168.1.70 / 255.255.255.0 |
| MAC Address | 00:00:5E:00:01:01            |

 **Ethernet Port Status**

|   |                       |
|---|-----------------------|
| LAN: <span style="color: green;">✔</span> | Up / 100.0 Mbps / FDX |
|---|-----------------------|

 **Mobile Broadband (MBB)**      [Show data usage](#)

| Profile Name | Interface | Status | APN              | IP Address   |
|--------------|-----------|--------|------------------|--------------|
| Profile1     | wwan0     | Up     | telstra.internet | 10.102.46.36 |

 **Connection Status**

|                       |  |
|-----------------------|--|
| Connection Up Time    | 00:01:21   |
| Provider              | Telstra  |
| Coverage              | HSPA+  |
| IMEI                  | 357597040214003  |
| Frequency             | WCDMA850   |
| Signal Strength (dBm) | -67 dBm (High)  |
| SIM Status            | SIM OK   |

Figure 7 - NTC-6908\_A Status page

## NTC-6908\_B Configuration

1. Configure the 3G Mobile Broadband settings

Status > Internet Settings > Wireless Settings > Services > System

Internet Settings > Mobile Broadband > Connection

**Mobile Broadband Profile Settings**

Profile Name:   Automatically configure my mobile broadband

APN Name:

Mobile Broadband Connection:  Enable  Disable

Username:

Password:

Authentication Type:  CHAP  PAP

Reconnect Delay:  (30-65535) secs

Reconnect Retries:  (1-65535, 0=Unlimited)

Metric:  (1-65535)

MTU:  (1-1500)

NAT Masquerading:  Enable  Disable

| Profile Name | Enabled | APN              | User |
|--------------|---------|------------------|------|
| Profile1     | Yes     | telstra.internet |      |
| Profile2     | No      |                  |      |
| Profile3     | No      |                  |      |
| Profile4     | No      |                  |      |
| Profile5     | No      |                  |      |
| Profile6     | No      |                  |      |

Figure 8 - NTC-6908\_B Mobile Broadband Configuration

2. Configure the LAN IP address

Status > Internet Settings > Wireless Settings > Services > System

Internet Settings > LAN > IP Setup

**LAN Configuration**

IP Address:  .  .  .

Subnet Mask:  .  .  .

Hostname:

**DNS Masquerade**

DNS Masquerade:  Enable  Disable

Figure 9 - NTC-6908\_B LAN IP Address Configuration

## 3. Configure the LAN DHCP Server

Status > Internet Settings > Wireless Settings > Services > System

[Internet Settings](#) > [LAN](#) > [DHCP](#)

| DHCP Configuration         |   |            |                                    |
|----------------------------|---|------------|------------------------------------|
| DHCP                       | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |            |                                    |
| DHCP Start Range           | 192 . 168 . 1 . 120   |            |                                    |
| DHCP End Range             | 192 . 168 . 1 . 200   |            |                                    |
| DHCP Lease Time            | 86400 (seconds)   |            |                                    |
| Default Domain Name Suffix | <input type="text"/>  |            |                                    |
| DNS Server 1 IP Address    | 192 . 168 . 1 . 60  |            |                                    |
| DNS Server 2 IP Address    | 192 . 168 . 1 . 50  |            |                                    |
| WINS Server 1 IP Address   | 0 . 0 . 0 . 0   |            |                                    |
| WINS Server 2 IP Address   | 0 . 0 . 0 . 0   |            |                                    |
| NTP Server (Option 42)     | 0 . 0 . 0 . 0   |            |                                    |
| TFTP Server (Option 66)    | <input type="text"/>  |            |                                    |
| Option 150                 | <input type="text"/>  |            |                                    |
| Option 160                 | <input type="text"/>  |            |                                    |
| DHCP Relay Configuration   |   |            |                                    |
| DHCP Relay                 | <input type="radio"/> Enable <input checked="" type="radio"/> Disable |            |                                    |
| DHCP Server Address        | 0 . 0 . 0 . 0   |            |                                    |
| Address Reservation List   |   |            |                                    |
| Computer Name              | MAC Address   | IP Address | <input type="button" value="Add"/> |
| DHCP Client List           |   |            |                                    |
| Computer Name              | MAC Address   | IP Address | Expire Time                        |

Figure 10 - NTC-6908\_B LAN DHCP Server Configuration Settings

## 4. Configure VRRP settings

Status > Internet Settings > Wireless Settings > Services > System

[Internet Settings](#) > [Routing](#) > [VRRP](#)

| VRRP Configuration |   |
|--------------------|---|
| VRRP Enable        | <input checked="" type="radio"/> Enable <input type="radio"/> Disable |
| Virtual Device ID  | 1 (1-255)   |
| Router Priority    | 10 (1-255)  |
| Virtual IP Address | 192 . 168 . 1 . 60  |

Figure 11 - NTC-6908\_B VRRP Configuration Settings

- Click **Save** and reboot the router. When it has finished starting up, click the **Status** link and then click the **LAN** link to see the LAN settings. The MAC address of NTC-6908\_B changes to the VRRP virtual MAC address 00:00:5E:00:01:01 where the last octet '01' is the Virtual Device ID.

Status
Login

All Status
PPPoE
PPTP
IPsec
Call-Forwarding

/ System Information

|                |   |
|----------------|---|
| System Up Time | 00:01:17  |
| Router Version | Hardware: 1.0 Software: V1.10.12.1                |
| Phone Module   | Model: MC8704 Hardware: 1.0 Firmware: T3_0_0_2BAP |
| MAC Address    | 00:00:5E:00:01:01                                 |

/ LAN

|             |                              |
|-------------|------------------------------|
| IP          | 192.168.1.50 / 255.255.255.0 |
| MAC Address | 00:00:5E:00:01:01            |

/ Ethernet Port Status

|   |                       |
|---|-----------------------|
| LAN: <span style="color: green;">✔</span> | Up / 100.0 Mbps / FDX |
|---|-----------------------|

/ Mobile Broadband (MBB) Show data usage

| Profile Name | Interface | Status | APN              | IP Address   |
|--------------|-----------|--------|------------------|--------------|
| Profile1     | wwan0     | Up     | telstra.internet | 10.102.46.39 |

/ Connection Status

|                       |                 |   |
|-----------------------|-----------------|---|
| Connection Up Time    | 00:00:32        |   |
| Provider              | Telstra         |   |
| Coverage              | HSPA+           |   |
| IMEI                  | 357597040214002 |   |
| Frequency             | WCDMA850        |   |
| Signal Strength (dBm) | -67 dBm (High)  |  |
| SIM Status            | SIM OK          |   |

Figure 12 - NTC-6908\_B Status page

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

VRRP Experience from ‘Test PC 1’

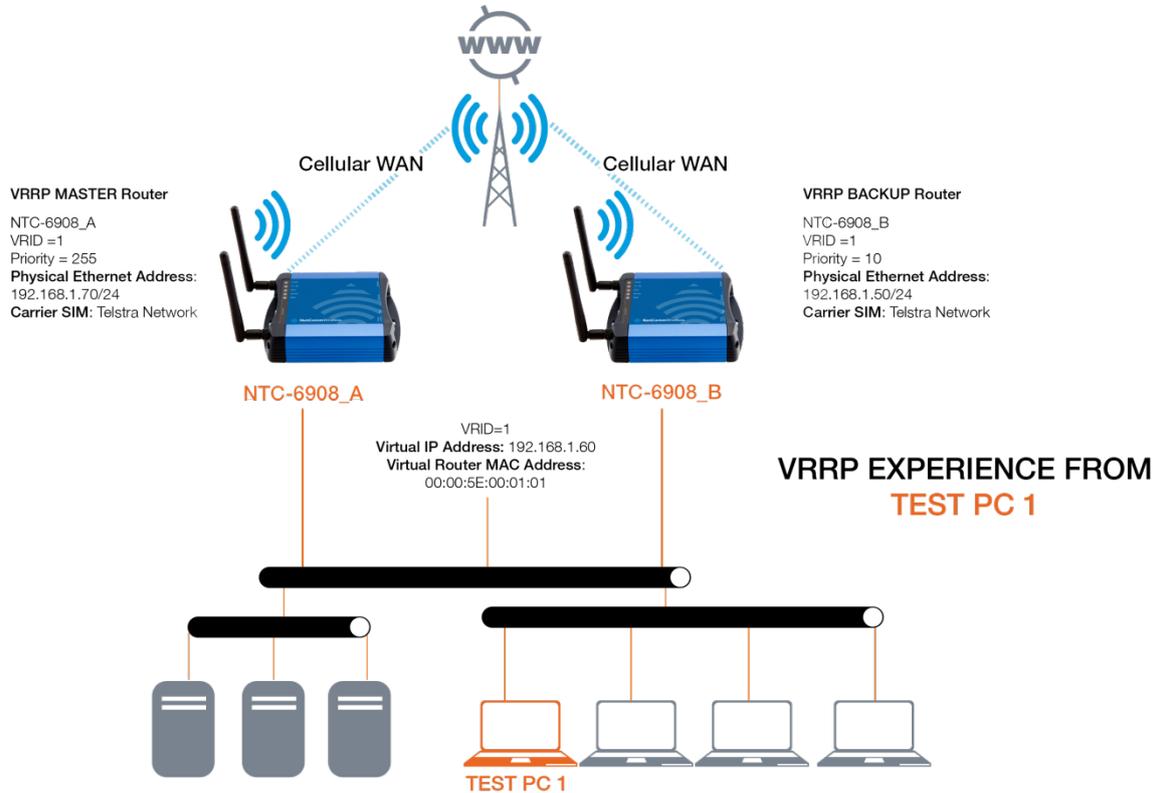


Figure 13 - VRRP concept generic logical network diagram

Test PC 1

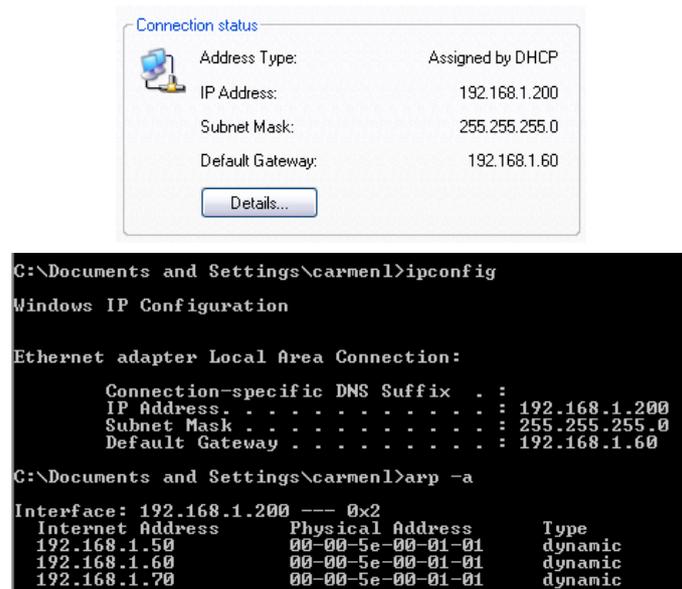


Figure 14 - Test PC 1 configuration

When both Cellular Routers are up, the master VRRP router, NTC-6908\_A is used as the default internet gateway.

```
C:\Documents and Settings\carmen1>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\carmen1>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  *        *        *        Request timed out.
  8  272 ms   *        *        74.125.127.147
  9  *        *        *        Request timed out.
 10 *        *        *        Request timed out.
 11 *        3149 ms *        74.125.127.147
 12 406 ms   479 ms   500 ms   165.228.103.205
 13 410 ms   469 ms   480 ms   203.50.20.1
 14 397 ms   479 ms   490 ms   203.50.6.29
 15 397 ms   520 ms   500 ms   203.50.13.70
 16 530 ms   599 ms   590 ms   202.84.143.146
 17 509 ms   610 ms   619 ms   202.84.148.142
 18 616 ms   710 ms   710 ms   72.14.216.81
 19 3371 ms  320 ms   *        74.125.127.147
 20 635 ms   700 ms   720 ms   216.239.43.212
 21 506 ms   549 ms   560 ms   74.125.127.147
Trace complete.
```

Figure 15 - NTC-6908\_A as default internet gateway

When Master Router NTC-6908\_A is down, the backup router, Router NTC-6908\_B becomes the gateway to the internet.

```
C:\Documents and Settings\carmen1>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),
```

```

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
Control-C
^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 16 - NTC-6908\_B as internet gateway

When Master Router NTC-6908\_A's (192.168.1.70) 3G connection is back online, Master Router NTC-6908\_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 vnsc-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 17 - NTC-6908\_A as internet gateway after connection is restored