Technical Tip

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VRRP Active-Standby Virtual Server Router (VSR) sample configuration

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Introduction

This document shows a sample configuration where two Nortel (formerly known as Alteon) Web or Application switches are configured as a virtual server router in an active-standby mode.

Associated Products

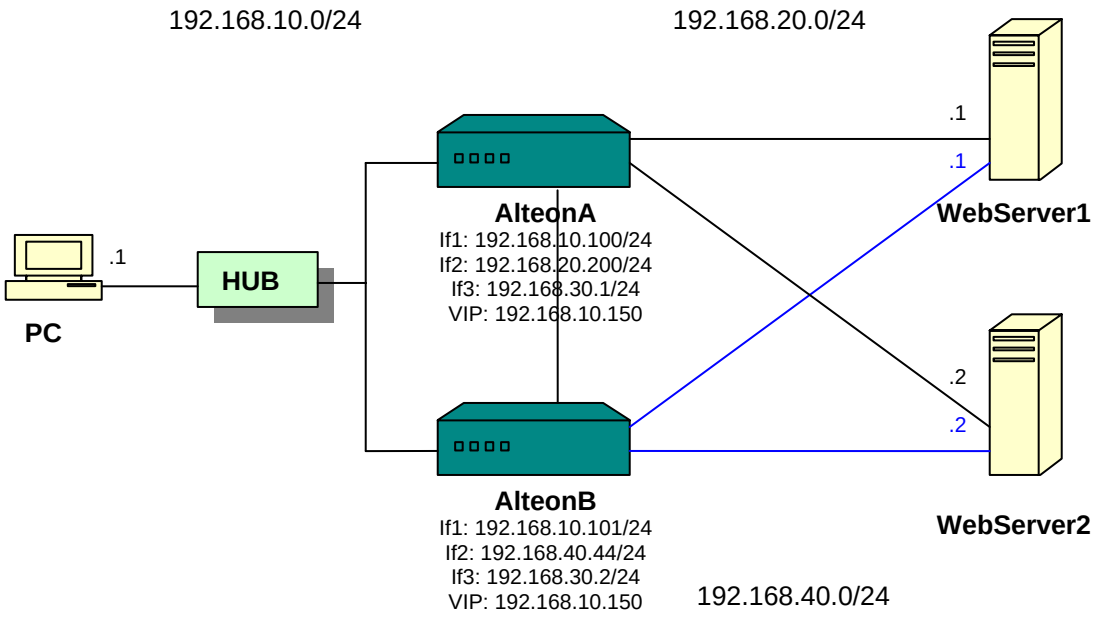
The information in this document is intended to be used with the following product(s) with the indicated software or hardware revisions:

Product Name or Order Number	Revision Information	
	Potentially Affected	*Corrected*
Nortel (formerly Alteon) WebOS and Application switches: 180e, 180 Plus, 184, AD2, AD3, AD4, 2224, 2424, 2208, 2216, 3408	All	N/A

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Sample Configuration

Setup



- **PC** – Windows 2000 workstation, IP 192.168.10.1/24
- **HUB** – Ethernet HUB
- **AlteonA** – Active switch, Nortel Web switch AD3, code version 10.0.3.7, interface 1 IP 192.168.10.100/24; interface 2 IP 192.168.20.200/24, VIP 192.168.10.150
- **AlteonB** – Backup switch, Nortel Web switch AD3, code version 10.0.3.7, interface 1 IP 192.168.10.101/24; interface 2 IP 192.168.40.4/24, VIP 192.168.10.150
- **WebServer1** – RedHat Linux 7.3 box with apache software installed; eth0 192.168.20.1/24, eth1 192.168.40.1/24
- **WebServer2** – RedHat Linux 7.3 box with apache software installed; eth0 192.168.20.2/24, eth1 192.168.40.2/24

The goal of the configuration is to configure an Active-Standby virtual server router (VSR) to serve HTTP requests to VIP.

Configuring PC

Configure IP address (192.168.10.1/24) on PC:

```
C:\>ipconfig
Windows 2000 IP Configuration
Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 192.168.10.1
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . :
```

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Configuring WebServer1

1. Configure the IP address (192.168.20.1/24) for the eth0 interface and the IP address (192.168.40.1/24) for the eth1 interface:

```
[root@linux7 user]# /sbin/ifconfig -a
eth0      Link encap:Ethernet  HWaddr 00:0C:29:4D:F9:8C
          inet addr:192.168.20.1  Bcast:192.168.20.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:523 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:31380 (30.6 Kb)  TX bytes:210 (210.0 b)
          Interrupt:10 Base address:0x1080

eth1      Link encap:Ethernet  HWaddr 00:0C:29:4D:F9:96
          inet addr:192.168.40.1  Bcast:192.168.40.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:28 errors:0 dropped:0 overruns:0 frame:0
          TX packets:7 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:1680 (1.6 Kb)  TX bytes:354 (354.0 b)
          Interrupt:9 Base address:0x10a0

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:152 errors:0 dropped:0 overruns:0 frame:0
          TX packets:152 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:11792 (11.5 Kb)  TX bytes:11792 (11.5 Kb)
```

2. Add the default route on WebServer1:

```
[root@linux7 user]# /sbin/route add default gw 192.168.20.200
```

3. Modify the **/etc/sysctl.conf** file to enable forwarding. Set the net.ipv4.ip_forward to 1:

```
net.ipv4.ip_forward=1
```

4. Start HTTPd:

```
[root@linux7 user]# /etc/init.d/httpd start
Starting httpd:                                            [  OK  ]
```

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5. Verify WebServer1 is listening on HTTP port 80:

```
[root@linux7 user]# netstat -lt
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address        Foreign Address      State
tcp        0      0 *:1024               *:*                  LISTEN
tcp        0      0 *:sunrpc             *:*                  LISTEN
tcp        0      0 *:http               *:*                  LISTEN
tcp        0      0 *:x11                *:*                  LISTEN
tcp        0      0 *:ftp                *:*                  LISTEN
tcp        0      0 *:ssh                *:*                  LISTEN
tcp        0      0 *:telnet             *:*                  LISTEN
tcp        0      0 *:https              *:*                  LISTEN
```

Configuring WebServer2

Configure WebServer2 in the same manner that WebServer1 has been configured.

Assign an IP address to eth0 (192.168.20.2/24), eth1 (192.168.40.2/24), enable forwarding, and start HTTP service.

Configuring AlteonA

Note: this sample configuration is started from factory default settings.

1. Log in to the switch. The default admin credentials are used in this example.

```
Enter password:
System Information at 11:05:11 Wed Apr 21, 2004
Alteon AD3
sysName:
sysLocation:
. . .
```

2. Select **n** to not run the setup script:

```
The switch is booted with factory default configuration.
  To ease the configuration of the switch, a "Set Up" facility which
  will prompt you with those configuration items that are essential
  to the operation of the switch is provided.
Would you like to run "Set Up" to configure the switch? [y/n] n
```

Configuring interfaces

1. Configure the IP address (192.168.10.100/24) for interface 1 and enable the interface:

```
>> Main# /cfg/ip/if 1/mask 255.255.255.0/addr 192.168.10.100/ena
Current subnet mask:     0.0.0.0
New pending subnet mask: 255.255.255.0
Current IP address:     0.0.0.0
New pending IP address: 192.168.10.100
Pending new broadcast address:  192.168.10.255
Current status: disabled
New status:     enabled
```

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2. Configure and enable interface 2. Set the IP to 192.168.20.200/24:

```
>> IP Interface 1# /cfg/ip/if 2/mask 255.255.255.0/addr 192.168.20.200/ena
Current subnet mask:     0.0.0.0
New pending subnet mask: 255.255.255.0
Current IP address:     0.0.0.0
New pending IP address: 192.168.20.200
Pending new broadcast address:  192.168.20.255
Current status: disabled
New status:     enabled
```

3. Configure interface 3 (192.168.30.1/24):

```
>> IP Interface 2# /cfg/ip/if 3/mask 255.255.255.0/addr 192.168.30.1/ena
Current subnet mask:     0.0.0.0
New pending subnet mask: 255.255.255.0
Current IP address:     0.0.0.0
New pending IP address: 192.168.30.1
Pending new broadcast address:  192.168.30.255
Current status: disabled
New status:     enabled
```

4. Apply and save changes:

```
>> IP Interface 3# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup",
 then overlay FLASH "active" with new config.
Confirm saving to FLASH [y/n]: y
New config successfully saved to FLASH.
Switch is currently set to use factory default config block on next boot.
Do you want to change that to the active config block? [y/n] y
Next boot will use active config block.
```

Configuring real servers

Configure WebServer1 eth0 interface (192.168.20.1) and WebServer2 eth0 interface (192.168.20.2) as real servers 1 and 2 respectively on AlteonA:

```
>> IP Interface 3# /cfg/slb/real 1/rip 192.168.20.1/ena
Current real server IP address:     0.0.0.0
New pending real server IP address: 192.168.20.1
Current status: disabled
New status:     enabled

>> Real server 1 # /cfg/slb/real 2/rip 192.168.20.2/ena
Current real server IP address:     0.0.0.0
New pending real server IP address: 192.168.20.2
Current status: disabled
New status:     enabled
```

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Configuring the real servers group

Configure the real servers group (group 1), add real server 1 and real server 2 to the group, set the metric to round robin (or any other appropriate metric), and set health check to tcp:

```
>> Real server 2 # /cfg/slb/group 1/add 1/add 2/metric round/health tcp
Real server 1 added to real server group 1.
Real server 2 added to real server group 1.
Current metric:         leastconns
New pending metric:     roundrobin
Current health check type:      tcp
New pending health check type:  tcp
```

Configuring Virtual IP

1. Configure the virtual server and assign a virtual IP address (192.168.10.150):

```
>> Real server group 1# /cfg/slb/virt 1/vip 192.168.10.150
Current virtual server IP address:     0.0.0.0
New pending virtual server IP address: 192.168.10.150
```

2. Enable the virtual server:

```
>> Virtual Server 1# ena
Current status: disabled
New status:     enabled
```

3. Configure the virtual service (http) and assign group 1 to the virtual service:

```
>> Virtual Server 1# service http/group 1
Current real server group:     1
New pending real server group: 1
```

4. Apply and save the changes:

```
>> Virtual Server 1 http Service# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup",
 then overlay FLASH "active" with new config.
Confirm saving to FLASH [y/n]: y
New config successfully saved to FLASH.
```

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Enabling Client/Server processing

Enable Client/Server processing on SLB ports. In this configuration, the client's PC is connected through HUB to port 1, so client processing is applied to SLB port 1. Servers are connected to ports 7 and 8, therefore server processing is enabled on SLB port 7 and 8:

```
>> Virtual Server 1 http Service# /cfg/slb/port 1/client e
Current client processing: disabled
New client processing:     enabled

>> SLB port 1# /cfg/slb/port 7/server e
Current server processing: disabled
New server processing:     enabled

>> SLB port 7# /cfg/slb/port 8/server e
Current server processing: disabled
New server processing:     enabled
```

Enabling SLB globally

Enable SLB globally:

```
>> SLB port 7# /cfg/slb/on
Current status: OFF
New status:     ON
```

As soon as SLB is configured and enabled the following messages appear stating that real servers are operational and virtual service is available:

```
Jun  1 15:30:50 NOTICE  slb: real service 192.168.20.1:80 operational
Jun  1 15:30:50 NOTICE  slb: real server 192.168.20.1 operational
Jun  1 15:30:50 NOTICE  slb: Services are available for Virtual Server
1:192.168.100.150
Jun  1 15:30:51 NOTICE  slb: real service 192.168.20.2:80 operational
Jun  1 15:30:51 NOTICE  slb: real server 192.168.20.2 operational
```

Configuring VRRP

1. Enable VRRP globally

```
>> VRRP Virtual Router 1# /cfg/vrrp/on
Current status: OFF
New status:     ON
```

2. Create virtual router 1:

```
>> Virtual Router Redundancy Protocol# vr 1
------------------------------------------------------------
[VRRP Virtual Router 1 Menu]
      track   - Priority Tracking Menu
      vrid    - Set virtual router ID
      addr    - Set IP address
      if      - Set interface number
      prio    - Set renter priority
      adver   - Set advertisement interval
      preem   - Enable/disable preemption
      share   - Enable/disable sharing
      ena     - Enable virtual router
      dis     - Disable virtual router
      del     - Delete virtual router
      cur     - Display current VRRP virtual router configuration
```

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3. Assign a virtual router ID (7 in this example) to the virtual router:

```
>> VRRP Virtual Router 1# vrid 7
Current virtual router ID:     1
New pending virtual router ID: 7
```

4. Set the IP address to VIP address (192.168.10.150):

```
>> VRRP Virtual Router 1# addr 192.168.10.150
Current IP address:     0.0.0.0
New pending IP address: 192.168.10.150
```

5. Set the priority to 101. By default the priority is set to 100. As we want AlteonA to be the master we are raising its priority to 101 and will leave the default priority 100 for AlteonB:

```
>> VRRP Virtual Router 1# prio 101
Current router priority:     100
New pending router priority: 101
```

6. Disable sharing:

```
>> VRRP Virtual Router 1# share dis
Current sharing: enabled
New sharing:     disabled
```

7. Enable virtual router:

```
>> VRRP Virtual Router 1# ena
Current status: disabled
New status:     enabled
```

8. Enable tracking. In this example, we will enable master virtual router tracking (vrs), interfaces tracking (ifs) and real servers tracking (reals):

```
>> VRRP Virtual Router 1# track/vrs e/ifs e/reals e
Current tracking master virtual routers: disabled
New tracking master virtual routers:     enabled
Current tracking other IP interfaces: disabled
New tracking other IP interfaces:     enabled
Current tracking L4 real servers: disabled
New tracking L4 real servers:     enabled
```

9. Note that each of the enabled tracking criteria will add priority to the configured virtual router priority. By default, every tracking criteria is set to increment the priority by 2. This value could be configured at the **`/cfg/vrrp/track`** menu.

   View the current priority increment:

```
>> VRRP Tracking# /cfg/vrrp/track/cur
vrs 2, ifs 2, ports 2, l4pts 2, reals 2, hsrp 10 hsrv 10
```

   For more information on configuring tracking please consult the “Configuring the Switch for Tracking” chapter of the Application guide.

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10. Apply and save the changes:

```
>> VRRP Virtual Router 1 Priority Tracking# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup", then overlay FLASH
"active" with new config.
Confirm saving to FLASH [y/n]: y
New config successfully saved to FLASH.
```

As soon as the changes are applied, the following messages appear on the console screen:

```
Jun  1 14:59:15 NOTICE  vrrp: virtual router  192.168.10.150 is now BACKUP
Jun  1 14:59:18 NOTICE  vrrp: virtual router  192.168.10.150 is now MASTER
```

At first AlteonA starts up as a Backup; once no other server with higher priority is found, it becomes the Master.

Configuring synchronization

To ease the configuration procedure, synchronization can be used to synchronize the AlteonB configuration with the AlteonA configuration.

Configure AlteonA for synchronization.

1. Enter SLB synchronization menu:

```
>> Virtual Router Redundancy Protocol# /cfg/slb/sync
------------------------------------------------------------
[Config Synchronization Menu]
      peer    - Synch Peer Switch Menu
      filt    - Enable/disable syncing filter configuration
      ports   - Enable/disable syncing port configuration
      prios   - Enable/disable syncing VRRP priorities
      pips    - Enable/disable syncing proxy IP addresses
      state   - Enable/disable syncing persistent session state
      update  - Set stateful failover update period
      cur     - Display current Layer 4 sync configuration
```

2. Enter peer 1 configuration menu:

```
>> Config Synchronization# peer 1
------------------------------------------------------------
[Peer Switch 1 Menu]
      addr    - Set peer switch IP address
      ena     - Enable peer switch
      dis     - Disable peer switch
      del     - Delete peer switch
      cur     - Display current peer switch configuration
```

3. Set the IP address of AlteonB (192.168.30.2 in this example) as the peer IP address and enable the peer:

```
>> Peer Switch 1# addr 192.168.30.2/ena
Current IP address:     0.0.0.0
New pending IP address: 192.168.30.2
Current status: disabled
New status:     enabled
```

Note: If there is a need to not synchronize some parts of the configuration, such as VRRP priorities, filter configurations, and port settings, disable synchronization for these parts from the **/cfg/slb/sync** menu.

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4. Apply and save the changes:

```
>> Peer Switch 1# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup",
 then overlay FLASH "active" with new config.
Confirm saving to FLASH [y/n]: y
New config successfully saved to FLASH.
```

Configuring AlteonB

Note: This sample configuration is started from factory default settings.

1. Log in to the switch. The default admin credentials were used in this example.

```
Enter password:
System Information at 11:05:11 Wed Apr 21, 2004
Alteon AD3
sysName:
sysLocation:
. . .
```

2. Select **n** to not run the setup script:

```
The switch is booted with factory default configuration.
  To ease the configuration of the switch, a "Set Up" facility which
  will prompt you with those configuration items that are essential
  to the operation of the switch is provided.
Would you like to run "Set Up" to configure the switch? [y/n] n
```

3. Configure the IP address for interface 1 (192.168.10.101/24) and enable it:

```
>> Main# /cfg/ip/if 1/mask 255.255.255.0/addr 192.168.10.101/ena
Current subnet mask:     0.0.0.0
New pending subnet mask: 255.255.255.0
Current IP address:     0.0.0.0
New pending IP address: 192.168.10.101
Pending new broadcast address:  192.168.10.255
Current status: disabled
New status:     enabled
```

4. Configure the IP address for interface 2 (192.168.40.44/24) and enable it:

```
>> IP Interface 2# /cfg/ip/if 2/mask 255.255.255.0/addr 192.168.40.44/ena
Current subnet mask:     0.0.0.0
New pending subnet mask: 255.255.255.0
Current IP address:     0.0.0.0
New pending IP address: 192.168.40.44
Current status: disabled
New status:     enabled
```

5. Configure the IP address for interface 3 (192.168.30.2/24) and enable it:

```
>> IP Interface 2# /cfg/ip/if 3/mask 255.255.255.0/addr 192.168.30.2/ena
Current subnet mask:     0.0.0.0
New pending subnet mask: 255.255.255.0
Current IP address:     0.0.0.0
New pending IP address: 192.168.30.2
Pending new broadcast address:  192.168.30.255
Current status: disabled
New status:     enabled
```

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6. Apply and save the changes:

```
>> IP Interface 3# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup",
 then overlay FLASH "active" with new config.
Confirm saving to FLASH [y/n]: y
New config successfully saved to FLASH.
Switch is currently set to use factory default config block on next boot.
Do you want to change that to the active config block? [y/n] y
Next boot will use active config block.
```

Configuring AlteonB for synchronization

1. Enable synchronization on AlteonB and set the AlteonA IP address 192.168.30.1 as peer 1:

```
>> IP Interface 3# /cfg/slb/sync/peer 1/addr 192.168.30.1/ena
Current IP address:     0.0.0.0
New pending IP address: 192.168.30.1
Current status: disabled
New status:     enabled
```

2. Apply and save the changes:

```
>> Peer Switch 1# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup",
 then overlay FLASH "active" with new config.
Confirm saving to FLASH [y/n]: y
New config successfully saved to FLASH.
```

3. From AlteonA force the synchronization. Note: As we have not configured any parts of the configuration to be omitted, VRRP, VR, filters, ports and SLB configuration will be synchronized:

```
>> Peer Switch 1# /oper/slb/sync

NOTE:  Use the "/c/slb/sync" menu to configure omitting sections of the configuration.

Synchronizing VRRP, VR priorities, FILT, PORT and SLB configuration to 192.168.30.2

Confirm synchronizing the configuration to 192.168.30.2 [y/n]: y
Sending Config .
Waiting for peer to finish config apply/save ...
Configuration on 192.168.30.2 has now been synchronized.
```

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4. On AlteonB check the configuration dump. Note that all the configuration except interface information has been synchronized to AlteonA:

```
>> Peer Switch 1# /cfg/dump
script start "Alteon AD3" 4  /**** DO NOT EDIT THIS LINE!
/* Configuration dump taken 15:15:59 Tue Jun  1, 2004
/* Version 10.0.30.7,  Base MAC address 00:60:cf:46:53:60
/c/ip/if 1
        ena
        addr 192.168.10.101
/c/ip/if 2
        ena
        addr 192.168.40.44
/c/ip/if 3
        ena
        addr 192.168.30.2
/c/vrrp/on
/c/vrrp/vr 1
        ena
        vrid 7
        if 1
        prio 101
        addr 192.168.10.150
        share dis
        track
                vrs e
                ifs e
                reals e
/c/slb
        on
/c/slb/sync/peer 1
        ena
        addr 192.168.30.1
/c/slb/real 1
        ena
        rip 192.168.20.1
/c/slb/real 2
        ena
        rip 192.168.20.2
/c/slb/group 1
        metric roundrobin
        add 1
        add 2
/c/slb/port 1
        client ena
/c/slb/port 7
        server ena
/c/slb/port 8
        server ena
/c/slb/virt 1
        ena
        vip 192.168.100.150
/c/slb/virt 1/service http
        group 1
/
script end  /**** DO NOT EDIT THIS LINE!
```

5. Change the real server 1 IP to WebServer1 eth1 interface IP (192.168.40.1):

```
>> Configuration# /cfg/slb/real 1/rip 192.168.40.1
Current real server IP address:     192.168.20.1
New pending real server IP address: 192.168.40.1
```

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6. Change the real server 2 IP to WebServer2 eth1 interface IP (192.168.40.2):

```
>> Real server 1 # /cfg/slb/real 2/rip 192.168.40.2
Current real server IP address:     192.168.20.2
New pending real server IP address: 192.168.40.2
```

7. Change the VRRP virtual router priority to 100 (lower than the 101 configured for the master):

```
>> Real server 2 # /cfg/vrrp/vr 1/prio 100
Current router priority:     101
New pending router priority: 100
```

8. Apply and save the changes:

```
>> VRRP Virtual Router 1# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup",
 then overlay FLASH "active" with new config.
Confirm saving to FLASH [y/n]: y
New config successfully saved to FLASH.
```

As soon as changes are applied the following messages appear, indicating real servers and virtual server are operational:

```
Jun  1 15:39:06 NOTICE  slb: real service 192.168.40.1:80 operational
Jun  1 15:39:06 NOTICE  slb: real server 192.168.40.1 operational
Jun  1 15:39:06 NOTICE  slb: Services are available for Virtual Server
1:192.168.100.150
Jun  1 15:39:06 NOTICE  slb: real service 192.168.40.2:80 operational
Jun  1 15:39:06 NOTICE  slb: real server 192.168.40.2 operational
```

Testing the configuration

1. Check status for virtual service on AlteonA. Make sure both real servers are up:

```
>> Information# /info/slb/virt 1
  1: 192.168.100.150, 00:60:cf:46:52:8e
    virtual ports:
    http: rport http, group 1, backup none
        real servers:
          1: 192.168.20.1, backup none, 2 ms, up
          2: 192.168.20.2, backup none, 2 ms, up
```

2. Check the VRRP status on AlteonA. Make sure AlteonA is the master.

Note: As we enabled VRRP tracking, priorities have been adjusted per configured increment. In this case, the priority is 113, which is 101 (configured base priority) + 2 (as AlteonA is initially the master increment of 2 for the VSR) + 2 (increment of 2 for the interfaces tracking) * 3 (number of interfaces) + 2 (increment of 2 for the tracking of real servers) * 2 (number of real servers):

```
>> Server Load Balancing Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 113, master
```

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3. Check the status for virtual service on AlteonB. Make sure both real servers are up:

```
>> Main# /info/slb/virt 1
  1: 192.168.100.150, 00:60:cf:46:53:6e
    virtual ports:
    http: rport http, group 1, backup none
        real servers:
          1: 192.168.40.1, backup none, 2 ms, up
          2: 192.168.40.2, backup none, 2 ms, up
```

4. Check VRRP status. Make sure AlteonB is a backup.

   Note the adjusted priority 110 = 100 (base priority) + 2 (increment for interfaces)* 3 (number of interfaces) + 2 (increment for real servers) * 2 (number of real servers):

```
>> Server Load Balancing Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 110, backup
```

5. From PC, clear the ARP cache:

```
C:\>arp -d
```

6. From PC, ping the virtual server (192.168.10.150) to make sure it is operational:

```
C:\>ping 192.168.10.150

Pinging 192.168.10.77 with 32 bytes of data:

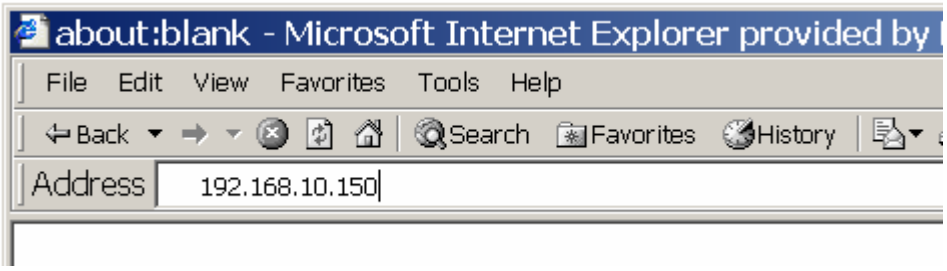
Reply from 192.168.10.150: bytes=32 time<10ms TTL=255
Reply from 192.168.10.150: bytes=32 time<10ms TTL=255
Reply from 192.168.10.150: bytes=32 time<10ms TTL=255
Reply from 192.168.10.150: bytes=32 time<10ms TTL=255

Ping statistics for 192.168.10.150:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  0ms, Average =  0ms
```

7. Check the ARP cache. Note the MAC address of 192.168.10.150 corresponding to the virtual router with configured VRID 7:

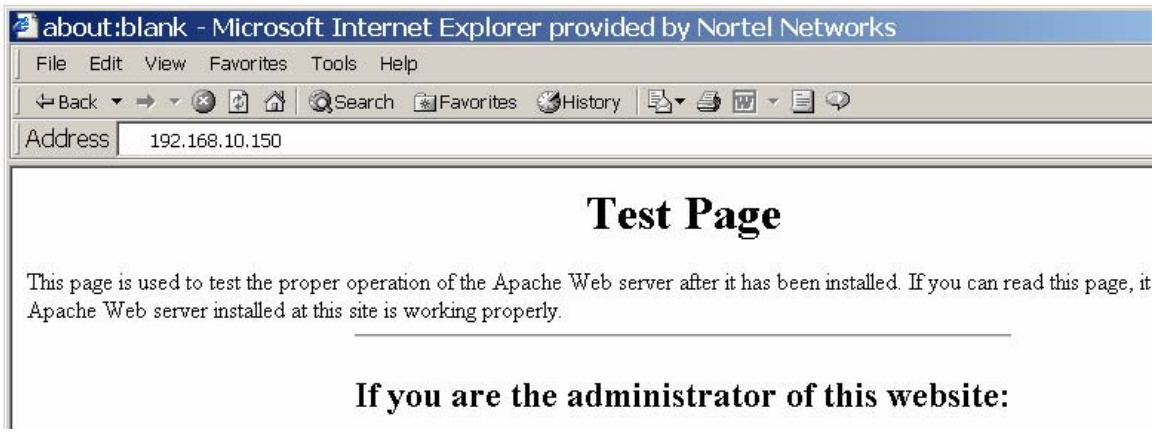
```
C:\>arp -a
Interface: 192.168.10.1 on Interface 0x2000005
  Internet Address      Physical Address      Type
  192.168.10.150        00-00-5e-00-01-07     dynamic
```

8. Launch a web browser (Internet Explorer in this example) and enter the IP address of the virtual router (192.168.10.150):



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9. Apache's default test page loads:



10. Check the session table on AlteonA. A request has been forwarded to real server 1 at IP address 192.168.20.1:

```
>> Session Table Information# /info/slb/sess/dump
 4,3:  192.168.10.1 1078 -> 192.168.20.1 80  age 10  E
```

11. Clear the ARP cache again.
12. Reload the page using Ctrl+F5 keys.
13. Check the session table on AlteonA again. As we have configured round robin as a metric, the next request has been sent to real server 2 at IP address 192.168.20.2:

```
>> Session Table Information# /info/slb/sess/dump
 4,3:  192.168.10.1 1079 -> 192.168.20.2 80  age 10  E
```

Note: None of the requests have been processed by AlteonB, as it is a backup and does not respond to an ARP request for virtual IP unless the master goes down.

14. Disconnect the link between AlteonA and WebServer2.
15. The following messages appear on the console, indicating that the real servers are down:

```
Jun  2 11:32:06 ALERT   slb: cannot contact real service 192.168.20.2:80
Jun  2 11:32:06 ALERT   slb: cannot contact real server 192.168.20.2
```

16. Check the VRRP information. As one link went down, the priority has been lowered by 2, and as 111 is still a higher priority than 110 for AlteonB, AlteonA remains the master:

```
>> Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 111, master, server
```

17. Disconnect the cable between AlteonA and WebServer1.
18. Note the messages on the console screen:

```
Jun  2 15:33:20 ALERT   slb: cannot contact real service 192.168.20.1:80
Jun  2 15:33:20 ALERT   slb: cannot contact real server 192.168.20.1
Jun  2 15:33:20 NOTICE  slb: No services are available for Virtual Server
1:192.168.10.150
Jun  2 15:33:23 NOTICE  vrrp: virtual router  192.168.10.150 is now BACKUP
```

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19. Check the priority on AlteonA. The priority has been lowered by 2 more, as another link to the web server went down:

```
>> Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 109, backup, server
```

20. Check the information on AlteonB: it became the master as it has virtual services available for real servers 1 and 2 by means of the 192.168.40.0/24 network:

```
>> Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 110, master, server
```

21. Clear the ARP cache on PC, launch the web browser again, and enter the IP address of the virtual server (192.168.10.150).
22. Apache's test page appears.
23. Check the session dump on AlteonB: the client's request has been forwarded to the real web server at IP address 192.168.40.1:

```
>> Session Table Information# /info/slb/sess/dump
 4,3:  192.168.10.1 1087 -> 192.168.40.1 80  age 10  E
```

24. Check the ARP cache on PC.
    Note: Even though AlteonB has answered the ARP request, VRRP MAC address was used:

```
C:\>arp -a
Interface: 192.168.10.1 on Interface 0x2000005
  Internet Address      Physical Address      Type
  192.168.10.150        00-00-5e-00-01-07     dynamic
```

25. Turn off AlteonA and test the above again.
26. With AlteonB being the master in the absence of AlteonA, it has answered the request:

```
>> Session Table Information# /info/slb/sess/dump
 4,5:  192.168.10.1 1090 -> 192.168.40.1 80  age 4  E
```

27. Connect all the cables back in place and turn on AlteonA.
28. Check the VRRP priority on AlteonA and state (initialization):

```
>> Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 101, init, server
```

29. Note the messages on the screen.

```
Jun  2 11:45:44 NOTICE  vrrp: virtual router  192.168.10.150 is now BACKUP

Jun  2 11:45:46 NOTICE  slb: real service 192.168.20.1:80 operational
Jun  2 11:45:46 NOTICE  slb: real server 192.168.20.1 operational
Jun  2 11:45:46 NOTICE  slb: Services are available for Virtual Server
1:192.168.10.150
Jun  2 11:45:46 NOTICE  slb: real service 192.168.20.2:80 operational
Jun  2 11:45:46 NOTICE  slb: real server 192.168.20.2 operational
```

30. Check the priorities on AlteonA:

```
>> Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 111, backup, server
```

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31. Check VRRP on AlteonB:

```
>> Information# /info/vrrp
VRRP information:
   1: vrid   7, 192.168.10.150,  if  1, renter, prio 112, master, server
```

AlteonB has become the master in the absence of AlteonA, and being the master, its priority has been raised by 2, making it 112. When AlteonA joins again, its priority of 111 is less than AlteonB's priority of 112, and AlteonB remains the master until its priority is changed by link failure or for another reason.

Thus, care must be taken when setting priorities and enabling tracking criteria and their increments so the desired behavior is achieved.

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Appendix A. AlteonA configuration

```
script start "Alteon AD3" 4  /**** DO NOT EDIT THIS LINE!
/* Configuration dump taken 16:36:13 Wed Jun  2, 2004
/* Version 10.0.30.7,  Base MAC address 00:60:cf:46:52:80
/c/sys
        idle 60
/c/ip/if 1
        ena
        addr 192.168.10.100
/c/ip/if 2
        ena
        addr 192.168.20.200
/c/ip/if 3
        ena
        addr 192.168.30.1
/c/vrrp/on
/c/vrrp/vr 1
        ena
        vrid 7
        if 1
        prio 101
        addr 192.168.10.150
        share dis
        track
                vrs e
                ifs e
                reals e
/c/slb
        on
/c/slb/sync/peer 1
        ena
        addr 192.168.30.2
/c/slb/real 1
        ena
        rip 192.168.20.1
/c/slb/real 2
        ena
        rip 192.168.20.2
/c/slb/group 1
        metric roundrobin
        add 1
        add 2
/c/slb/port 1
        client ena
/c/slb/port 8
        server ena
/c/slb/virt 1
        ena
        vip 192.168.10.150
/c/slb/virt 1/service http
        group 1
/
script end  /**** DO NOT EDIT THIS LINE!
```

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Appendix B. AlteonB configuration

```
script start "Alteon AD3" 4  /**** DO NOT EDIT THIS LINE!
/* Configuration dump taken 16:28:59 Wed Jun  2, 2004
/* Version 10.0.30.7,  Base MAC address 00:60:cf:46:53:60
/c/sys
        idle 60
/c/ip/if 1
        ena
        addr 192.168.10.101
/c/ip/if 2
        ena
        addr 192.168.40.44
/c/ip/if 3
        ena
        addr 192.168.30.2
/c/vrrp/on
/c/vrrp/vr 1
        ena
        vrid 7
        if 1
        addr 192.168.10.150
        share dis
        track
                vrs e
                ifs e
                reals e
/c/slb
        on
/c/slb/sync/peer 1
        ena
        addr 192.168.30.1
/c/slb/real 1
        ena
        rip 192.168.40.1
/c/slb/real 2
        ena
        rip 192.168.40.2
/c/slb/group 1
        metric roundrobin
        add 1
        add 2
/c/slb/port 1
        client ena
/c/slb/port 8
        server ena
/c/slb/virt 1
        ena
        vip 192.168.10.150
/c/slb/virt 1/service http
        group 1
/
script end  /**** DO NOT EDIT THIS LINE!
```

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