Technical Tip

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NORTEL

URL-based load balancing

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Introduction

This document illustrates the operation and configuration of URL-based load balancing on Nortel (formerly Alteon) Web and Application switches.

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) Web and Application switches: 180e, 180 Plus, 184, AD2, AD3, AD4, 2224, 2424, 2208, 2216, 3408	All	N/A

Overview

The URL (Universal Resource Location)-based server load balancing feature allows administrators to optimize resource access and server performance by sending clients' requests to designated servers based on all or part of the URL(s) embedded in the body of the HTTP requests.

The Nortel Web or Application switch parses each URL or URL sub-string in an HTTP 1.0 or HTTP 1.1 request and binds the new session to the best server in the designated server group that hosts the URL.

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With URL load balancing, the administrator defines a list of strings to be used for load balancing and assigns these strings to the appropriate real servers in the group that will serve the requests.

For example, consider a situation depicted in Figure 1. Six real servers have been assigned to handle HTTP requests. The first and second real servers were assigned to process all requests that contain .html, .gif or .mp3 as a part of the URL; the third and fourth real servers were assigned to process all requests that have .cgi, .bin or .exe as a part of the URL; and the fifth and sixth real servers were assigned to process URLs that start with /software and requests that contain .jpg string as a part of the URL. In addition, the real servers in the first group have been configured to process any other requests that do not match any defined strings.

When the user sends an HTTP request containing .gif in the URL (for example, www.example.com/logo.gif), the Nortel Web or Application switch looks up the real servers' configuration and forwards the request to the real server configured to process this kind of requests. If multiple servers are configured to process this kind of request, the switch looks up the configured metric and makes a forwarding decision based on that.

When another request is received that contains, for example, /software as a part of the URL, the switch forwards the request to the appropriate real server.

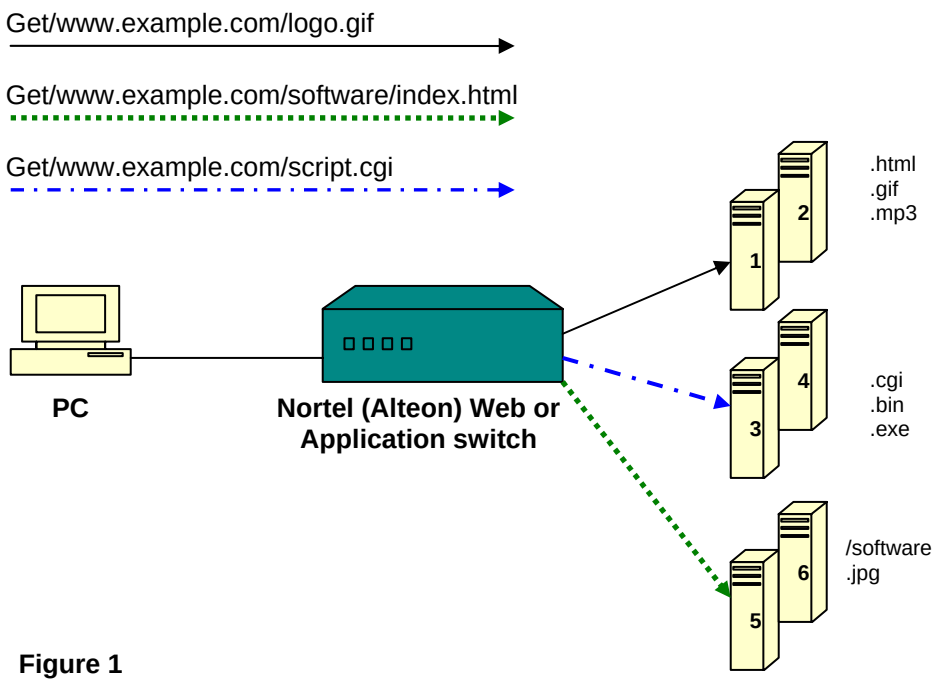


Figure 1

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Using a string that has a forward slash (/) as a first character of the string (such as, /software) would match strings that start with the forward slash only. For example, if /software is configured as a string the following requests will match the string:

```
www.example.com/software/index.html
www.example.com/software/button.gif
```

It will not match the following occurrences of the string:

```
www.example.com/download/software/index.html
www.example.com/product/software/pricelist.html
```

If the string does not have a leading slash any occurrence of a string in the URL is processed. For example, if software is defined as a matching string, the following requests are processed:

```
www.example.com/software/index.html
www.example.com/download/software/index.html
```

If a matching string contains only a forward slash (/), all requests to the root directory are processed. For example, the following requests are processed:

```
www.example.com/index.html
www.example.com/logo.gif
```

Up to 128 strings can be configured on the Nortel Web or Application switch, each containing no more than 40 characters.

Regular expressions can be defined to be used as a matching string. For more information on regular expression matching please consult the appropriate Application Guide.

In addition, the switch supports exclusionary string matching. With exclusionary string matching a real server could be configured to match any requests that do not contain a specified string. For example, if an exclusionary string such as “game” is specified and assigned to one of the real servers, the real server will process any URL request except for ones that contain “game” as a part of the string.

For example, if “game” is defined as exclusion string the following will not be processed:

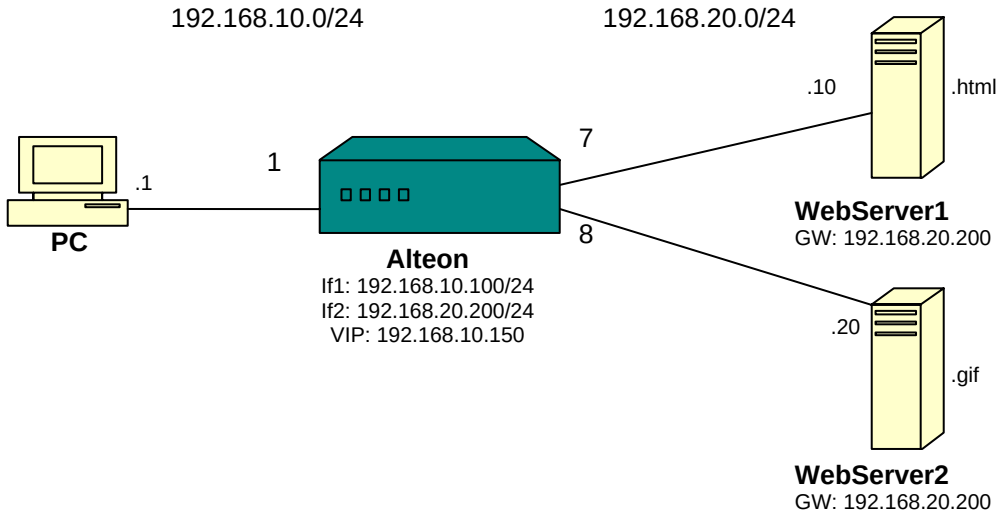
www.example.com/games

Note: Exclusion is assigned per real server, not per string. Thus any string that is assigned to the real server with exclusion enabled for that server will not be processed.

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Sample Configuration

Setup



PC – Windows 2000 workstation, IP address 192.168.10.1/24;
Alteon – Nortel Web switch AD3, code version 10.0.30.7, interface 1 IP 192.168.10.100/24, interface 2 IP 192.168.20.200/24, Virtual IP 192.168.10.150, port 1 – client port, ports 7, 8 – server ports;
WebServer1 – Linux RedHat 7.3 server with apache software installed, IP address 192.168.20.10/24;
WebServer2 – Linux RedHat 7.3 server with apache software installed, IP address 192.168.20.20/24.

The goal of the configuration is to configure URL-based load balancing to balance .html requests to WebServer1 and .gif requests to WebServer2.

Configuring the PC

Configure the IP address (192.168.10.1/24) on the 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 . . . . . . . . . :
```

Configuring WebServer1

1. Configure the IP address (192.168.20.10/24) on WebServer1:

```
[root@linux7 user]# /sbin/ifconfig eth0 192.168.20.10 netmask 255.255.255.0
```

2. Configure Alteon's interface 2 IP (192.168.20.200) as a default gateway:

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

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3. Create a sample HTML file (example.html), for example:

```
[root@linux7 user]# more example.html
<html>
      <head>
            <title> Example Page </title>
      </head>
      <body>
            Welcome to Web Server!
      </body>
</html>
```

4. Move the created file to `/var/www/html` directory (Apaches's root document repository):

```
[root@linux7 user]# mv example.html /var/www/html/
```

5. Start the HTTP server:

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

Configuring WebServer2

1. Configure the IP address (192.168.20.20/24) on WebServer2:

```
[root@linux7 user]# /sbin/ifconfig eth0 192.168.20.20 netmask 255.255.255.0
```

2. Configure Alteon's interface 2 IP (192.168.20.200) as a default gateway:

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

3. Place a sample GIF image to /var/www/html directory, in this example the Nortel logo is used as a GIF image:

```
[root@linux7 user]# mv nn_logo.gif /var/www/html/
```

4. Start the HTTP server:

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

Configuring Alteon

Note: Configuration of Alteon has been started from factory default settings.

1. Log in to the switch:

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

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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
```

2. Configure the IP address (192.168.20.200/24) for interface 2 and enable the interface:

```
>> 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. Apply and save the changes:

```
>> IP Interface 2# 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.
```

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Defining strings to be used for URL load balancing

By default the virtual server is configured to handle all URL requests. Specific URL strings should be defined in order for the Alteon to make a load balancing decision based on URL requests.

1. Enter the layer 7 SLB configuration menu:

```
>> IP Interface 2# /cfg/slb/layer7/slb/
------------------------------------------------------------
[Server Loadbalance Resource Menu]
      message - Set HTTP error message
      add     - Add SLB string for load balance
      rename  - Rename SLB string for load balance
      rem     - Remove SLB string for load balance
      cur     - Display current configuration
```

2. View the current settings. Note, only one default string “any” is defined:

```
>> Server Loadbalance Resource# cur
Error message:
No available server to handle this request

Number of entry: 1
1: any
```

3. Add a string to match the request for files with .html extension:

```
>> Server Loadbalance Resource# add .html
```

4. Add a string to match the request for files with .gif extension:

```
>> Server Loadbalance Resource# add .gif
```

5. Apply the changes:

```
>> Server Loadbalance Resource# apply
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
```

6. View the current configuration. Note the entry numbers for .html and .gif strings:

```
>> Server Loadbalance Resource# cur
Error message:
No available server to handle this request

Number of entries: 3
1: any
2: .html
3: .gif
```

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Configuring real servers

1. Configure real server 1. Enter the real server 1 configuration menu, set the real server 1 IP address (192.168.20.10) and enable the real server:

```
>> Server Loadbalance Resource# /cfg/slb/real 1/rip 192.168.20.10/ena
Current real server IP address:     0.0.0.0
New pending real server IP address: 192.168.20.10
Current status: disabled
New status:     enabled
```

2. As we want .html requests to be forwarded to real server 1, we need to assign the appropriate string to the real server. As .html string was entered as entry number 2, this entry is assigned to real server:

```
>> Real server 1 # layer7/addlb 2
SLB string ID 2 added to server 1.
```

3. Configure real server 2. Enter the real server 2 configuration menu, set the real server 2 IP address (192.168.20.20) and enable the real server:

```
>> Real server 1 # /cfg/slb/real 2/rip 192.168.20.20/ena
Current real server IP address:     0.0.0.0
New pending real server IP address: 192.168.20.20
Current status: disabled
New status:     enabled
```

4. Assign .gif string matching (string entry number 3) to real server 2:

```
>> Real server 2 # layer7/addlb 3
SLB string ID 3 added to server 2.
```

Assigning real servers to a group

Define a real servers group; place real servers into this group; define the appropriate metric (round robin is used in this example); define the appropriate health check mechanism (TCP in this example):

```
>> Real Server 2 Layer 7 Commands# /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
```

Creating virtual server

1. Configure virtual server, server 1 in this example. Set the IP address for the virtual server, and enable virtual server:

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

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2. Assign HTTP service to virtual server; assign the created group 1 to the server:

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

3. Enable delayed binding:

```
>> Virtual Server 1 http Service# dbind ena
Current delayed binding: disabled
New delayed binding:     enabled
```

4. Enable URL load balancing:

```
>> Virtual Server 1 http Service# httpslb urlslb
```

Enabling client/server processing on ports

Enable client/server processing on the appropriate ports. In this configuration the client is connected to port 1, server 1 is connected to port 7, and server 2 is connected to port 8, thus client processing should be enabled on port 1 and server processing should be enabled on ports 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 direct access mode

Enable direct access mode (DAM):

```
>> SLB port 1# /cfg/slb/adv/direct e
Current Direct Access Mode: disabled
New Direct Access Mode:     enabled
```

Note: Alternatively, Proxy IP addresses could be assigned to every port and direct access mode disabled.

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Enabling SLB globally

1. Enable SLB globally:

```
>> Layer 4 Advanced# /cfg/slb/on
Current status: OFF
New status:     ON
```

2. Apply and save the changes:

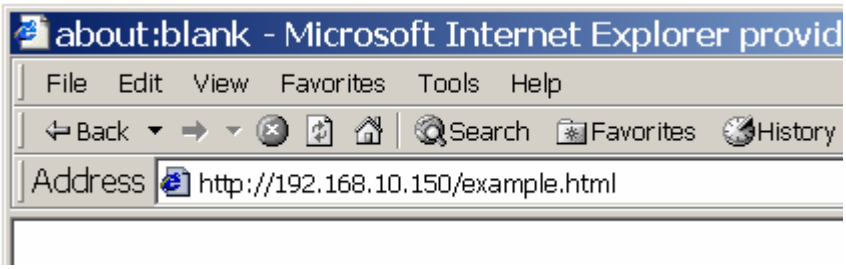
```
>> Layer 4# apply/save
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
Request will first copy the FLASH "active" config to "backup",
 then overlay FLASH "active" with new config.
Confirm saving to FLASH [y/n]:y
New config successfully saved to FLASH.
```

Note that as soon as changes are applied, the following messages appear on the console indicating the real servers and virtual server are up and operational:

```
Jun 10 17:09:22 NOTICE  slb: real service 192.168.20.10:80 operational
Jun 10 17:09:22 NOTICE  slb: real server 192.168.20.10 operational
Jun 10 17:09:22 NOTICE  slb: Services are available for Virtual Server
1:192.168.10.150
Jun 10 17:09:23 NOTICE  slb: real service 192.168.20.20:80 operational
Jun 10 17:09:23 NOTICE  slb: real server 192.168.20.20 operational
```

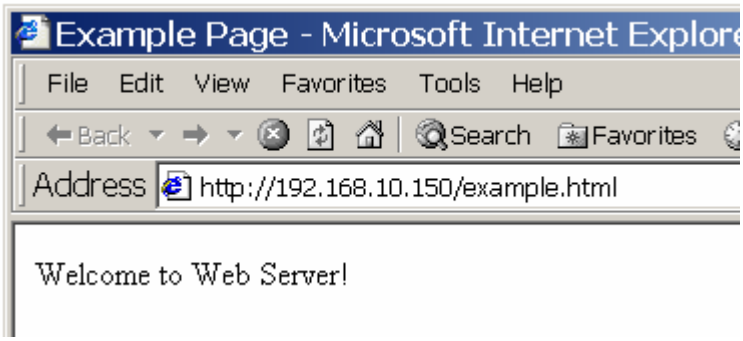
Testing the configuration

1. Open a web browser on the PC and enter the address of the created HTML file on the virtual server, 192.168.10.150/example.html in this example. Hit Enter:



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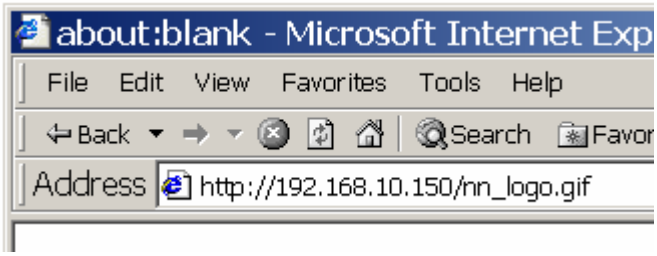
2. The sample HTML page loads:



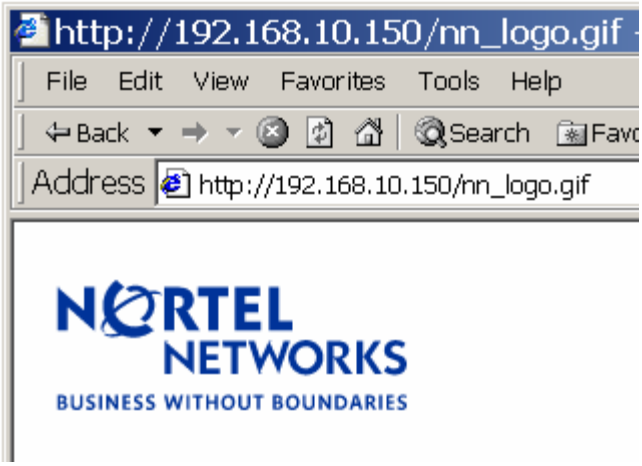
3. Check the sessions dump on Alteon. The HTTP request containing the .html string was forwarded to WebServer1 (192.168.20.10):

```
>> Session Table Information# /info/slb/sess/dump
 4,4:  192.168.10.1 1933, 192.168.10.150 80 -> 4100 192.168.20.10 80  age 10  E
```

4. Enter the URL of a GIF file, 192.168.10.150/nn_logo.gif in this example. Hit Enter:



5. The GIF file loads:



6. Check the session table on Alteon. The HTTP request containing the .gif string has been forwarded to WebServer2 (192.168.20.20):

```
>> Session Table Information# /info/slb/sess/dump
 4,6:  192.168.10.1 1937, 192.168.10.150 80 -> 4102 192.168.20.20 80  age 10  E
```

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7. Check the URL string matching statistics, note one hit for the .html request and one hit for the .gif request:

```
>> Session Table Information# /stats/slb/layer7/str
------------------------------------------------------------------
SLB String stats:
  ID SLB String                                          Hits
   1 any                                                    0
   2 .html                                                  1
   3 .gif                                                   1
```

8. Enter just the IP address of virtual server in the browser address window and hit Enter:

9. The error is displayed as we didn't assign any other traffic to any real server:



10. Note, the error message that is displayed in case no servers are available for the kind of request could be configured via the **`/cfg/slb/layer7/slb/message`** command.

For example, to set the error message to "Sorry, no servers are available":

```
>> Session Table Information# /cfg/slb/layer7/slb/message "Sorry, no servers are
available"
```

11. Then apply the changes and try to open a page again:



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Sample configuration with exclusion

Setup
The same setup as for the previous sample configuration is used.

The goal of the configuration is to configure WebServer2 to process any request except requests containing .gif as a part of the URL.

Configuring the PC, WebServer1, WebServer2
The configuration for the PC, WebServer1 and WebServer2 is done in the same manner as for the previous example. Only differences will be noted.

1. Create and place a sample HTML page into the root directory (/var/www/html) on WebServer2 in the same manner as it was done for WebServer1 in the previous example:

```
[root@linux7 user]# more example.html
<html>
      <head>
            <title> Example Page </title>
      </head>
      <body>
            Welcome to Web Server 2!
      </body>
</html>
```

2. Move the created file to /var/www/html directory (Apaches's root document repository):

```
[root@linux7 user]# mv example.html /var/www/html/
```

Configuring Alteon
The configuration is based on the configuration in the previous example, only differences will be noted.

As after the previous configuration .gif is already assigned to real server 2, all we need to do is to invert the logic, so .gif requests are not processed by real server 2.

1. Enable exclusion on real server 2:

```
>> Main# /cfg/slb/real 2/layer7/exclude ena
Current exclusionary string matching operation: disabled
New exclusionary string matching operation:     enabled
```

2. Apply the changes:

```
>> Real Server 2 Layer 7 Commands# apply
------------------------------------------------------------------
Apply complete; don't forget to "save" updated configuration.
```

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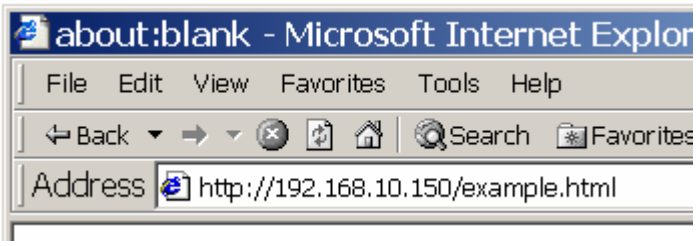
Testing the configuration

1. Temporary disable real server 1:

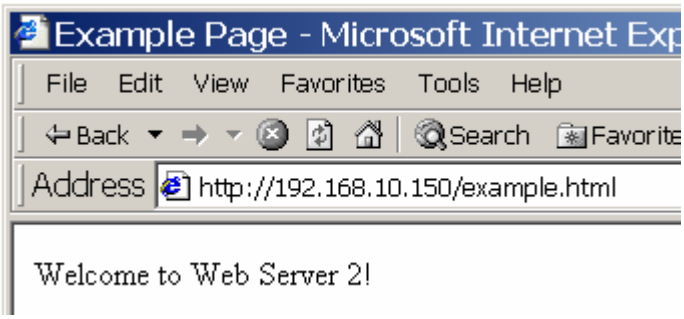
```
>> Main# /oper/slb/dis 1
Allow cookie persistent HTTP 1.0 sessions ? [y/n]
Real server 1 is now disabled.

Jun 16 15:03:52 ALERT   slb: real server 192.168.20.10 disabled through configuration
```

2. Open a web browser and enter the IP address (virtual IP 192.168.10.150) and location of a created sample HTML file. Hit Enter:



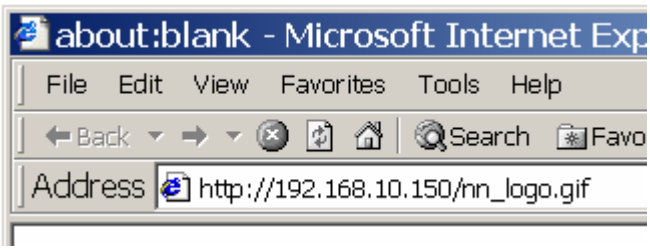
3. As no part of the URL contained a .gif string the page is displayed:



4. Check the session table on Alteon:

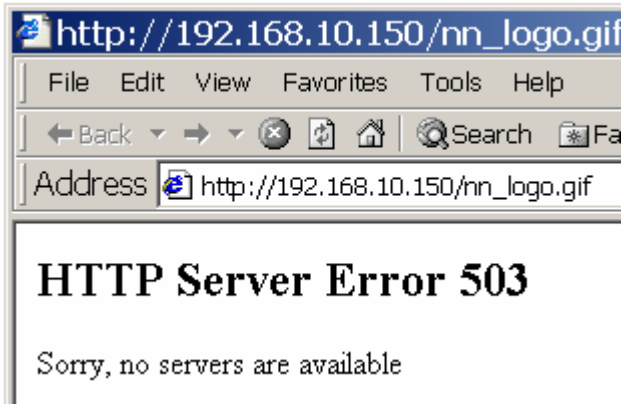
```
>> Session Table Information# /info/slb/sess/dump
 8,10:  192.168.10.77 1410, 192.168.10.150 80 -> 4106 192.168.20.20 80  age 4
```

5. Open a browser and enter the IP address of the virtual router and the location of a GIF file:



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6. As only one real server is operational and it is configured to process any requests except requests that contain .gif as a part of the URL string, the page could not be displayed as there are no servers available that could process this kind of request:



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Appendix A. Alteon configuration file

```
script start "Alteon AD3" 4  /**** DO NOT EDIT THIS LINE!
/* Configuration dump taken 17:32:24 Thu Jun 10, 2004
/* Version 10.0.30.7,  Base MAC address 00:60:cf:46:53:60
/c/ip/if 1
        ena
        addr 192.168.10.100
/c/ip/if 2
        ena
        addr 192.168.20.200
/c/slb
        on
/c/slb/adv
        direct ena
/c/slb/real 1
        ena
        rip 192.168.20.10
/c/slb/real 2
        ena
        rip 192.168.20.20
/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 192.168.10.150
/c/slb/virt 1/service http
        group 1
        dbind ena
/c/slb/layer7/slb
        message "Sorry, no servers are available"
        ren 2 ".html"
        ren 3 ".gif"
/c/slb/real 1/layer7
        addlb 2
/c/slb/real 2/layer7
        addlb 3
/c/slb/virt 1/service http
        httpslb urlslb
/
script end  /**** DO NOT EDIT THIS LINE!
```

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Appendix B. Alteon configuration for exclusion string matching

```
script start "Alteon AD3" 4  /**** DO NOT EDIT THIS LINE!
/* Configuration dump taken 15:19:38 Wed Jun 16, 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 192.168.10.100
/c/ip/if 2
        ena
        addr 192.168.20.200
/c/slb
        on
/c/slb/adv
        direct ena
/c/slb/real 1
        ena
        rip 192.168.20.10
/c/slb/real 2
        ena
        rip 192.168.20.20
/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 192.168.10.150
/c/slb/virt 1/service http
        group 1
        dbind ena
/c/slb/layer7/slb
        message "Sorry, no servers are available"
        ren 2 ".html"
        ren 3 ".gif"
/c/slb/real 1/layer7
        addlb 2
/c/slb/real 2/layer7
        exclude e
        addlb 3
/c/slb/virt 1/service http
        httpslb urlslb
/
script end  /**** DO NOT EDIT THIS LINE!
```

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If after following this guide you are still having problems, please ensure you have carried out the steps exactly as in this document. If problems still persist, please contact Nortel Networks Technical Support (contact information is available online at: http://www.nortel.com/cgi-bin/comments/comments.cgi?key=techsupport_cu).

We welcome you comments and suggestions on the quality and usefulness of this document. If you would like to leave a feedback please send your comments to: CRALT@nortel.com