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ADTRAN

Configuration Guide

Layer 3 Switching in AOS

This guide provides an overview of Layer 3 switching and its operation in ADTRAN Operating System (AOS) products. Included in this guide is a description of Layer 3 switching, a description of express caching, and the operation of Layer 3 switching in the AOS products. This guide also describes the configuration and application of Layer 3 switching through the AOS command line interface (CLI) and the web-based graphical user interface (GUI).

This guide includes the following sections:

Layer 3 Switching Overview

To begin understanding Layer 3 switching, you must understand the function of both Layer 2 switching and Layer 3 routing. Normally, a Layer 2 switch operates as a bridge, forwarding data frames on the data link layer (DLL) (Layer 2) between switches, using the unit's medium access control (MAC) address. In Layer 3 routing, however, packets are forwarded to other routers or switches using the network layer (Layer 3), using Layer 3 protocols, such as the IP protocol.

Layer 2 switches are typically used in local area networks (LANs). LAN switches operate by receiving incoming frames, saving them to the buffer, and then reading the destination MAC address contained in the frame's header. The MAC address is then compared to a list of addresses in the switch's lookup table. If a corresponding MAC address is found in the lookup table, the switch forwards the frame out of the corresponding interface according to the lookup table.

Layer 3 routers are typically used to connect LANs to the Internet or to connect multiple LANs together. A router routes packets in a similar method to switches; it receives incoming packets and looks at the packet's Layer 3 source and destination addresses to determine the path the packet should take. The main difference between Layer 2 switching and Layer 3 routing is the use of MAC addresses versus the use of network protocols and IP addresses to determine the packet's destination.

Express Caching

Express caching is a model of route caching used to enhance routing performance. This is the model used for Layer 3 switching. When used in Layer 3 switching, express caching pushes all packet-forwarding routes for virtual local area network (VLAN) interfaces into the switch fabric. The entire route table is proactively mirrored in a forwarding information base (FIB) memory, called the route-cache, avoiding the lookup failures necessary for population of a fast switch cache. Thus, express caching improves the efficiency in high activity routing systems, lowering the CPU burden associated with managing fast switching caches.

What Is Layer 3 Switching?

Layer 3 switching is a happy marriage between Layer 2 switching and Layer 3 routing. In AOS, Layer 3 switches have hardware designed to allow typical software-based Layer 3 IP routing to occur within the hardware of the switch fabric. Hardware forwarding enables LAN switch interfaces to perform IP routing at wire speeds. When a packet is received on an Ethernet port with a corresponding Layer 3 interface (VLAN interface), it has the potential to be forwarded without software intervention. If a corresponding route exists in the hardware forwarding tables, the packet is intercepted, modified in the appropriate manner, and retransmitted, before it reaches the CPU. If the route is not present in the hardware tables, the packet is forwarded to the IP stack (process switched) for standard software routing.

AOS Products and Layer 3 Switching

AOS implements different Layer 3 switching varieties on several different products. Most products support either Layer 3 Lite switching or a more robust version of Layer 3 switching. The differences between these types of Layer 3 switching are outlined in the following sections. In addition, certain router products incorporate a version of Layer 3 switching that is unique. The specifics for Layer 3 switching on AOS router products are also outlined in the following sections.

Layer 3 Lite Switching

Layer 3 Lite is a term used to describe NetVanta switches with a small set of Layer 3 capabilities. These switches include the second generation NetVanta 1230 Series and the second generation NetVanta 1530 Series switches. In addition to their normal Layer 2 switch fabric, these switches have the capability to cache routes and hosts into the switch fabric to perform hardware routing. This also allows them to support more than one virtual local area network (VLAN) IP interface for management. As new routes are added to the switch, it forwards these routes into a hardware table. Similarly, as new hosts are added to the ARP and MAC tables, it pushes these hosts into a hardware host forwarding table. Any traffic with hosts or routes in these tables are routed via hardware at line speed. The limits of the two switch series are outlined in *Table 1 on page 6*. It is important to note that ADTRAN does not recommend making the switch the default gateway for more than the number of the hosts the respective switch supports in its host table as not all of these hosts could be hardware routed.

Robust Layer 3 Switching

ADTRAN's full Layer 3 switches build on the capabilities added with Layer 3 Lite, but with a greatly increased Layer 3 capability. These switches support many more hosts and routes in the hardware tables than Layer 3 Lite switches, although the Layer 3 switching functionality behaves in the same manner. The Layer 3 switch line also supports the Router Information Protocol (RIP) and Open Shortest Path First (OSPF) routing protocols, as well as Virtual Routing Redundancy Protocol (VRRP) for added routing and redundancy capability. The NetVanta 1540 Series and NetVanta 1600 Series products support robust Layer 3 switching functionality.

Router with Layer 3 Switching Capabilities

The NetVanta 1335 Series router possesses a full Layer 3 routing stack and is therefore considered a router that possesses switching capabilities. It supports the AOS firewall, VPN, Policy Based Routing (PBR), and other routing features. Any traffic processed by these features is sent to the CPU for processing. The NetVanta 1335 can act as a Layer 3 switch, when the routing features are not being used. The NetVanta 1335 has a 16-route express cache which is used to push forwarding routes for VLAN interfaces down into the switch fabric. The NetVanta 1335 does not possess a host cache; instead, any traffic must match a forwarding route for it to be hardware switched. If the traffic does not match a forwarding route in hardware, and the cache is full, the traffic is sent to the CPU for processing.

It is recommended that if you are using the route-cache on an interface in the NetVanta 1335 that you do not enable the AOS RapidRoute engine. In firmware release R10.4.0 or later, this feature is enabled by default and must be disabled using the **no ip ffe** command on the corresponding interface. For more information refer to the *RapidRoute* configuration guide, available online at https://supportforums.adtran.com.

Refer to *Hardware and Software Requirements and Limitations on page 5* for more specific information about the requirements and limitations of the NetVanta 1335 Series Layer 3 switching.

Layer 3 Switching and AOS Routing

There are several considerations for Layer 3 switching and how it interacts with routing in AOS products. The following sections describe these considerations.

Adjacent Routes

When new adjacent routers are added to the network, and packets must be sent through a new route, the NetVanta products must know the MAC address of the new router. To determine this address, the unit uses an ARP request to contact the adjacent router. When the adjacent router responds to the ARP request, an entry is added to the MAC table for that host, and the new route is added to the hardware routing tables. Using the ARP request ensures that the NetVanta products add the new route to the hardware table.

This same process occurs when MAC entries expire from the ARP table.

Connected Routes

In the NetVanta products, packets destined for a host on a directly connected network that do not have a current ARP entry must be forwarded to the CPU for processing before hardware routing can take place. The CPU will send an ARP request for the unresolved host, and then populate the ARP cache after the response is received. Due to this process, the first packet from each host is software routed. Once the ARP response is received, the new host entry is added to the hardware table and all subsequent packets destined for this new address are hardware routed using the new host entry.

Default Routes

Default routes always exist at the end of the hardware route lookup tables, but otherwise behave the same as all other routes.

Hardware and Software Routing Interactions

In the following illustration, the relationship between hardware and software routing functions in the NetVanta products is described through the packet path and NetVanta decision points.

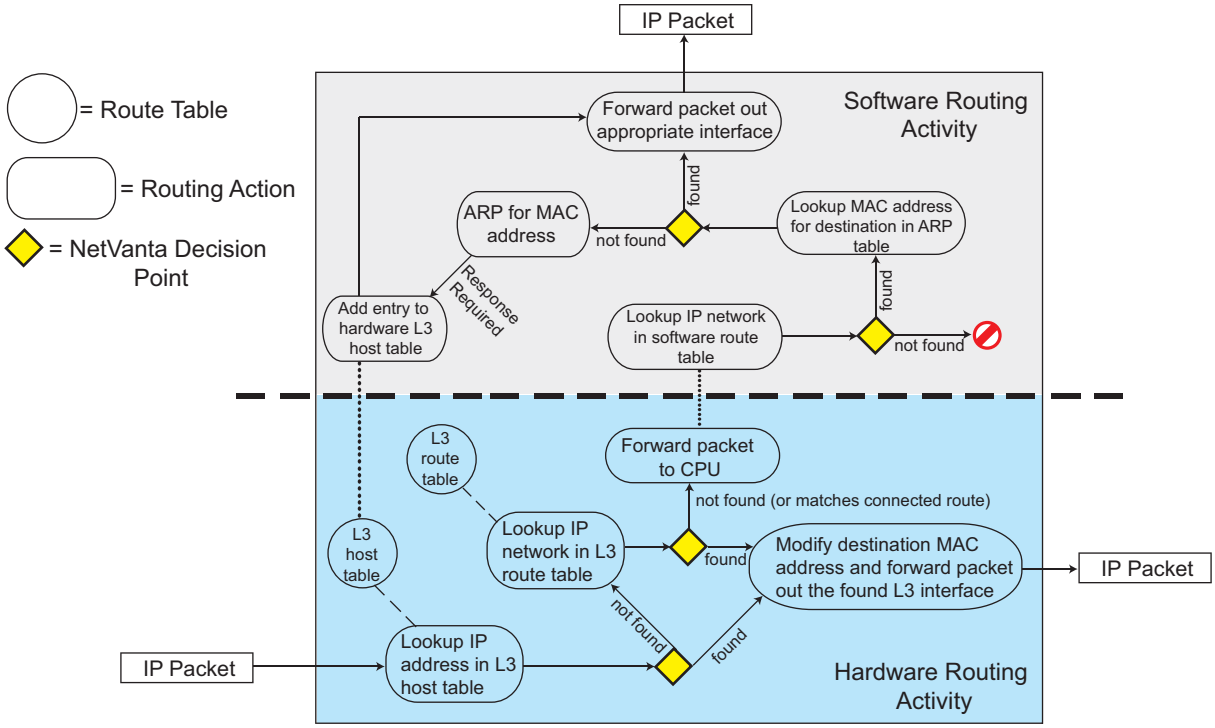


Figure 1. Hardware and Software Routing in NetVanta Layer 3 Switching

Refer to *Hardware and Software Requirements and Limitations on page 5* for more specific information about requirements and limitations of Layer 3 switching.

Hardware and Software Requirements and Limitations

It is important to remember that Layer 3 switching does not process traffic through software routing, so traffic restriction, traffic shaping, and quality of service (QoS) features are not available when using Layer 3 switching.

Refer to the *AOS Product Feature Matrix* (available online at https://supportforums.adtran.com) for more information about products that support Layer 3 switching.

The following table describes the different requirements and limitations of Layer 3 switching on different NetVanta Series products..

Table 1. Layer 3 Switching in NetVanta Series Products

NetVanta 1335 Series	NetVanta 1530 Series (second generation or later)	NetVanta 1540 Series	NetVanta 1230 Series (second generation or later)	NetVanta 1638 Series
Layer 3 switching (Express Cache) can be enabled or disabled globally or per interface.	Express Cache can be enabled or disabled globally or per interface.	Express Cache is always enabled.	Express Cache can be enabled or disabled globally or per interface.	Express Cache is always enabled.
By default, configured for software routing and hardware forwarding is disabled.	By default, Layer 3 switching is enabled.	Layer 3 switching is always enabled and cannot be disabled.	By default, Layer 3 switching is enabled.	By default, Layer 3 switching is always enabled and cannot be disabled.
Hardware route table is limited to 16 entries. These entries are routes learned via routing protocol or static routes.	The hardware table holds 16 static routes and 232 ARP entries. These entries are static routes only.	The hardware table holds 1000 routes and ARP entries combined. These entries are routes learned via routing protocol or static routes.	The hardware table holds 16 static routes and 256 ARP entries. These entries are static routes only.	The hardware table holds 16K static routes and 4100 ARP entries. These entries are routes learned via routing protocol or static routes.
Supports up to 32 Layer 3 interfaces for Layer 3 switching.	Supports up to 8 Layer 3 interfaces for Layer 3 switching.	Supports up to 256 Layer 3 interfaces for Layer 3 switching.	Supports up to 16 Layer 3 interfaces for Layer 3 switching.	Supports up to 256 Layer 3 interfaces for Layer 3 switching.

Configuring Layer 3 Switching Using the GUI

Although Layer 3 switching (Express Cache) is always enabled (and cannot be disabled) on the NetVanta 1540 Series or NetVanta 1638 Series, on other NetVanta Series products it can be enabled or disabled either globally or on a per-VLAN interface basis. Configuration of Layer 3 switching is detailed in the following sections.

Enabling/Disabling Layer 3 Switching

To enable Layer 3 switching globally using the GUI, follow these steps:

1. Open a new web page in your Internet browser.
2. Enter your AOS product's IP address in the Internet browser's address field in the following form

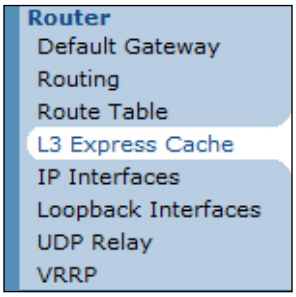
   http://<*ip address*>, for example:

   http://65.162.109.200

3. At the prompt, enter your user name and password and select **OK**.

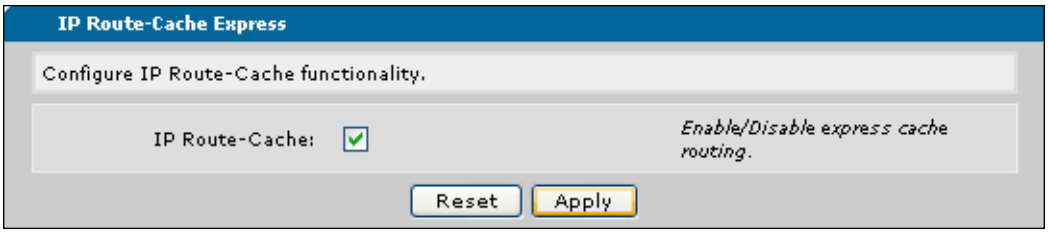
NOTE *The default user name is **admin** and the default password is **password**.*

4. Navigate to **Data** > **Router** > **L3 Express Cache**.



NOTE *The **L3 Express Cache** selection is available on units running AOS firmware 17.5 and later for the NetVanta 1335 Series, AOS firmware 17.8 and later for the second generation NetVanta 1534 Series, AOS firmware R10.8.0 and later for the second generation NetVanta 1230 Series, and on all firmware versions for the NetVanta 1540 Series and NetVanta 1638 Series products.*

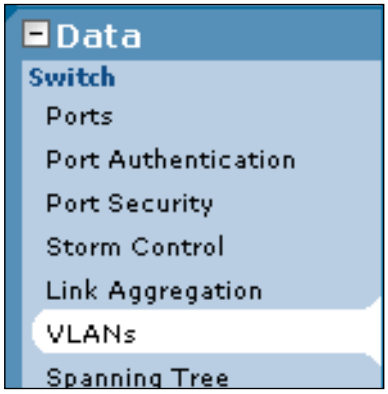
5. Select the box next to **IP Route-Cache** and select **Apply**.



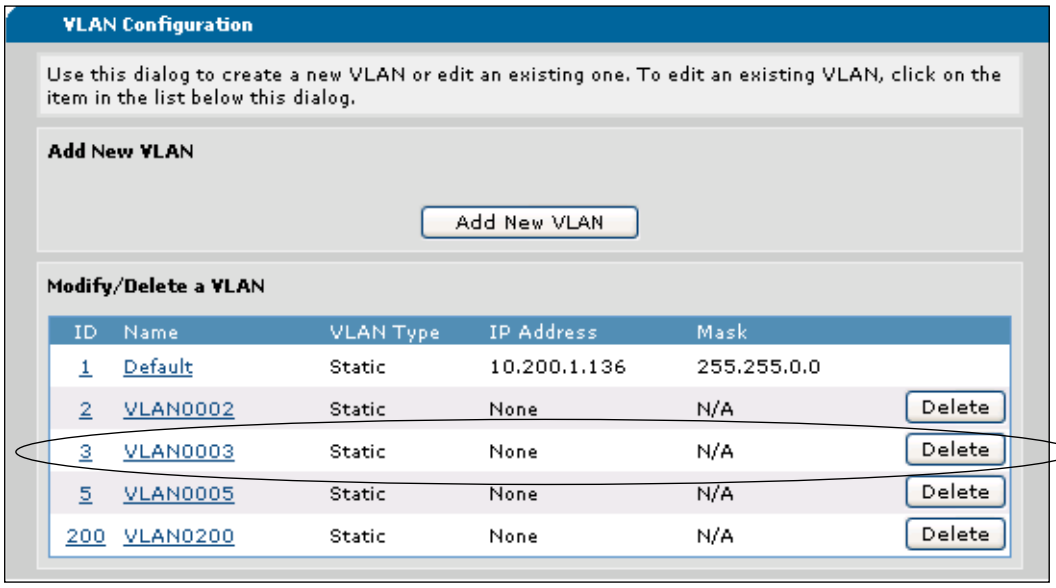
6. Layer 3 switching is now globally enabled. To disable Layer 3 switching, simply deselect the box next to **IP Route-Cache** and select **Apply**.

To enable Layer 3 switching on a VLAN interface, connect to the unit's GUI and follow these steps:

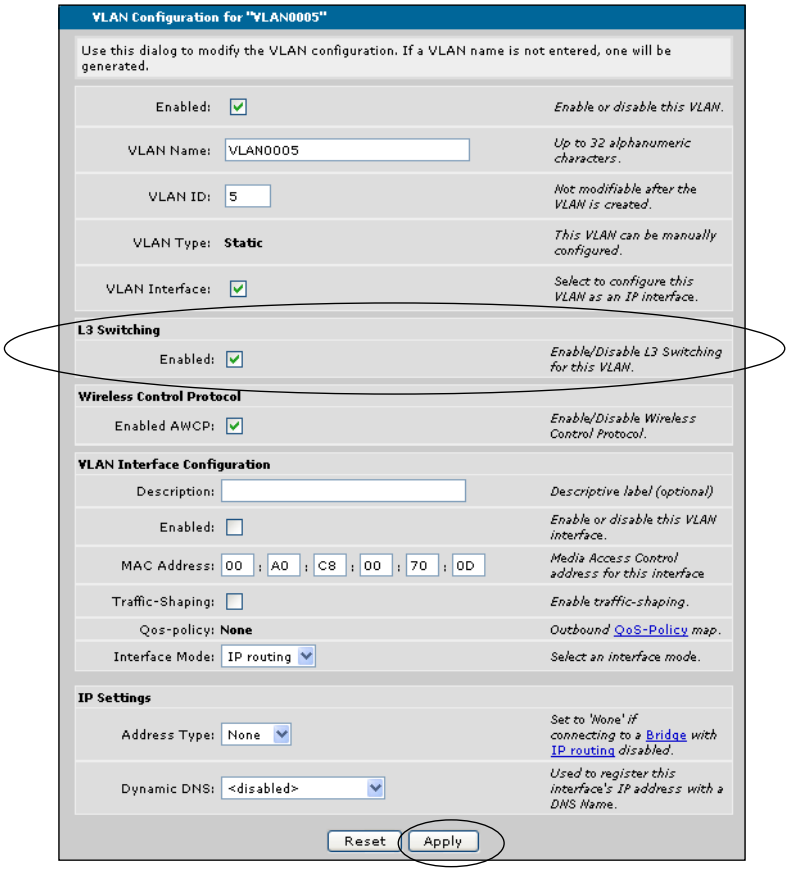
1. Navigate to **Data** > **Switch** > **VLANs**.



2. Select the appropriate VLAN interface from the list of configured interfaces using the underlined hyperlink.



3. Select the **Enabled** box beneath **L3 Switching** to enable Layer 3 switching on the VLAN interface and select **Apply**.



4. Layer 3 switching is now enabled on the specific VLAN interface. To disable Layer 3 switching on this interface, simply deselect the same **Enabled** box and select **Apply**. Repeat this process for each VLAN interface on which you want to enable Layer 3 switching.

Configuring Layer 3 Switching Using the CLI

Although Layer 3 switching (Express Cache) is always enabled (and cannot be disabled) on the NetVanta 1540 Series and NetVanta 1638 Series, on other NetVanta Series products it can be enabled or disabled either globally or on a per-VLAN interface basis. Configuration of Layer 3 switching is detailed in the following sections.

Enabling/Disabling Layer 3 Switching

To enable Layer 3 switching globally using the CLI, Telnet to the unit, and from the Global Configuration mode prompt, enter the **ip route-cache express** command as follows:

```
(config)#ip route-cache express
```

This command enables Layer 3 switching at the global level. Using the **no** form of this command disables Layer 3 switching. By default, Layer 3 switching is enabled on all NetVanta Series products except the NetVanta 1335.

To enable Layer 3 switching on a VLAN interface, Telnet to the unit, and navigate to the VLAN interface configuration mode. Enter the **ip route-cache express** command at the prompt to enable Layer 3 switching on the VLAN interface. Enter the command as follows:

```
(config)#interface vlan 10
(config-intf-vlan 10)#ip route-cache express
```

This command enables Layer 3 switching at the VLAN interface level. Using the **no** form of this command disables Layer 3 switching on the interface. By default, Layer 3 switching is enabled on all NetVanta Series products except the NetVanta 1335.

Layer 3 Switching Application Examples

The following examples show sample configurations and applications for Layer 3 switching in the NetVanta 1335 Series, second generation NetVanta 1534 Series, and NetVanta 1544 Series.

> *These configurations are for example only. You should ensure the configuration is modified to fit your network before entering these configurations into your unit.*

Layer 3 Switching and the NetVanta 1335 Series/NetVanta 1530 Series

> *The following example documents the configuration of a NetVanta 1335 Series for Layer 3 switching; however, the second generation NetVanta 1530 Series, NetVanta 1540 Series, NetVanta 1230 Series, and NetVanta 1638 Series are configured in the same manner.*

In this scenario, a single location uses a NetVanta 1335 with a Metro Ethernet Internet connection. The client has two VLANs: VLAN 3 for the Sales department, and VLAN 4 for the server farm. Layer 3 switching is enabled on the VLAN 3 and VLAN 4 interfaces. Ethernet port **0/1**, which is connected to the Metro Ethernet link, has Layer 3 switching disabled. *Figure 2* illustrates the scenario.

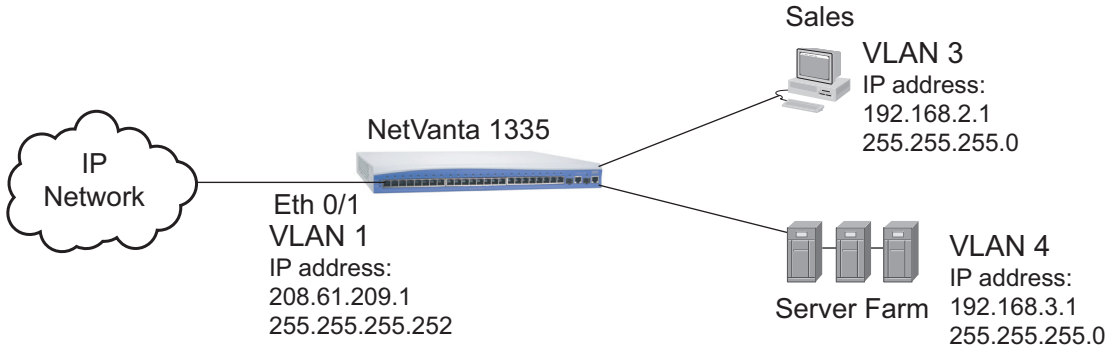


Figure 2. Layer 3 Switching and the NetVanta 1335

In this example, Layer 3 switching is disabled on the Ethernet 0/1 WAN interface so that the firewall and NAT can be applied to the interface. This way, packets destined for the Internet will be routed through software, which allows firewall and NAT policies to be applied to packets as they are routed through VLAN 1. VLAN 1 is not cached in the hardware route table, so packets are forwarded to the standard software route table.

Layer 3 switching in this example is only applied to packets travelling between VLAN 3 and VLAN 4. This Layer 3 switching is performed at line speed, because although these VLANs are configured for Layer 3 switching, the NetVanta 1335 cannot restrict traffic between the two VLANs. This is because when Layer 3 switching is enabled, the packets are routed in hardware before they reach the software IP route table where ACPs are applied.

Because Layer 3 switching is disabled by default on the NetVanta 1335 Series, only the two VLANs must have Layer 3 switching enabled. Therefore, the Layer 3 switching configuration for this scenario looks like this:

Creating VLANs and assigning them to switchports does not enable Layer 3 switching. These activities are included in this example to show the basics for VLAN configuration.

```
!
interface switchport 0/1
     no shutdown
     switchport access vlan 1
!
interface switchport 0/2
     no shutdown
     switchport access vlan 3
!
interface switchport 0/3
     no shutdown
     switchport access vlan 3
!
interface switchport 0/4
     no shutdown
     switchport access vlan 4
!
interface switchport 0/5
     no shutdown
     switchport access vlan 4
!
interface vlan 1
     ip address 208.61.209.1 255.255.255.252
     no ip route-cache express
     no shutdown
!
interface vlan 3
     ip address 192.168.2.1 255.255.255.0
     ip route-cache express
     no shutdown
!
interface vlan 4
     ip address 192.168.3.1 255.255.255.0
     ip route-cache express
     no shutdown
```

*The **switchport access vlan 1** command will not be shown in the output of the **show run** command since it is the default.*

NOTE *The firewall configuration needed to allow NAT to take place has been omitted as it is outside the scope of this example.*

Layer 3 Switching and the NetVanta 1540 and NetVanta 1638 Series

In this scenario, two locations are connected via Metro Ethernet. *Figure 3* represents the remote location of the two, which employs a NetVanta 1544. The NetVanta 1544 has five VLANs. VLAN 1 is the connection to the network, VLAN 2 is used by SIP phones talking to an IP private branch exchange (PBX) at the host location, VLAN 3 is used by the Sales department, VLAN 4 is used by the Engineering department, and VLAN 5 is used for a wireless network. Layer 3 switching is enabled on all locations (it cannot be disabled on the NetVanta 1544). In this configuration, the NetVanta 1544 performs Layer 3 switching between all VLANs at line rate.

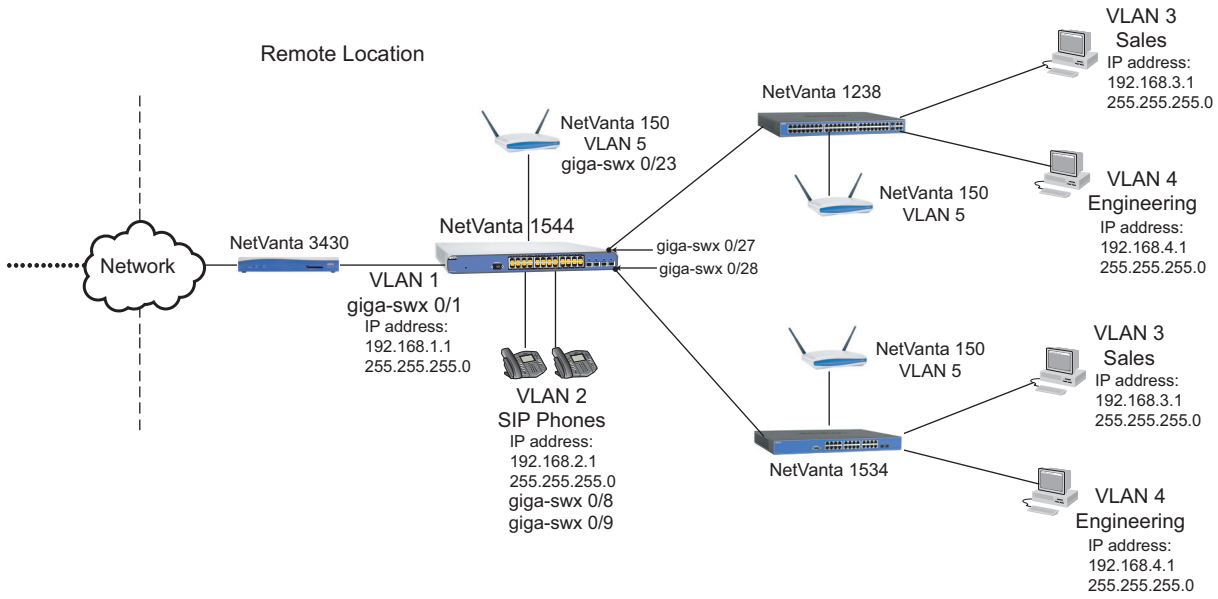


Figure 3. Layer 3 Switching and the NetVanta 1540 Series

The Layer 3 switching configuration for this scenario looks like this:

```
!
interface gigabit-switchport 0/1
    no shutdown
    switchport access vlan 1
!
interface gigabit-switchport 0/8
    no shutdown
    switchport access vlan 2
!
interface gigabit-switchport 0/9
    no shutdown
    switchport access vlan 2
!
```



```
interface gigabit-switchport 0/23
     no shutdown
     switchport access vlan 5
!

interface gigabit-switchport 0/27
     no shutdown
     switchport mode trunk
!
interface gigabit-switchport 0/28
     no shutdown
     switchport mode trunk
!
interface vlan 1
     ip address 192.168.1.1 255.255.255.0
     no shutdown
!
interface vlan 2
     ip address 192.168.2.1 255.255.255.0
     no shutdown
!
interface vlan 3
     ip address 192.168.3.1 255.255.255.0
     no shutdown
!
interface vlan 4
     ip address 192.168.4.1 255.255.255.0
     no shutdown
!
interface vlan 5
     ip address 192.168.5.1 255.255.255.0
     no shutdown
!
```

*The **switchport access vlan 1** command will not be shown in the output of the **show run** command since it is the default.*

Layer 3 Switching Command Summary

The following table summarizes the CLI commands available for Layer 3 switching. This table displays the access prompt, the command, and the command description.

Table 2. Layer 3 Switching Command Summary

Access Prompt	Command	Command Description
(config)#	**[no] ip route-cache express**	Enables and disables Layer 3 switching at the global level. Disabled by default.
(config-intf-vlan <*vlan*>)#	**[no] ip route-cache express**	Enables and disables Layer 3 switching at the interface level. Disabled by default.
#	**show ip route-cache express [count]**	Displays the addresses currently being express cached in hardware.
#	**show ip route-cache express host-table [count]**	Displays the hardware host (ARP) entries currently used to route packets to directly connected networks.
#	**show interfaces gigabit-switchport** <*slot/port*>	Displays switchport statistics (NetVanta 1335 Series, NetVanta 1530 Series, NetVanta 1540 Series, NetVanta 1638 Series), including Layer 3 switching statistics (NetVanta 1530 Series, 1540 Series, and 1638 Series only).
#	**clear ip route-cache express**	Removes all routes from the hardware forwarding table.
#	**debug ip route-cache express**	Enables the display of recent Layer 3 switching events.

Troubleshooting

The best method of troubleshooting Layer 3 switching procedures on your unit is to use the **debug** feature. You can access debug information using the CLI. You can also choose to review the Layer 3 switching configuration by viewing the Layer 3 statistics using the **show** commands or via the GUI.

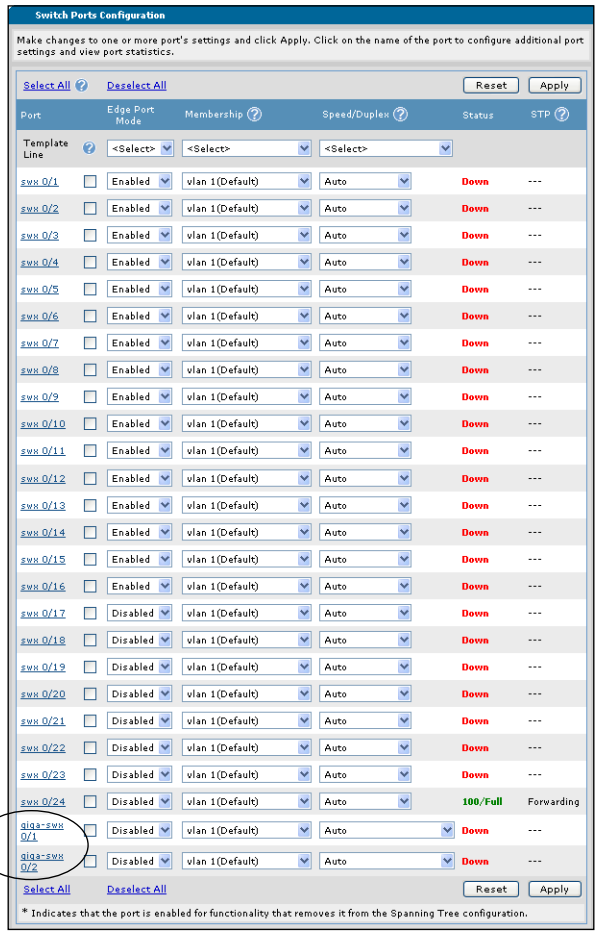
Viewing Layer 3 Switching Information Using the GUI

You can use the GUI to view Layer 3 switching information, clear Layer 3 statistics for switchports, and view your unit's express cache route table.

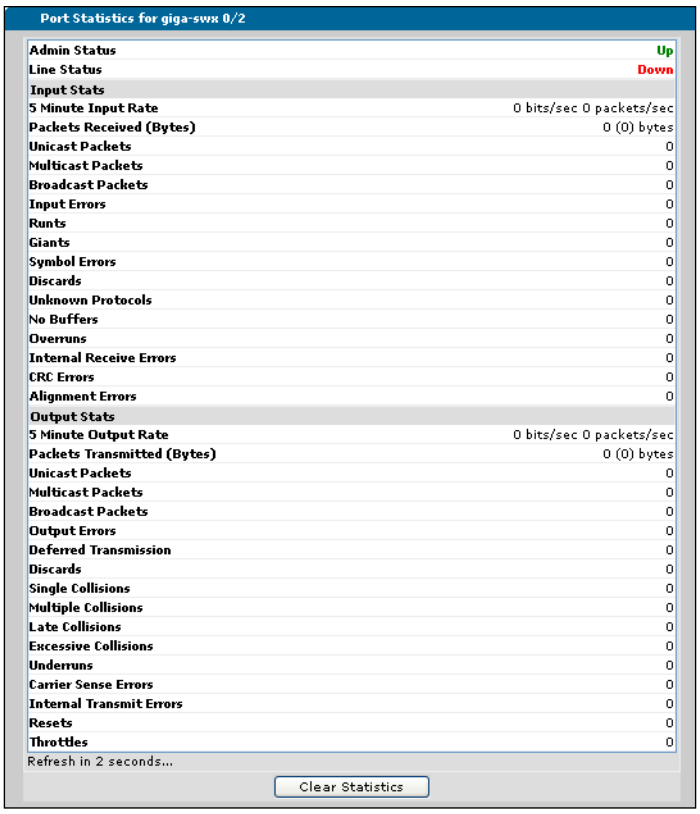
Viewing Layer 3 Switching Gigabit Ethernet Switchport Statistics

To view Layer 3 switching statistics for a Gigabit Ethernet switchport interface, follow these steps:

1. Connect to the unit's GUI, and navigate to **Data** > **Switch** > **Ports**.
2. Select the appropriate Gigabit Ethernet switchport from the list.

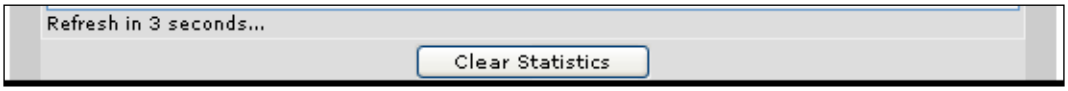


3. At the bottom of the menu, you see the header **Port Statistics for giga-swx 0/2** (where **giga-swx 0/2** is the name of the Gigabit Ethernet switchport you selected). The statistics are listed in this dialog box.



Clearing Layer 3 Switching Statistics

To clear Layer 3 switching statistics from the Gigabit Ethernet switchport, select **Clear Statistics** at the bottom of the interface statistics dialog box.



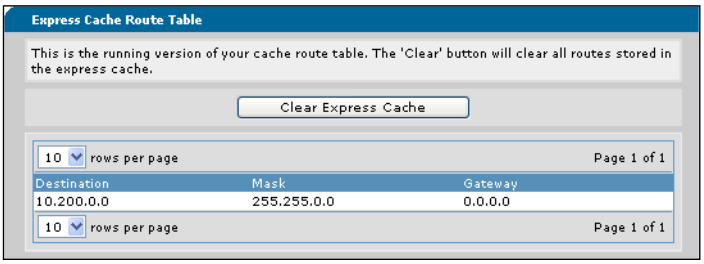
CAUTION

*Selecting **Clear Statistics** will also clear all other statistics for the Gigabit Ethernet switchport.*

Viewing the Express Cache Route Table

To view the unit's express cache route table, follow these steps:

1. Connect to the unit's GUI and navigate to **Data** > **Router/Bridge** > **L3 Express Cache**.
2. At the bottom of the menu, you see the header **Express Cache Route Table**. This is the current version of your hardware route table.



3. Select **Clear Express Cache** to clear the routes stored in the express cache.

Viewing Layer 3 Switching Information Using the CLI

You can also view Layer 3 switching information using the CLI. You can view statistics for the route cache and for Gigabit Ethernet switchport Layer 3 switching, as well as clear the routes stored in the route cache.

Viewing the Route Cache

To view the unit's route cache, enter the **show ip route-cache express [count]** command from the Enable mode prompt. The following is sample output from the **show ip route-cache express** command:

```
#show ip route-cache express
DESTINATION      MASK           GATEWAY
-------------------------------------------------------------------------------
10.23.18.0       255.255.255.0  172.22.22.36
```

This command displays the addresses currently being express cached in hardware. This is a subset of the overall route table. The optional **count** parameter narrows the output to the number of entries in the route cache.

Viewing the Route Cache Host Table

To view the hardware host (ARP) entries currently used to route packets to directly connected networks, enter the **show ip route-cache express host-table [count]** command from the Enable mode prompt. The following is sample output from the **show ip route-cache express host-table** command:

```
#show ip route-cache express host-table
DESTINATION      MAC ADDRESS        INTERFACE
-------------------------------------------------------------------------------
10.23.131.254    00:A0:C8:00:7E:D3  vlan 1
20.1.1.2         00:DE:AD:00:55:55  vlan 20
21.1.1.2         00:A0:C8:00:78:A8  vlan 21
22.1.1.2         00:A0:C8:24:7E:6A  vlan 22
```

The optional **count** parameter narrows the output to the number of entries in the ARP table.

*The **show ip route-cache express host-table [count]** command is not available on the NetVanta 1335 Series.*

Viewing the Gigabit Ethernet Switchport Layer 3 Switching Statistics

To view statistics for Layer 3 switching on a Gigabit Ethernet switchport, enter the **show interfaces gigabit-switchport** <*slot/port*> command from the Enable mode prompt. In addition to other switchport statistics, this command displays the number of IP packets intercepted by Layer 3 switching (received packets), the number of IP packets accepted but discarded due to lack of buffer space (discards), the number of IP Layer 3 switching header errors, and the number of IP packets that were successfully forwarded by Layer 3 switching (forwards). The following is sample output for the **show interfaces gigabit-switchport** command:

```
#show interfaces gigabit-switchport 0/1
giga-swx 0/21 is UP, line protocol is UP
    Hardware address is 00:A0:C8:00:24:4F
    RJ-45 Shielded
    100Mb/s, negotiated full-duplex, configured full-duplex
    ARP type: ARPA; ARP timeout is 20 minutes
    5 minute input rate 6232 bits/sec, 10 packets/sec
    5 minute output rate 344 bits/sec, 0 packets/sec
        3432 packets input, 237372 bytes
        6 unicasts, 1 broadcasts, 3067 multicasts input
        0 unknown protocol, 2781 discards
        0 input errors, 0 crc errors
        358 packets output, 28552 bytes
        7 unicasts, 0 broadcasts, 351 multicasts output
        0 output errors, 0 deferred, 0 discards
        0 single, 0 multiple, 0 late collisions
        0 excessive collisions
L3 Switch
    25 packets input, 25 packets forwarded
    0 header errors, 0 discards
```


NOTE

*The **show interfaces gigabit-switchport** command does not include Layer 3 switching statistics in the output on the NetVanta 1335 Series.*

Clearing the Route Cache

To clear all routes from the hardware forwarding tables, enter the **clear ip route-cache express** command from the Enable mode prompt. This command removes all currently cached routes, but subsequent route updates are still pushed to the hardware tables after the command is issued. Enter the command as follows:

```
#clear ip route-cache express
```

Debug Using the CLI

To use the CLI to access Layer 3 switching debug information, enter the **debug ip route-cache express** command from the Enable mode prompt. This command displays recent Layer 3 switching events on the unit. These events include:

- Adding a route to hardware
- Adding a host entry (ARP) to hardware
- A route or host entry that could not be added to hardware because the ARL entry does not exist
- A route or host entry was added because an ARL entry now exists in the ARL table
- A route or host entry could not be added because the route table is full (this creates a WARNING)

The following is sample output from the **debug ip route-cache express** command:

```
#debug ip route-cache express
xRt: Periodic ARP for 10.2.42.254
xRt: Processed 1 ARP events, with 0 remaining

xRt: host entry added: IP=192.168.1.10, MAC=00:10:94:00:00:01, Vlan=1
xRt: host entry added: IP=192.168.3.10, MAC=00:10:95:00:00:01, Vlan=3
xRt: host entry not added (no ARL entry): IP=192.168.5.10, MAC=00:10:96:00:00:01, Vlan=5
xRt: host entry added: IP=192.168.7.10, MAC=00:10:97:00:00:01, Vlan=7
xRt: host entry added: IP=192.168.9.10, MAC=00:10:98:00:00:01, Vlan=9
xRt: host entry added: IP=192.168.11.10, MAC=00:10:99:00:00:01, Vlan=11
xRt: host entry added: IP=192.168.13.10, MAC=00:10:9a:00:00:01, Vlan=13
xRt: host entry not added (no ARL entry): IP=192.168.15.10, MAC=00:10:9b:00:00:01, Vlan=15
xRt: host entry added: IP=192.168.17.10, MAC=00:10:9c:00:00:01, Vlan=17
xRt: host entry added: IP=192.168.19.10, MAC=00:10:9d:00:00:01, Vlan=19
xRt: Processed 10 ARP events, with 605 remaining
xRt: Processed 10 L2 events, with 393 remaining

xRt: host entry added (ARL entry found): IP=192.168.1.20, MAC=00:10:94:00:00:0b, Vlan=1
xRt: host entry added (ARL entry found): IP=192.168.15.10, MAC=00:10:9b:00:00:01, Vlan=15
xRt: host entry added (ARL entry found): IP=192.168.3.18, MAC=00:10:95:00:00:09, Vlan=3
xRt: host entry added (ARL entry found): IP=192.168.3.41, MAC=00:10:95:00:00:20, Vlan=3
xRt: Processed 10 L2 events, with 217 remaining
xRt: Processed 10 ARP events, with 228 remaining
```



```
xRt: ARP entry for 192.168.3.10 was updated
xRt: ARP entry for 192.168.3.11 was updated
xRt: ARP entry for 192.168.3.12 was updated
xRt: ARP entry for 192.168.3.13 was updated
xRt: ARP entry for 192.168.3.14 was updated
```

To disable Layer 3 switching debug messaging, use the **no** form of the command as follows:

```
#no debug ip route-cache express
```

To disable all currently enabled debug messaging, use the **undebug all** command as follows:

```
#undebug all
```

Hardware Resources Error (NetVanta 1534 Only)

If there are insufficient hardware resources to support Layer 3 switching in the NetVanta 1534 product, Layer 3 switching will not be enabled and an error message will be displayed, for example:

```
(config)#ip route-cache express
%Not enough hardware resources for L3 Switching.
```