Configuration guide

HP Network Simulator

Lab 4—IP Subnet-based and MAC-based VLANs

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Introduction

This configuration guide describes how to create, configure, and connect virtual HP Comware v7 devices using the HP Network Simulator (HNS) tool.

Comware v7 is a network operating system that runs on HP high-end network devices. The HNS is an ideal Comware v7 learning tool. With the HNS, users can create:

- Fixed form-factor and modular routers
- Stackable and modular switches
- LAN and WAN links

This lab assumes that HNS has been downloaded and installed according to the user guide provided with the download. Installation of the HNS tool is outside the scope of this guide. This lab also assumes that the reader is familiar with the HNS basics and configuration examples provided in the user guide.

Requirements

The following hardware is required:

- A PC with:
  - CPU frequency: 3.0 GHz or more
  - Memory: 4 GB or more
  - Hard disk: 80 GB or more
  - Operating system: Windows® 7/8 or Ubuntu (32-bit or 64-bit)

The following software is required:

- HP Network Simulator
- Oracle VM Virtual Box Release 4.2.18 or later

Note:

1. If running HNS on Windows, use the name “VirtualBox Host-Only Ethernet Adapter” for the Virtual Box Ethernet adapter.
2. If running HNS on Ubuntu, use the name “vboxnet0” for the Virtual Box Ethernet adapter.

Objective

In this guide, readers will learn the main concepts for ports and VLANs. Additionally, the lab will teach readers how to:

- Create IP Subnet-based VLANs

The layout of the lab consists of two virtual switches and two virtual routers.

Lab concepts

VLAN overview

VLANs enable users to be grouped by logical function instead of physical location. This helps to control bandwidth usage within a network by allowing high-bandwidth users to be grouped on low-traffic segments, and to organize users from different LAN segments according to their need for common resources and/or their use of individual protocols. VLANs can be port-based, protocol-based, MAC-based, auto voice, or basic QinQ.

This guide focuses on the following types of VLANs:

- IP Subnet-based VLANs
- MAC-based VLAN

Defining switch ports

When applying VLANs to ports on HP Comware switches, it is important to understand how VLANs can be tagged or untagged, and the terminology used. HP Comware switches support the following switch port link-types:

- Access:
  - Supports a single untagged VLAN
  - Generally used to connect client devices like PCs and printers
- Trunk:
  - Supports a single untagged VLAN and zero or more tagged VLANs
  - Generally used to connect to another switch
- Hybrid:
  - Supports zero or more tagged and untagged VLANs
  - If more than one untagged VLAN is configured on the port, an additional VLAN identification mechanism is required for untagged ingress traffic, such as MAC-based VLAN, protocol-based VLAN, IP Subnet-based VLAN, or RADIUS
  - Can be used to connect any type of device

IP Subnet-based VLANs

In this method, packets are assigned to VLANs based on their source IP addresses and subnet masks. A port configured with IP Subnet-based VLANs assigns a received untagged packet to a VLAN based on the source address of the packet. Use this feature when packets from an IP Subnet or IP address must be transmitted in a VLAN. This feature is available only on hybrid ports, and it processes only untagged packets. An IP Subnet-based VLAN has one or multiple subnets to match inbound packets. Each subnet has a unique index in the IP Subnet-based VLAN. All subnets in an IP Subnet-based VLAN have the same VLAN ID.

MAC-based VLANs

MAC-based VLANs also apply to hybrid ports only. Inbound frames are assigned to different VLANs based on their MAC address. The MAC-based VLAN feature assigns hosts to a VLAN based on their MAC addresses. This feature is usually used with security technologies such as 802.1X to provide secure and flexible network access for terminal devices. There are three types of MAC-based VLANs.

Static MAC-based VLAN assignment

Use static MAC-based VLAN assignment in networks that have a small number of VLAN users. To configure static MAC-based VLAN assignment on a port, the following tasks must be performed:

1. Create MAC-to-VLAN entries
2. Enable the MAC-based VLAN feature on the port
3. Assign the port to the MAC-based VLAN

Dynamic MAC-based VLAN assignment

When the target MAC-based VLANs of a port cannot be determined, the dynamic MAC-based VLAN assignment on the port can be used. Perform the following tasks:

1. Create MAC-to-VLAN entries
2. Enable the MAC-based VLAN feature on the port
3. Enable dynamic MAC-based VLAN assignment on the port

Server-assigned MAC-based VLAN

Use the server-assigned MAC-based VLAN feature with access authentication, such as MAC-based 802.1X authentication, to implement secure and flexible terminal access. In addition to configuring the server-assigned MAC-based VLAN feature on the device, the username-to-VLAN entries on the access authentication server must be configured.

When a user passes authentication of the access authentication server, the server issues the VLAN ID for the user to the device. The device generates a MAC-to-VLAN entry by using the source MAC address of the user packet and the received VLAN ID. The VLAN is then a MAC-based VLAN, and the port connecting the user is assigned to the MAC-based VLAN.

This guide will cover configuration of IP Subnet-based VLANs only.

Defining Layer 2 and Layer 3 ports

HP Comware routers and Layer 3 switches provide Layer 2 and Layer 3 Ethernet interfaces.

- Layer 2 Ethernet interface: Physical Ethernet interfaces operating at the data link layer (Layer 2) to forward traffic within a subnet between hosts
- Layer 3 Ethernet interface: Physical Ethernet interfaces operating at the network layer (Layer 3) to forward traffic between different subnets. An IP address can be assigned to a Layer 3 Ethernet interface

The following commands allow for a port to be switched between Layer 2 (bridge) and Layer 3 (route).

```
port link-mode { bridge | route }
undo port link-mode
```

By default, HNS router ports are configured for port link-mode route.

Note:
Changing the link mode of an Ethernet interface causes all settings to be restored to their default values in the new link mode.

Device creation

1. Copy paste the following within the HNS tool to create two simulated switches and two simulated routers, as well as the connections between the devices.

```
#*******************************************************************************
# Router A
device_id = 1
# Device type: 32-bit centralized device
device_model = SIM1100
# Card model: SIM1103
board = SIM1103 : memory_size 1024
#*******************************************************************************
# Switch A
device_id = 2
# Device type: 32-bit centralized device
device_model = SIM2100
# Card model: SIM2101
board = SIM2101 : memory_size 1024
#*******************************************************************************
# Switch B
device_id = 3
# Device type: 32-bit centralized device
device_model = SIM2100
# Card model: SIM2101
board = SIM2101 : memory_size 1024
#*******************************************************************************
# Router B
device_id = 4
# Device type: 32-bit centralized device
device_model = SIM1100
# Card model: SIM1103
board = SIM1103 : memory_size 1024
```

```
#*******************************************************************************
# Connections between Devices
# Connection between interface 2 on Router A and interface 2 on Switch A
device 1 : interface 2 <---> device 2 : interface 2
# Connection between interface 3 on Router A and interface 3 on Switch A
device 1 : interface 3 <---> device 2 : interface 3
# Connection between interface 4 on Switch A and interface 4 on Switch B
device 2 : interface 4 <---> device 3 : interface 4
# Connection between interface 2 on Switch B and interface 2 on Router B
device 3 : interface 2 <---> device 4 : interface 2
# Connection between interface 3 on Switch B and interface 3 on Router B
device 3 : interface 3 <---> device 4 : interface 3
#*******************************************************************************
```

2. Save and run the file.
3. Two simulated switches and two simulated routers will be created in VirtualBox Manager.
4. Start all four devices.

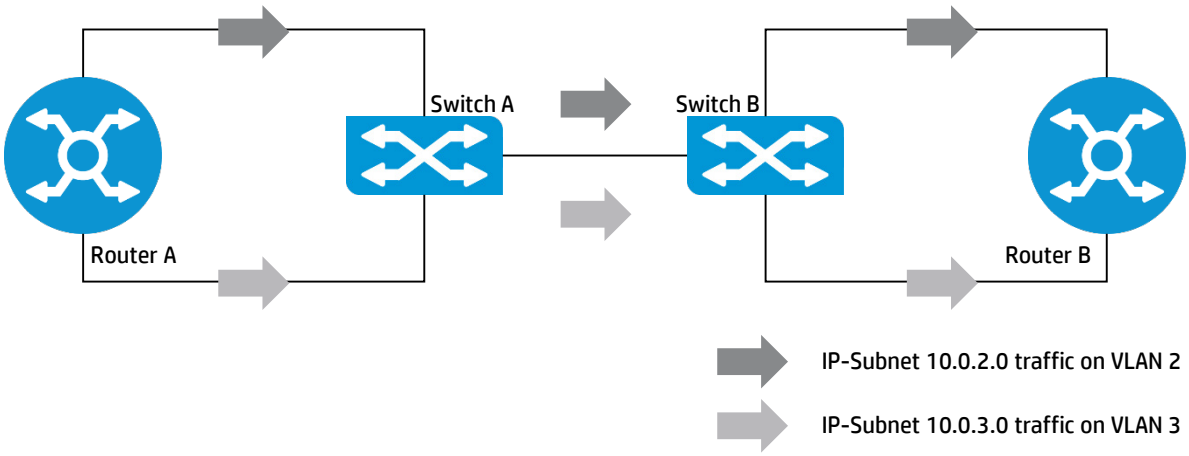
Configure: IP Subnet-based VLAN

This section of the configuration guide will focus on configuring IP Subnet-based VLAN between the simulated devices.

Network diagram

Figure 1 provides a logical view of how traffic will flow through the network.

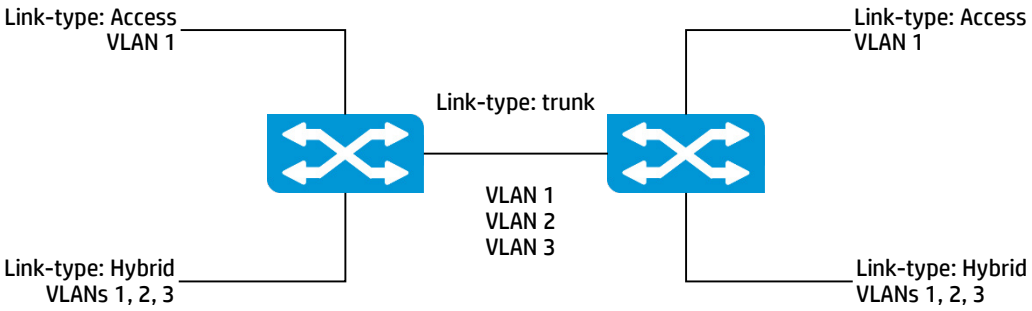
Figure 1. IP Subnet-based VLAN diagram



Device roles

In this lab, IP Subnet-based VLANs will be configured, as well as multiple link-types on switches A and B. The routers will be used to create traffic, and test the configuration between the switches.

Figure 2. Link-type diagram



Router configuration

The information in the following table will be used to assign IP addresses to the routers.

Table 1. Router configuration

	Interface	IP address	Mask Length
Router A	g0/0/2	10.0.2.1	24
Router B	g0/0/2	10.0.2.2	24
Router A	g0/0/3	10.0.3.1	24
Router B	g0/0/3	10.0.3.2	24

1. Configure the system name for Router A.

```
<HP> system-view
[HP] sysname Router A
[Router A]
```

2. Configure IP addresses on Router A.

```
[Router A] interface g0/0/2
[Router A-gig0/0/2] ip address 10.0.2.1 24
[Router A-gig0/0/2] interface g0/0/3
[Router A-gig0/0/3] ip address 10.0.3.1 24
```

3. Configure the system name for Router B.

```
<HP> system-view
[HP] sysname Router B
[Router B]
```

4. Configure IP addresses on Router B.

```
[HP] sysname Router B
[Router B] interface g0/0/2
[Router B-gig0/0/2] ip address 10.0.2.2 24
[Router B-gig0/0/2] interface g0/0/3
[Router B-gig0/0/3] ip address 10.0.3.2 24
```

Switch configuration

The table below indicates the link-type and VLANs that will be configured for each switch port.

Table 2. Switch port configuration

Switch ports	Link-Type	Switch A	Switch B
gig1/0/2	Access Port	VLAN 1	VLAN 1
gig1/0/3	Hybrid Port	VLAN 1 untagged	VLAN 1 untagged
		VLAN 2 untagged	VLAN 2 untagged
		VLAN 3 untagged	VLAN 3 untagged
gig1/0/4	Trunk Port	VLAN all	VLAN all

1. Create VLANs 2 and 3 on Switch A, configure them as IP Subnet-based VLANs, and assign subnet 10.0.2.0 under VLAN 2 and subnet 10.0.3.0 under VLAN 3.

```
[Switch A] vlan 2
[Switch A-vlan2] ip-subnet-vlan ip 10.0.2.0 255.255.255.0
[Switch A-vlan2] quit
[Switch A] vlan 3
[Switch A-vlan3] ip-subnet-vlan ip 10.0.3.0 255.255.255.0
[Switch A-vlan3] quit
```

2. Configure the switch ports according to table 2.

```
[Switch A] interface gig 1/0/3
[Switch A-gig1/0/3] undo shutdown
[Switch A-gig1/0/3] port link-type hybrid
[Switch A-gig1/0/3] port hybrid vlan 1 2 3 untagged
[Switch A-gig1/0/3] port hybrid pvid vlan 1
[Switch A-gig1/0/3] port hybrid protocol-vlan vlan 2 all
[Switch A-gig1/0/3] port hybrid protocol-vlan vlan 3 all
[Switch A-gig1/0/3] quit

[Switch A] interface gig 1/0/4
[Switch A-gig1/0/4] undo shutdown
[Switch A-gig1/0/4] port link-type trunk
[Switch A-gig1/0/4] port trunk permit vlan all
[Switch A-gig1/0/4] quit
```

Repeat the previous steps on Switch B.

Verify

The next steps will test and verify that the configuration has been properly executed.

1. Ping from Router A to Router B with interface g0/0/3 shutdown on both routers. This represents traffic flowing through the IP Subnet 10.0.2.0.

```
[Router B] interface g0/0/3
[Router B-gig0/0/3] shutdown
[Router B-gig0/0/3] interface g0/0/2
[Router B-gig0/0/2] undo shutdown
```

```
[Router A] interface g0/0/3
[Router A-gig0/0/3] shutdown

[Router A-gig0/0/3] interface g0/0/2
[Router A-gig0/0/2] undo shutdown
[Router A-gig0/0/2] ping 10.0.2.2
```

2. Now, ping from Router B to Router A with interface g0/0/3 shutdown on both routers.

```
[Router B] interface g0/0/2
[Router B-gig0/0/2] ping 10.0.2.1
```

3. Ping from Router A to Router B with interface g0/0/2 shutdown on both routers. This represents traffic flowing through the IP Subnet 10.0.3.0.

```
[Router B] interface g0/0/3
[Router B-gig0/0/3] undo shutdown
[Router B-gig0/0/3] interface g0/0/2
[Router B-gig0/0/2] shutdown

[Router A] interface g0/0/2
[Router A-gig0/0/2] shutdown
[Router A-gig0/0/2] interface g0/0/3
[Router A-gig0/0/3] undo shutdown
[Router A-gig0/0/3] ping 10.0.3.2
```

3. Now, ping from Router B to Router A with interface g0/0/2 shutdown on both routers.

```
[Router B] interface g0/0/3
[Router B-gig0/0/2] ping 10.0.3.1
```

Reset

1. Remove VLAN 2 and VLAN 3 from both the switches.

```
[Switch A] undo vlan 2
[Switch A] undo vlan 3
```

2. Repeat the same for Switch B.

Additional links

End User License Agreement

HNS configurations are similar to those of the HP 5900 Switch Series. See the HP 5900 Switch Series manuals for configuration guidance.

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