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Налаштування конвергентних комп'ютерних мереж

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з навчальної дисципліни
"Конвергентна мережна інфраструктура"
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Лабораторний практикум призначений для формування практичних навичок налаштування конвергентних комп'ютерних мереж під час вивчення курсу "Конвергентна мережна інфраструктура".

Лабораторний практикум сприяє підготовці фахівців на рівні міжнародної професійної сертифікації, які здатні працювати з перспективними мережевими рішеннями HPE FlexNetwork - унікальної гнучкої мережної архітектури, яка реалізує відкриті рішення та віртуальну інфраструктуру. Практикум забезпечує формування здатності до розробки архітектурних рішень побудови мереж з гнучкою архітектурою, проектування та розробка мережних рішень гнучкої архітектури, інтеграція мережних рішень та систем гнучкої архітектури, адміністрування гнучкої мережної архітектури, використання нових технологічних рішень для удосконалення гнучкої мережної архітектури.

Лабораторний практикум призначено для студентів, аспірантів і викладачів, які планують підготуватися до міжнародної сертифікації рівня HP Accredited Technical Professional (HP ATP) – FlexNetworks.

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Introduction

This book helps you study for the Applying HP FlexNetwork Fundamentals (HP0-Y52) exam and the HP2-Z37 fast track exam to achieve the HP ATP FlexNetwork Solutions V3 certification. The certification validates that you have the networking skills and expertise to design, implement and manage the modern network, based on the HP FlexNetwork Architecture, for small to mid-size businesses. It also verifies that you understand the converged infrastructure strategy including network virtualization with HP's Intelligent Resilient Framework (IRF).

Areas of study include the ability to:

Perform basic configuration, access security and setup on HP switches;

Configure Layer 2 technologies such as STP, Link Aggregation and VLANs;

Configure basic IP Routing with static and dynamic routing technologies;

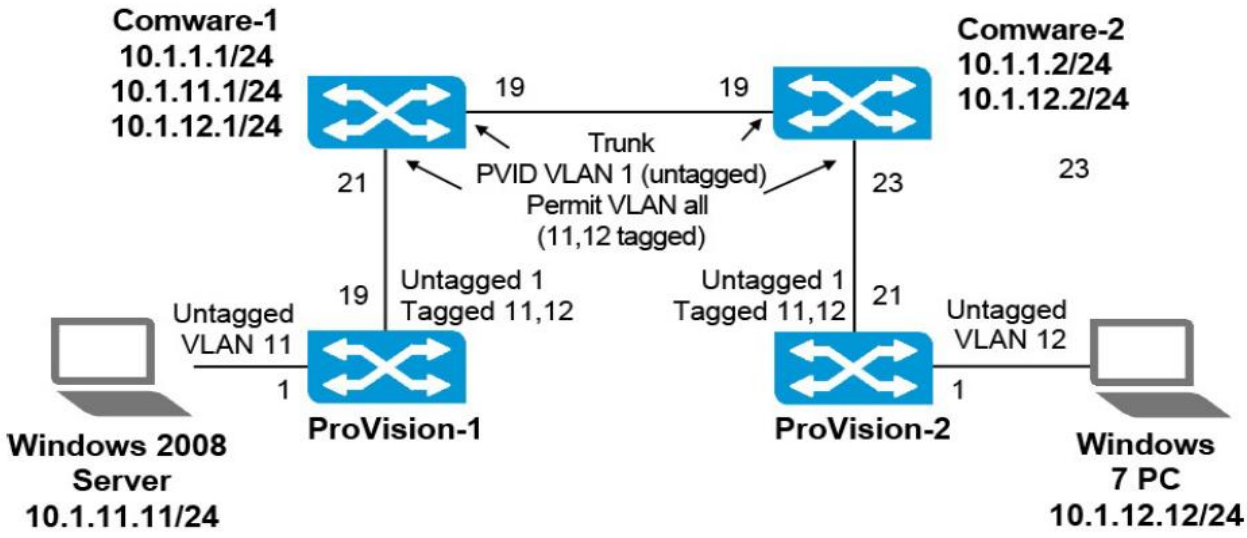
Manage and monitor networks with HP IMC network management software.

This Laboratory workshop introduces you to: Switch management, HP ProVision command line interface (CLI) and Comware CLI, Basic networking technologies and protocols, such as link aggregation, virtual LANs (VLANs), Spanning Tree Protocol (STP), HP Intelligent Resilient Framework(IRF), and Simple Network Management Protocol (SNMP).

This Laboratory workshop provides some example configurations that guide you through the steps required to configure technologies such as STP or HP IRF. Each example configuration includes a network topology such as the one shown in Figure Introduction.

These network topologies include four switches, which are labeled ProVision-1, ProVision-2, Comware-1, and Comware-2. The network topology also includes a Windows server and a Windows client.

The network topology shows IP addresses, VLAN assignments, and the ports used to connect to each switch. In Figure Introduction, for example, Comware-1 connects to ProVision-1 on port 21 and connects to Comware-2 on port 19.



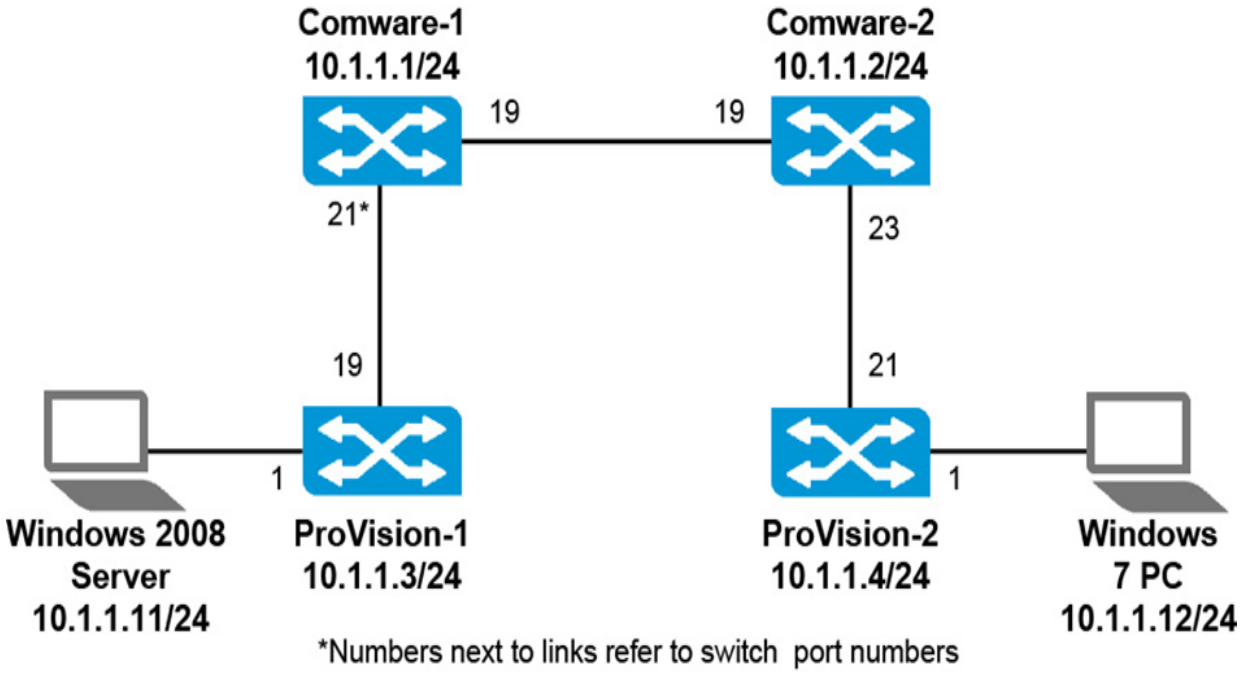
Basic Switch Configuration.
Lab Activity 1

Objectives

For the lab activities in this course, you should assume that you are a network administrator who has been hired to install and configure HP switches at a small company.
After completing this lab, you will be able to:

- Explore the HP switch CLI
- Return switch to factory default settings
- Examine command history
- Define the switch hostname
- Assign an IP address to the VLAN 1 interface
- View commands previously executed on the switch
- Accessing switch interfaces, disable and enable interfaces
- Save configuration settings
- Examine Link Layer Discovery Protocol (LLDP)
- Examine the ARP table
- Check basic connectivity

At the end of this activity, your lab topology will be similar to that shown in Figure.

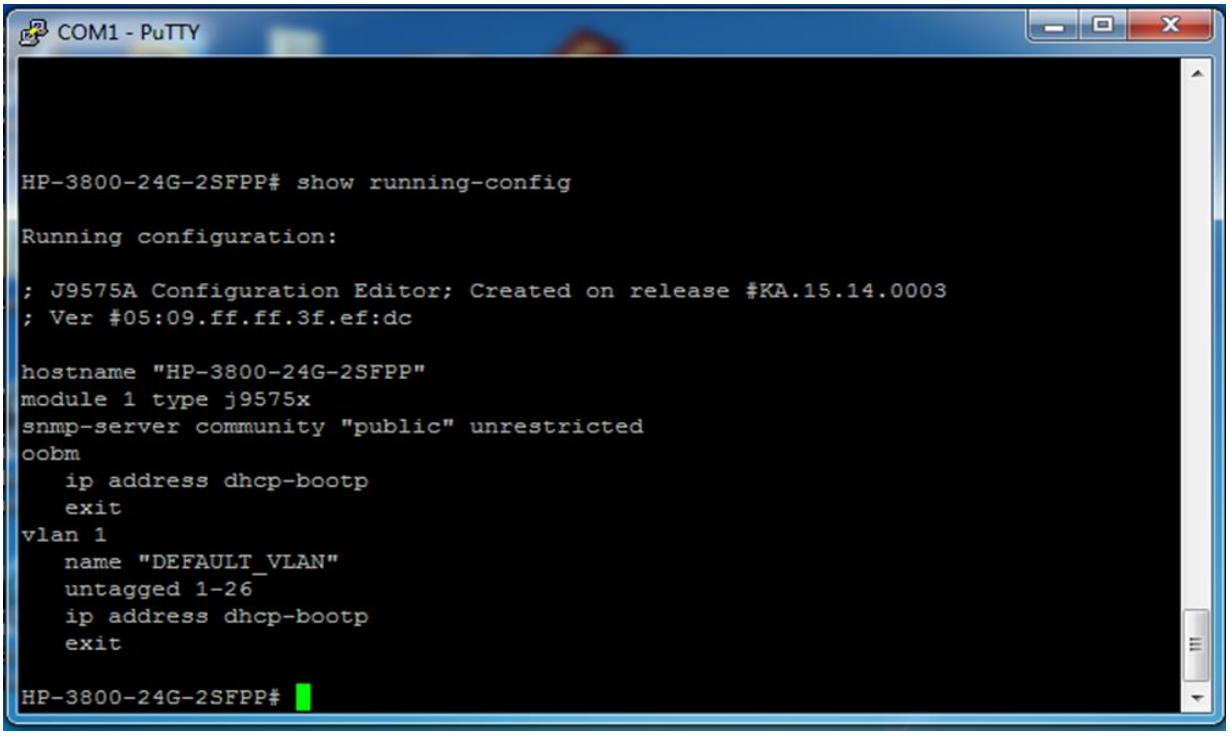


Task 1: Explore the CLI on an HP ProVision Switch

1. Verify that the switch has the correct Lab 1 startup configuration by running the command:

Switch# show running-config

You should see output similar to the following (some output has been omitted and replaced with "…"):



If the running-config includes other settings, you must return HP ProVision switch to factory default settings

2. Return HP ProVision switch to factory default settings

If the output includes other commands, you can return the ProVision switch to factory default settings using the following command:

ProVision# erase startup-config

During the process of returning the switch to factory default settings, you will be prompted to confirm that you want to reboot the switch; **press y**. The switch will be rebooted.

3. You can use help keys to find the appropriate command to complete a particular task or to help you complete a command. Note that, if you enter a string and ? without a space, you see commands that start with those letters. If you enter a command and ? after a space, you see options for that command.

You must use help keys on the next level:
basic level
enable level
global configuration level

CLI	Description
? or help	See a brief description for all available commands at your context or view.
<string>?	See commands that start with certain letters.
<command> ?	See options for the command and a brief description of each option.
<string><Tab>	Auto complete a command or a command option: Type as many characters as necessary to identify the command uniquely and press <**Tab**>

? _____
_____
<string> ? _____
_____

<command> ? _____
_____

<string> Tab _____
_____

Some important commands available at the enable context include:
show, which enables you to examine current configuration parameters
copy, which enables you to back up the switch configuration
ping and **traceroute**, which are connectivity test tools

To list the parameters available for the show command, enter:
ProVision# show ?

Task 2: Explore the CLI on an HP Comware Switch

1. The Comware switch prompt indicates your current view: <HP>. You can move to the system view by entering the command:
system-view
[HP]

Verify that the switch has the correct Lab 1 startup configuration by running the command:

[Comware] display current-configuration

You should see output similar to the following (some output has been omitted and replaced with "…"):

_____
_____
_____

If the current-configuration includes other settings, you must return HP Comware switch to factory default settings

2. Return HP ProVision switch to factory default settings

If the Comware switch is not running the default configuration, you can return it to factory default settings by entering:

<HP> reset saved-configuration

When the following prompt is displayed, **press y** and then <Enter>.

The saved configuration file will be erased. Are you sure? [Y/N]: ***Y***
Configuration file in flash is being cleared.
Please wait ...
MainBoard:
Configuration file is cleared.

You then need to reboot the switch, using the reboot command as shown below. If a prompt is displayed, asking if you want to save the current configuration, **press n** and then press <Enter>. When prompted to continue the reboot, **press y** and then <Enter>.

<HP> reboot
Start to check configuration with next startup configuration file, please wait.....DONE!
*This command will reboot the device. Current configuration will be lost, save current configuration? [Y/N]:****n***
*This command will reboot the device. Continue? [Y/N]:****y***
#May 1 14:00:07:594 2000 Comware DEVM/1/REBOOT:
Reboot device by command.
%May 1 14:00:07:694 2000 Comware DEVM/5/SYSTEM_REBOOT: System is rebooting now.
Starting.....

3. You can use help keys to find the appropriate command to complete a particular task or to help you complete a command. Note that, if you enter a string and ? without a space, you see commands that start with those letters. If you enter a command and ? after a space, you see options for that command

You must use help keys on the next level:
user view
system-view

? or help _____
_____

<string> ? _____
_____

<command> ? _____
_____

<string> Tab _____
_____

Some important commands available at the system-view level include:
display, which enables you to examine current configuration parameters
save, which enables you to back up a switch configuration
ping and **traceroute**, which are connectivity test tools

To list the parameters available for the display command, enter:
<Comware> display ?

Task 3: Configure a hostname and sysname

1. Configure a hostname on an ProVision switch

Navigate to the (config)# context. The global configuration context provides the commands necessary to complete most of the steps in this activity.

Define a hostname for your switch. Use the name (either **ProVision-1 or ProVision-2**). The prompt will immediately change to display your new hostname.

Switch (config)# hostname ProVision-1

2. Configure a sysname on an Comware switch

Custom names for Comware switches are called system names, or sysname. To assign a system name, first access the system view. From there, enter the sysname [name] command.

Define a hostname for your switch. Use the name **(either Comware-1 or Comware-2**). If you wanted to assign the switch a sysname of Comware-1, you would enter:

[HP] sysname Comware-1

Task 4: View commands previously executed on the switch

1. Examine command history on an ProVision switch

You can view the commands that have been entered on both the ProVision and Comware CLI. On a ProVision switch, enter:

ProVision-1# show history

You will see output similar to the following:

6 configure
5 hostname ProVision-1
4 show interfaces brief
3 interface 2-18,20-24 disable
2 interface 1 name Server
1 interface 19 name Comware-1

As the example output shows, the administrator moved to the global configuration mode, configured the hostname, view the interfaces, disabled interfaces 2–18 and 20–24, and configured descriptions for interfaces 1 and 19.

Note the number to the left of each entry in the history. You can repeat any command in the history by entering **repeat** followed by the index number.

Switch(config)# repeat <index_number>

Press any key to stop the command from repeating.

You can repeat any command a specific number of times by entering **count** and an integer after the **repeat** command. For instance, the following command will repeat the last command twice.

Switch(config)# repeat count 2

2. Examine command history on an Comware switch

On a Comware switch, enter:

[Comware-1] display history

You will see output such as:

system-view
sysname Comware-1
port-group manual myports
group-member e1/0/1 to e1/0/24
shutdown
quit

As this example output shows, the administrator moved to the System view, configured a sysname, created a port group, added interfaces to the port group, shut down the interfaces assigned to the port group, and moved back to the System view.

Task 5: Accessing HP ProVision switch interfaces, disable and enable interfaces

1. Accessing HP ProVision switch interfaces

You can configure settings on a range of interfaces at the same time. To do so, you simply specify multiple IDs rather than the individual IDs in the command. Use a comma (,) to separate port IDs and a dash (-) to indicate a range. For example, enter:

ProVision(config)# interface 1,3-6

You then access a prompt that indicates the range of interfaces. For example, if you entered the command above, the prompt would reflect these interfaces:

ProVision(eth-1,3-6)#

You can then configure the settings for this range of interfaces and return on the global configuration level

ProVision(eth-1,3-6)# exit

2. Disable and enable interfaces

By default, all interfaces on ProVision and Comware switches are enabled. You may want to disable all *unused* ports. Disabling ports can strengthen security, preventing anyone from connecting unauthorized devices to the network. It can also help prevent Layer 2 loops.

To disable ports - for example, ports 1 to 18 and ports 20 to 24 - on a ProVision-1 switch, enter the following command:

ProVision-1 (config)# interface 1-18,20-24 disable

If you enter this command on a switch that has a total of 26 ports, only interfaces 1 and 19 will be enabled.

To enable an interface, enter the following command:

ProVision-1 (config)# interface 1 enable

To disable ports - for example, ports 1 to 18 and ports 20 to 24 - on a ProVision-2 switch, enter the following command:

ProVision-2 (config)# interface 1-20,22-24 disable

If you enter this command on a switch that has a total of 26 ports, only interfaces 1 and 19 will be enabled.

To enable an interface, enter the following command:

ProVision-2 (config)# interface 1 enable

To check which interfaces are disabled or enabled on a Provision switch, enter the following command:

ProVision(config)# show interfaces brief

The output you see will look similar to the following:

_____
_____
_____
_____

You may also want to add descriptions to interfaces so that you can remember how they are used. For example, you can enter a description that indicates the device to which the interface is connected. In the example that follows, the description indicates interface 1 is connected to a server and interface 19 is connected to a switch with the sysname Comware-1:

ProVision-1 (config)# interface 1 name Server
ProVision-1 (config)# interface 19 name Comware-1

ProVision-2 (config)# interface 1 name PC
ProVision-2 (config)# interface 21 name Comware-2

Task 6: Accessing HP Comware switch interfaces, disable and enable interfaces

1. Accessing HP Comware switch interfaces

To access an interface context on Comware switches, you use the following command:

interface <type_slot_#>/<sub_slot>/<port_#>

You replace <slot_#> with the slot in which the module or the card is installed. For both modular and fixed port switches, <slot_#> begins at 1 on the switch and <sub_slot> begins at 0. The ports are numbered from 1 to the maximum number of ports supported on that switch.

For example, interface G1/0/19 indicates the port is Gigabit Ethernet port, and it is the 19 port on module 1.

[Comware] interface e1/0/19
[Comware-Ethernet1/0/19]

You can then configure the settings for this range of interfaces and return on the system-view.

[Comware-Ethernet1/0/19] quit

2. Creating a range of interfaces on HP Comware switches

When you define the **interface range**, you specify the range of interfaces that belong to it, and you can also give the interface range a name.

For example, you can enter:

[Comware] interface range name EdgePorts e1/0/1 e1/0/3 to e1/0/6

You can then configure settings on all of the interfaces at once.

quit

The interface range **persists in the device configuration**. You can access it again by specifying the range name. For example:

[Comware] interface range name EdgePorts

You can then configure additional settings on the interfaces that you previously defined in this range.

3. Creating a port group on HP Comware switches

Comware switches support another way of defining settings on multiple physical interfaces at once: **manual port groups**. Manual port groups are available in older versions of software. You define a manual port group by name. You then add interfaces to the group. For example:

[Comware] port-group manual EdgePorts
[Comware-port-group-manual-EdgePorts] group-member e1/0/1 e1/0/3 to e1/0/6
[Comware] port-group manual EdgePorts
[Comware-port-group-manual- EdgePorts] group-member e1/0/1 to e1/0/28
[Comware-port-group-manual- EdgePorts] shutdown
[Comware-port-group-manual- EdgePorts s] quit

You can then configure settings on all of the interfaces at once.

The port group **does not persist in the config**. If you want to configure settings on a range of interfaces again, you must create the port group again.

4. Disable and enable interfaces

If you wanted to disable just one port, you would enter:
[Comware-1] interface e1/0/1
[Comware-1-Ethernet1/0/1] shutdown
……
[Comware-1-Ethernet1/0/18] shutdown
[Comware-1-Ethernet1/0/20] shutdown
[Comware-1-Ethernet1/0/22] shutdown
[Comware-1-Ethernet1/0/23] shutdown
[Comware-1-Ethernet1/0/24] shutdown

If you wanted to disable just one port, you would enter:
[Comware-2] interface e1/0/1
[Comware-2-Ethernet1/0/1] shutdown
……
[Comware-2-Ethernet1/0/18] shutdown
[Comware-2-Ethernet1/0/20] shutdown
[Comware-2-Ethernet1/0/21] shutdown
[Comware-2-Ethernet1/0/22] shutdown
[Comware-2-Ethernet1/0/24] shutdown

To check which interfaces are disabled or enabled on a Comware switch, enter the following command:
[Comware] display interface brief

The output should be similar to the following:
The brief information of interface(s) under route mode:
Link: ADM - administratively down; Stby – standby

_____
_____
_____
_____
_____

To enable ports, enter the undo shutdown command at the appropriate interface context.
[Comware-1] interface e1/0/25
[Comware-1-Ethernet1/0/25] undo shutdown

[Comware-2] interface e1/0/25
[Comware-2-Ethernet1/0/25] undo shutdown

When you enable ports, you may want to add descriptions to help you remember how the port is being used. For example, if you wanted to enable port g1/0/19, you might enter the following description:

[Comware-1-Ethernet1/0/19] description Comware-2
[Comware-1-Ethernet1/0/21] description Provision-1
[Comware-1-Ethernet1/0/21] quit

[Comware-2-Ethernet1/0/19] description Comware-1
[Comware-2-Ethernet1/0/23] description Provision-2
[Comware-2-Ethernet1/0/23] quit

Task 7: Configuring IP addresses on an ProVision switches

To manually configure an IP address on a ProVision switch, first access the terminal session. From there, you can access the global configuration mode context, move to the desired VLAN context, and assign that VLAN an IP address. The following commands, for example, assign VLAN 1 the IP address 10.1.1.3 255.255.255.0.

ProVision# configure
ProVision(config)# vlan 1 ip address 10.1.1.3/24
ProVision(config)# exit

To verify the configuration, you enter:
ProVision# show ip

The output will look similar to the following:

_____
_____
_____

Task 8: Configuring IP addresses on an Comware switches

To configure an IP address on a Comware switch, you move to the system view, then to the view for the appropriate VLAN interface, and enter the IP address command. In the following example, VLAN 1 is assigned IP address 10.1.1.1 with a 24-bit mask.

<Comware> system-view
[Comware] interface vlan 1
[Comware-Vlan-interface1] ip address 10.1.1.1 24

To verify the configuration, enter the display this command. You can use this command at any CLI context to display the commands that apply to that particular context.

[Comware-Vlan-interface1] display this

The output should look similar to the following:

Task 9: Save configuration settings

When you make configuration changes to the switch, you should save the changes to the startup-config file. If you do not save these changes, they will be lost if the switch is rebooted.

1. HP ProVision switches
To save the configuration on a ProVision switch, enter the following command:
ProVision(config)# write memory

2. HP Comware switches
To save the configuration on a Comware switch, enter:
[Comware] save

When prompted if you are sure you want to save the config, press **y**. When prompted to input a filename, accept the default and press <Enter>.

The current configuration will be written to the device. Are you sure? [Y/N]:
y
Please input they file name(.cfg)[flash:/config.cfg]*
(To leave the existing filename unchanged, press the enter key): <Enter>
Validating file. Please wait....

Saved the current configuration to mainboard device successfully

Task 10: Examine Link Layer Discovery Protocol (LLDP)

In a heterogeneous network, devices from different vendors need to be able to discover one another and exchange configuration information. To enable this exchange of information, the Internet Engineering Task Force (IETF) defined LLDP in IEEE 802.1AB. The protocol operates at the Data Link layer, enabling directly connected devices to exchange information.

With LLDP, devices exchange local device information such as its major functions:

management IP address;
device ID;
port ID.

Each device sends this information as type, length, and value (TLV) in LLDP data units (LLDPDUs) to directly connected devices. At the same time, the device receives LLDPDUs from neighbors that support LLDP. The local device saves the information it receives in a standard management information base (MIB). Simple Network Management Protocol (SNMP) programs, such as HP Intelligent Management Center (IMC), can use the LLDP information stored in MIBs to quickly detect Layer 2 network topology changes and identify each change.

1. Link Layer Discovery Protocol (LLDP) on an ProVision switch

HP switches support Link Layer Discovery Protocol (LLDP), a Layer 2 protocol that enables devices to exchange information such as their system name, description, IP addresses, and information about routing support. Enter:

Switch# show lldp ?

What options are available?

_____
_____
_____

Enter:

Switch# show lldp info remote-device

What information is displayed?

_____
_____
_____

Enter the following command, including the number of a port connected to another device.

Switch# show lldp info remote-device <port>

What information is displayed?

_____
_____
_____

2. Link Layer Discovery Protocol (LLDP) on an Comware switch

Enter:

[Comware] lldp enable

[Comware] display lldp ?

What options are available?

_____
_____
_____

Enter:
[Comware] display lldp neighbor-information

What information is displayed?

_____
_____
_____

3. ***[Comware] display lldp neighbor-information ?***

What options are available?

_____
_____
_____

Enter:
[Comware5]display lldp neighbor-information brief

What information is displayed?

_____
_____
_____

Enter the following command, including the number of a port connected to another device.

[Comware]display lldp neighbor-information interface g1/0/21

What information is displayed?

_____
_____
_____

Task 11. Examine the ARP table

1. If you want to examine the ARP table on the ProVision switch, use the **show arp** command. As the example output below shows, the ARP table displays the device, its IP address, and its MAC address.

ProVision# show arp

_____
_____
_____

You can also examine the MAC address table on ProVision switch by using the **show mac-address** command. The table displays the device, its MAC address, and its port.

ProVision# show mac-address

_____
_____
_____
_____

2. To examine the ARP table on a Comware switch, use the display arp command. You will see output similar to the following:

[Switch]# display arp

_____
_____
_____

To examine the MAC address table, use the **display mac-address** command.

[Switch]# display mac-address

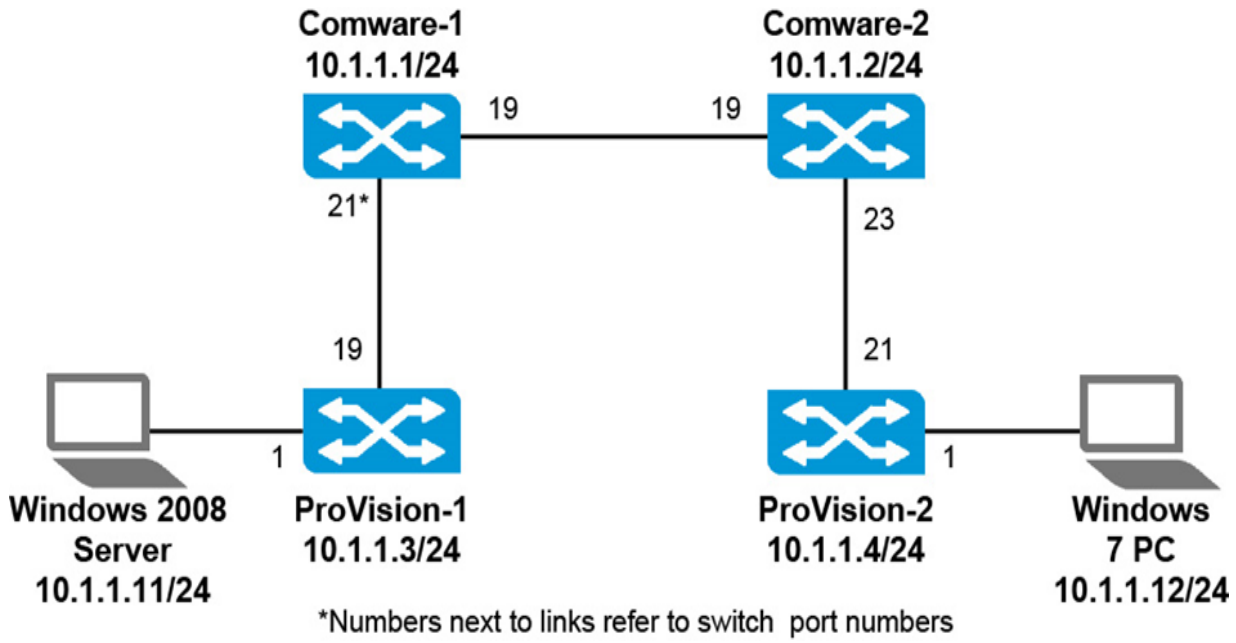
_____
_____
_____

Protecting Management Access.
Managing Software and Configurations
Lab Activity 2

Objectives

For the lab activities in this course, you should assume that you are a network administrator who has been hired to install and configure HP switches at a small company.
After completing this lab, you will be able

- Access on an HP ProVision switch
- Access on an HP Comware switch
- Software images on HP ProVision switches
- Software images on HP Comware switches
- Configuration file management on HP Provision switches
- Configuration file management on HP Comware switches



Task 1: Explore the CLI on an HP Provision switches

1. Verify that the HP ProVision switch has the correct Lab 2 startup configuration by running the command:

Switch# show running-config

You should see the output.
If the running-config includes other settings, you must return HP ProVision switch *to factory default settings.*

2. Return HP ProVision switch to factory default settings

If the output includes other commands, you can return the ProVision switch to factory default settings using the following command:

ProVision# erase startup-config

During the process of returning the switch to factory default settings, you will be prompted to confirm that you want to reboot the switch; **press y**. The switch will be rebooted.

3. Startup Configs on an HP Provision switches for Lab Activity 2

ProVision-1
hostname "ProVision-1"
interface 1
name "Server"
exit
interface 2-18
disable
exit
interface 19
name "Comware-1"
exit
interface 20-24
disable
exit
vlan 1
name "DEFAULT_VLAN"
untagged 1-24
ip address 10.1.1.3 255.255.255.0
exit
snmp-server community "public" unrestricted

ProVision-2
hostname "ProVision-2"
interface 1
name "PC"
exit
interface 2-20

disable
exit
interface 21
name "Comware-2"
exit
interface 22-24
disable
exit
vlan 1
name "DEFAULT_VLAN"
untagged 1-24
ip address 10.1.1.4 255.255.255.0
exit
snmp-server community "public" unrestricted

Task 2: Explore the CLI on an HP Comware switch

1. The Comware switch prompt indicates your current view: <HP>
You can move to the system view by entering the command:

<Comware5> system-view
[Comware5]

Verify that the switch has the correct Lab 2 startup configuration by running the command:
[Comware] display current-configuration

You should see the output.
If the current-configuration includes other settings, you must return HP Comware switch *to factory default settings.*

2. Return HP Comware switch to factory default settings

If the Comware switch is not running the default configuration, you can return it to factory default settings by entering:

<HP> reset saved-configuration

When the following prompt is displayed, **press y** and then <Enter>.

The saved configuration file will be erased. Are you sure? [Y/N]: ***Y***
Configuration file in flash is being cleared.
Please wait ...
MainBoard:
Configuration file is cleared.

You then need to reboot the switch, using the reboot command as shown below. If a prompt is displayed, asking if you want to save the current configuration, press **n** and then press <Enter>. When prompted to continue the reboot, press **y** and then <Enter>.

<HP> reboot
Start to check configuration with next startup configuration file, please wait.....DONE!
*This command will reboot the device. Current configuration will be lost, save current configuration? [Y/N]:**n***
*This command will reboot the device. Continue? [Y/N]:**y***
#May 1 14:00:07:594 2000 Comware DEVM/1/REBOOT:
Reboot device by command.
%May 1 14:00:07:694 2000 Comware DEVM/5/SYSTEM_REBOOT: System is -rebooting now.
Starting.....

3. Startup Configs on an HP Comware switches for Lab Activity 2

Comware-1
sysname "Comware-1"
interface Vlan-interface1
ip address 10.1.1.1 255.255.255.0
interface Ethernet1/0/1
shutdown
……
interface Ethernet1/0/18
shutdown
interface Ethernet1/0/19
description Comware-2
interface Ethernet1/0/20
shutdown
interface Ethernet1/0/21
description Provision-1
interface Ethernet1/0/22
shutdown
……
interface Ethernet1/0/24
shutdown

Comware-2
sysname "Comware-2"
interface Vlan-interface1
ip address 10.1.1.2 255.255.255.0
interface Ethernet1/0/1

shutdown
……
interface Ethernet1/0/18
shutdown
interface Ethernet1/0/19
description Comware-1
interface Ethernet1/0/20
shutdown
interface Ethernet1/0/21
shutdown
interface Ethernet1/0/22
shutdown
interface Ethernet1/0/23
description Provision-2
interface Ethernet1/0/24
shutdown

Task 3: Access on an HP ProVision switch

1. You can protect management access to the switch's CLI by configuring a manager username and password, an operator username and password, or both.

To configure a **password**, access the ProVision switch CLI and move to the global configuration mode.

ProVision-1# configure

To configure an **operator password**, you use the password operator command. When you enter this command, you will be prompted to type the password. The password you enter is case sensitive. In the following example, the password will be set to "(111)"

ProVision-1(config)# password operator
New password for operator: 111
Please retype new password for operator: 111

To configure a **manager password**, you enter the password manager command from the global configuration mode. As before, you will be prompted to enter the password.

ProVision-1(config)# password manager
New password for manager: 222
Please retype new password for manager: 222

Type **logout** to log out of the management interface. Type **yes** or **y** when prompted to confirm logout and to save the current configuration.
Press Enter several times to **re-enter** the CLI.

When users access the switch CLI, they will be prompted for a username. As you recall, if you do not set a username, the default username, **operator**—is used. When the users are prompted for a username, they can enter **operator**.

Username: operator

Users will then be prompted for a password. For the example used above, users would enter **hp**. Note that when entering the password, users will not see the letters that they type.

Password: 111

If users enter the correct password for the operator, they will be at the basic mode. From here, users can try to move to the enable mode by entering:

ProVision-1> enable

When users access the switch CLI, they will be prompted for a username. As you recall, if you do not set a username, the default username, **manager** —is used.

When the users are prompted for a username, they can enter **manager**.

Username: manager

Users will then be prompted for a password. For the example used above, users would enter hp. Note that when entering the password, users will not see the letters that they type.

Password: 222

Remove the username and passwords for both the manager and operator accounts.

Switch(config)# no password all

Type **logout** and press Enter to reestablish a management session. Notice that you are not prompted for a username and password.

2. If you want to change the manager username, you can add the user-name option to the password manager command and then specify another username.

You can configure a different username for the operator, using the same user-name option:

ProVision-1(config)# password operator user-name techsupport

New password for operator: 111

Please retype new password for operator: 111

The command below changes the manager username to admin.

ProVision-1(config)# password manager user-name admin

New password for manager: 222

Please retype new password for manager: 222

Type **logout** to log out of the management interface. Type **yes** or **y** when prompted to confirm logout and to save the current configuration.
Press Enter several times to **re-enter** the CLI.

When users access the switch CLI, they will be prompted for a username. Username in this case **techsupport** is used. When the users are prompted for a username, they can enter **techsupport**.

Username: techsupport

Users will then be prompted for a password. For the example used above, users would enter **hp**. Note that when entering the password, users will not see the letters that they type.

Password:111

If users enter the correct password for the operator, they will be at the basic mode. From here, users can try to move to the enable mode by entering:

ProVision-1> enable

When users access the switch CLI, they will be prompted for a username. Username in this case **admin** is used. When the users are prompted for a username, they can enter **admin**.

Username admin

Users will then be prompted for a password. For the example used above, users would enter hp. Note that when entering the password, users will not see the letters that they type.

Password: 222

Remove the username and passwords for both the manager and operator accounts.

Switch(config)# no password all

Type **logout** and press Enter to reestablish a management session. Notice that you are not prompted for a username and password.

3. Configure the operator and manager username and password in the following way:

ProVision(config)# password operator user-name <name> plaintext <password>
ProVision(config)# password manager user-name <name> plaintext <password>

ProVision(config)# password operator user-name techsupport plaintext 111
ProVision(config)# password manager user-name admin plaintext 222

Type **logout** to log out of the management interface. Type **yes** or **y** when prompted to confirm logout and to save the current configuration.
Press Enter several times to **re-enter** the CLI.

When users access the switch CLI, they will be **prompted for a username and password** similarly to the previous cases.

4. If you want **to store the credentials** in the internal flash and view them in the config, you should enter the include-credentials command.

ProVision(config)# include-credentials

After you enter this command, the currently configured manager and operator usernames and passwords, RADIUS shared secret keys, SNMP and 802.1X authenticator (port-access) security credentials, and SSH client public-keys are stored in the running configuration. To view the currently configured security settings in the running configuration, enter:

ProVision# show running-config

_____
_____
_____

5. You can remove the password for the operator account by entering:

ProVision-1(config)# no password operator
Password protection for operator will be deleted, continue [y/n]? y

To remove the manager password, enter:

ProVision(config)# no password manager
Password protection for manager will be deleted, continue [y/n]? y

Remove the username and passwords for both the manager and operator accounts.

Switch(config)# no password all

Type **logout** and press Enter to reestablish a management session. Notice that you are not prompted for a username and password.

Task 4: Access on an HP Comware switch

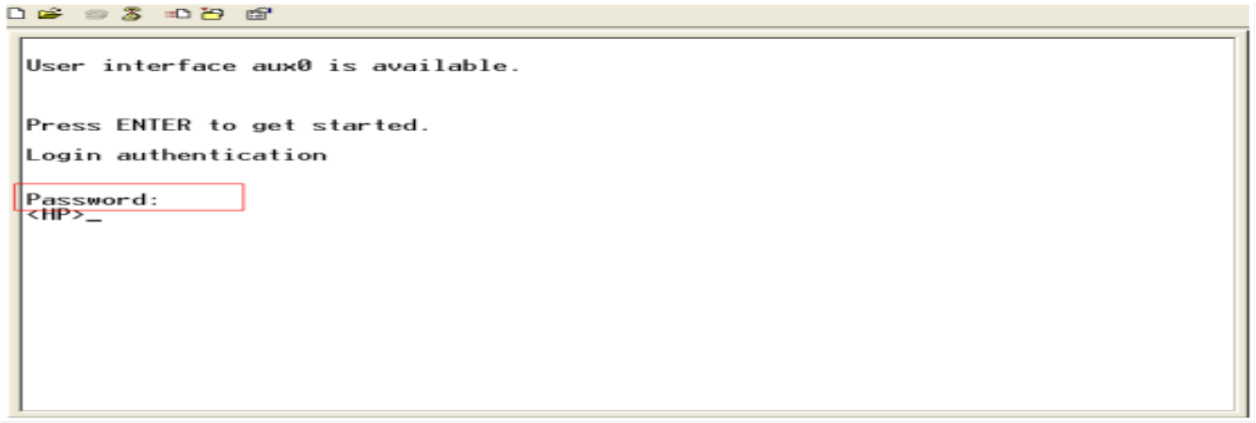
1. Configuring password authentication for console login

By default, console login does not require authentication. Any user can log in through the console port without authentication and have user privilege level 3. To improve device security, configure the password or scheme authentication mode immediately after you log in to the device for the first time.

To configure password authentication for console login you must:

<Comware5> system-view
[Comware5] user-interface aux 0
[Comware5-ui-aux0] authentication-mode password
[Comware5-ui-aux0] set authentication password simple <password>
[Comware5-ui-aux0] authorization-attribute level 3
[Comware-1] quit
<Comware-1> quit

The next time you attempt to log in through the console port, you must provide the configured login password, as shown in Figure.



To remove the password you must configuring none authentication for console login

[Comware5] user-interface aux 0
[Comware5-ui-aux0] authentication-mode none
[Comware-1] quit
<Comware-1> quit

Press Enter several times to re-enter the CLI.

When users access the switch CLI, notice that you are not prompted for a password.

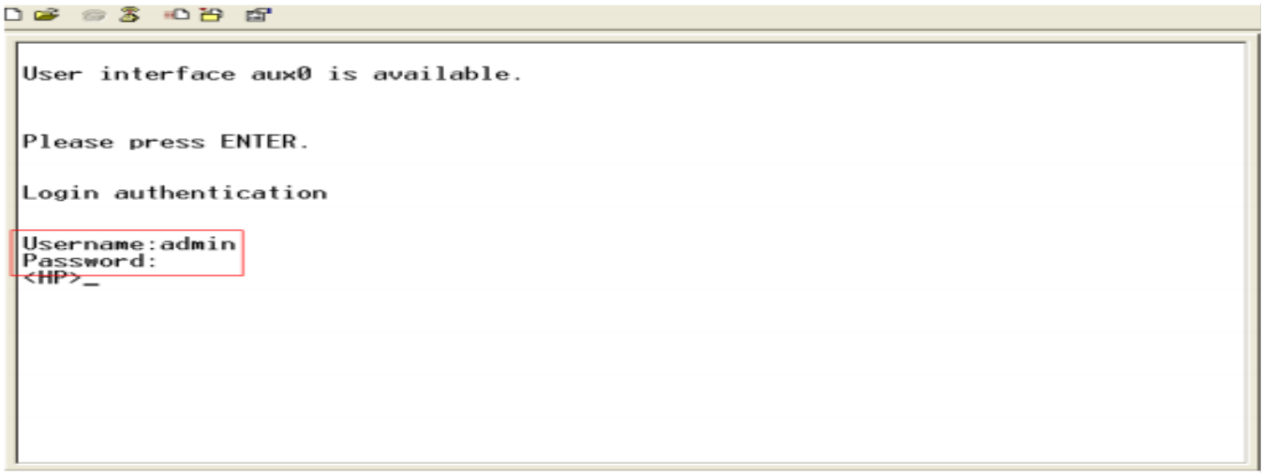
2. Configuring scheme authentication for console login:

If the local authentication scheme is used, use the authorization-attribute level command in **local user view** to set the user privilege level on the device.

To configure scheme authentication for console login you must:

<Comware5> system-view
[Comware5] local-user admin
[Comware5] password simple <password>
[Comware5] authorization-attribute level 3
[Comware-1] quit
<Comware-1> quit

The next time you attempt to log in through the console port, you must provide the configured login username and password, as shown in Figure.



To remove the password you must configuring none authentication for console login:

[Comware5] user-interface aux 0
[Comware5-ui-aux0] authentication-mode none
[Comware-1] quit
<Comware-1> quit

Press Enter several times to re-enter the CLI.

When users access the switch CLI, notice that you are not prompted for the username and password.

3. Password authentication on the VTY user interface

To set up password authentication on a Comware switch, access a console session with the switch and navigate to the system view.

<Comware-1> system-view

You can configure a password for one VTY interface or a range of VTY interfaces at the same time. To access the entire range of VTY interfaces, enter:

[Comware-1] user-interface vty 0 4

The interfaces already use password authentication, but the command for setting that method is authentication-mode password. The example below sets the password to "(111)"

[Comware-1-ui-vty0-4] authentication-mode password
[Comware-1-ui-vty0-4] set authentication password simple 111
[Comware-1-ui-vty0-4] quit

To determine the rights that a user who is currently logged in to the switch has, you can enter the display users command. As you can see in the output below, VTY interface (Telnet) users have privilege level 0 after these commands are entered.

[Comware-1] display users all

_____
_____
_____

You can change the privilege level for users who log in through Telnet by configuring the privilege level for the VTY user interfaces.
For example, to set the privilege level to 2, enter:

[Comware-1] user-interface vty 0 4
[Comware-1-ui-vty0-4] user privilege level 2
[Comware-1-ui-vty0-4] quit

This change will take affect when the user logs out of the switch and then logs in again. You can verify the change by entering the display users command when the user logs in to the switch again.

<Comware-1> display users all

_____
_____
_____

Remove the passwords.

[Comware-1] user-interface vty 0 4
[Comware-1-ui-vty0-4] authentication-mode none
[Comware-1-ui-vty0-4] quit
<Comware-1> quit

Press Enter to reestablish a management session. Notice that you are not prompted for a username and password.

4. Super password

By default, **no super passwords are set**. To permit users to raise their privileges to a specific level, simply set a super password for that level:

[Comware] super password [level-number] <cipher | plaintext> <string>

a) ***[Comware-1] super password level 1 simple 111***

If the super commands were entered on the switch, you could use a super password — 111, in this example—to move to a different privilege level.

<Comware-1> super 1
Password: 111
User privilege level is 1, and only those commands can be used
whose level is equal or less than this.
Privilege note: 0-VISIT, 1-MONITOR, 2-SYSTEM, 3-MANAGE

<Comware-1> display users all

_____
_____
_____

You could also enter the ? to list the commands you could execute:

<Comware-1> ?
User view commands:

_____
_____
_____
_____

If you tried to move to system view, however, you would see the following message:

<Comware-1> system-view
% Unrecognized command found at '^' position.

You cannot reach the system view and use configuration commands at this level.

b) ***[Comware-1] super password level 2 simple 111***

In this example, you could use the super password — 111 in the example — to switch to privilege level 2:

<Comware-1> super 2
Password: 111
User privilege level is 2, and only those commands can be used
whose level is equal or less than this.
Privilege note: 0-VISIT, 1-MONITOR, 2-SYSTEM, 3-MANAGE

<Comware-1> display users all

_____
_____
_____

If you entered "?" you would see that you now have access to more user view commands.

<Comware-1> ?
User view commands:

_____
_____
_____

c) ***[Comware-1] super password level 3 simple 111***

In this example, you could then switch to level 3, using the super password, 111.

<Comware-1> super 3
Password: 111
User privilege level is 3, and only those commands can be used whose level is equal or less than this.
Privilege note: 0-VISIT, 1-MONITOR, 2-SYSTEM, 3-MANAGE

<Comware-1> display users all

_____
_____
_____

If you entered "?" you would see that you now have access to more user view commands.

<Comware-1> ?
User view commands:

_____
_____
_____

The next time you logged in using a Telnet session, you would receive the privilege level 0. You could test this by completing the steps outlined above and then logging out of the switch.

[Comware-1] quit
<Comware-1> quit

You could check this by initiating a new Telnet session and logging back in. At the same time, you should launch a console session and, from that session, view users.

<Comware-1> display users all

_____
_____
_____

Task 5: Software images on HP ProVision switches

1. View software images on HP ProVision switches

If you want to know which software version a ProVision switch is running, access the switch CLI and then enter the show version command. Examine the output to determine which boot image the switch used when it booted last:

ProVision-1# show version
Image stamp:
*/ws/swbuildm/KA_rel_irvine_qaoff/code/build/tam(swbuildm_KA_rel_*
irvine_qaoff_rel_irvine)
Mar 13 2013 11:26:17
KA.15.10.0011
542
Boot Image: Primary

Record the software version on your switch below. You will compare this information to the output of show flash.

Image (software version): _____
Boot Image (boot location): _____

Now examine the current contents of the flash memory on your switch. The contents should be similar to the output shown in Figure. In this example, both flash areas contain the RA.15.05.10 software versions. You will replace the secondary image with the primary image.
Switch(config)# show flash

If you want to examine the boot files or boot ROM version in the switch's flash, use the show flash command:

ProVision-1# show flash
Image Size (bytes) Date Version
--- --- --- ---
Primary Image : 14881496 03/13/13 KA.15.10.0011
Secondary Image : 14881496 03/13/13 KA.15.10.0011
Boot ROM Version : KA.15.09
Default Boot : Primary

Record the software versions on your switch below

Primary
_____
Secondary
_____

What do **Boot image** (of show version) and **Default Boot** (of show flash) each refer to?
_____
_____
_____

2. Boot from different images on HP ProVision switches

To reconfigure the switch to boot from the secondary software location, you should use the boot system flash secondary command. This command reboots the switch immediately. You will be prompted to confirm the reboot. You may also be prompted to save the current configuration.

ProVision-1# boot system flash secondary
System will be rebooted from secondary image. Do you want to continue [y/n]? ***y***
Do you want to save current configuration [y/n/^C]? ***y***

After you enter this command, notice that as the switch reboots, its default boot profile is "(secondary.)"

After the switch reboots, you can use the show flash command to see which flash image was used on the last reboot. In the example output below, the secondary image was used.

ProVision-1# show version
Image stamp:
*/ws/swbuildm/KA_rel_irvine_qaoff/code/build/tam(swbuildm_KA_rel_*
irvine_qaoff_rel_irvine)
Mar 13 2013 11:26:17
KA.15.10.0011
542
Boot Image: Secondary

Boot Image_____

If you want to set the default flash location **to primary again**, you use the *boot set-default flash primary* command. Confirm the change by entering y when prompted.

ProVision-1# boot set-default flash primary
This command changes the location of the default boot. This command will change the default flash image to boot from primary image.
Hereafter, 'reload' and 'boot' commands will boot from primary image.
Do you want to continue [y/n]? ***y***

Note that the *boot set-default flash primary* command **does not initiate an immediate reboot**. If you **view the flash**, it shows the software selected for subsequent reboots.

ProVision-1# show flash

```
Image               Size (bytes) Date     Version
------------------ ------------ -------- ---------------
Primary Image     :     14881496 03/13/13 KA.15.10.0011
Secondary Image   :     14881496 03/13/13 KA.15.10.0011
Boot ROM Version : KA.15.09
Default Boot      : Primary
```

Primary _____
Secondary _____

However, if you view the version information, you will see that the switch is still using the **secondary image**, from which it booted before.

ProVision-1# show version
Image stamp:
*/ws/swbuildm/KA_rel_irvine_qaoff/code/build/tam(swbuildm_KA_rel_*
irvine_qaoff_rel_irvine)
Mar 13 2013 11:26:17
KA.15.10.0011
Boot Image: Secondary

If you want the switch to use the primary image, you can initiate a reboot. Because the switch has been configured to use the primary image on subsequent reboots, it will boot with this image.

ProVision-1# reload
System will be rebooted from primary image. Do you want to continue [y/n]? ***y***

Task 6: Software images on HP Comware switches

1. View software images on HP Comware switches

You can use the display version command to view the software version and the boot ROM version the switch is using. This information is highlighted in the example output below. Remember that some software upgrades might require an upgrade to the boot ROM. The release notes for each software version will note if a boot ROM upgrade is required.

<Comware-1> display version
HP Comware Platform Software
Comware Software, Version 5.20, Release 1211P09
Copyright (c) 2010-2012 Hewlett-Packard Development Company, L.P.
HP A5800-24G Switch uptime is 0 week, 0 day, 3 hours, 47 minutes
HP A5800-24G Switch with 2 Processors
1024M bytes SDRAM
4M bytes Nor Flash Memory
Config Register points to Nand Flash
Hardware Version is Ver.B
CPLD Version is 003
BootRom Version is 215
[SubSlot 0] 24GE+4SFP Plus Hardware Version is Ver.B
[SubSlot 1] No Module

BootRom Version _____

You can also use the *display boot-loader* command to determine the default image (switch OS) used when booting the switch.

<Comware-1> display boot-loader

The current boot app is: _____
The main boot app is: _____
The backup boot app is: _____
_____

To view the files in the flash file system of the switch, enter.

<Comware-1> dir

Directory of flash:/

```
   0     -rw-   7032287  Apr 26 2000 12:01:32   logfile.log
   1     -rw-       151  Apr 26 2000 14:17:59   system.xml
   2     -rw-      1983  Apr 26 2000 14:18:01   config.cfg
   3     -rw-      2406  Apr 26 2000 12:30:46   iccrunning.cfg
<-output omitted>
   28    drw-         -  Apr 28 2000 03:05:32   ams
   29    drw-         -  Apr 28 2000 03:05:33   apj
   30    drw-         -  Apr 28 2000 03:05:34   emea
   31    -rw-  21624756  Dec 02 2009 13:50:12   a5800_5820x-cmw520-
r1211p09.bin
```

In the above output, notice the configuration file, **config.cfg** (File 2). Files 28, 29, and 30 are directories. **File 31 is an operating system.**

Table lists the meaning of the letters in the second column.

Letter	Meaning
D	directory (The item is a directory)
R	read (You have read access to this file or directory.)
W	write (You have write access to this file or directory.)

2. Boot from different images on HP Comware switches

To change the software image that the switch uses to boot, you use the *boot-loader* command. The following example command makes the **s4mb03_02__03s56.app** file the new main OS from which the switch boots.

***<Comware-1> boot boot-loader* s4mb03_02__03s56.app**
This command will set the boot file of the specified board. Continue? [Y/N]: ***y***
The specified file will be used as the main boot file at the next reboot on slot 1!

To verify that the software image for the next boot has been changed, you use the display boot-loader command.

<Comware-1> display boot-loader

The current boot app is: _____
The main boot app is: _____
The backup boot app is: _____

If you want to set the same software file as the backup boot loader file, you use this command:

<Comware-1> boot boot-loader backup-attribute **s4mb03_02__03s56.app**
This command will set the boot file of the specified board. Continue? [Y/N]: y
The specified file will be used as the backup boot file at the next reboot on slot 1!

You can verify your changes by entering:

<Comware-1> display boot-loader

The current boot app is: _____
The main boot app is: _____
The backup boot app is: _____

The following example command makes the **s4mb03_03__02s56ep4.app** file the new main OS from which the switch boots.

***<Comware-1> boot boot-loader* s4mb03_03__02s56ep4.app**
This command will set the boot file of the specified board. Continue? [Y/N]: ***y***
The specified file will be used as the main boot file at the next reboot on slot 1!

The current boot app is: _____
The main boot app is: _____
The backup boot app is: _____

Task 7: Configuration file management on HP Provision switches

1. Configuration file management on an HP Provision switch

ProVision switches have three **config file** slots in their flash memory. You can copy **config files** to any slot in a number of ways:

- From another config file
- From a TFTP server or an SFTP server
- From a USB device

To view the config files in the ProVision switch's flash, you can use the show config files command.

ProVision-1# show config files

Configuration files:

```
id | act pri sec | name
---+-------------+-------------------------------------------------
 1 |   *   *   * | config1
 2 |             |
 3 |             |
```

2. Change the configuration file that HP ProVision switches use to boot

You will first create another configuration file and store it in slot 2 on the ProVision switch. To do so, you change the hostname on the existing configuration file and then copy the configuration to slot 2 on the ProVision switch.

From the global configuration view, change the switch's hostname to "(ProVision-X)" and save the configuration.

ProVision(config)# hostname ProVision-X

ProVision-X(config)# write memory

Copy the config1 file in the first slot to a file called config2 and verify the copy.

ProVision-X# copy config config1 config config2

ProVision-X# show config files

Configuration files:

```
id | act pri sec | name
---+-------------+-------------------------------------------------
 1 |   *   *   * | config1
 2 |             | config2
 3 |             |
```

Change the current configuration's hostname to "(ProVision-1)" and save this configuration change.

ProVision-X(config)# hostname ProVision-1
ProVision-1(config)# write memory

At this point, the **config2** file has a hostname of "(ProVision-X)" and the **config1** file, the default configuration boot file, has a hostname of "(ProVision-1.)"

ProVision switches give you two ways to boot from a config file:

- Set the config file as the default file used with the primary or secondary software (**startup-default command**)
- Boot from the primary or secondary software and use the config file just for this first reboot (**boot system command**)

This example uses the second option, using the boot system command to reboot the switch from its current software, primary, and from config file, config2. (If you complete this configuration and are prompted to save the configuration, do not.)

ProVision-1(config)# boot system flash primary config config2
System will be rebooted from primary image. Do you want to continue [y/n]? ***y***

After the switch reboots, the prompt should show that the switch booted from config 2.

ProVision-X#

View the configuration files. Notice that: **config2** is the active file; but **config2 is not a primary or a secondary** configuration file. The boot system command specified a one-time boot of this file.

ProVision-X# show config files
Configuration files:

```
id | act pri sec | name
---+-------------+-------------------------------------------------
 1 |       *   *  | config1
 2 |   *          | config2
 3 |              |
```

With this configuration, if you make a change to the running-config and save it, the change is saved to config2. You can test this by making and saving a simple change and then viewing config2.

ProVision-X(config)# hostname ProVision-Y
ProVision-Y(config)# write memory

ProVision-Y(config)# show config config2
Startup configuration:
; J9575A Configuration Editor; Created on release #KA.15.10.0011
; Ver #03:03.1f.ef:f0
*hostname "**ProVision-Y**"*
<output omitted>

The **config2** is now stored on the switch but is not associated with either flash area. You can configure the switch to use this configuration as its default configuration or associate it with one of the flash areas. The following command configures the switch to always use the "config2" file.

Switch(config)# startup-default config config2
Switch(config)# ***show config files***

_____
_____
_____

Remove the config2 configuration that you created in an earlier task. Reboot your switch, using the original startup-config file.

Switch(config)# boot system flash primary config config1

Enter **show config files** to verify that the configuration in id 1 is active. Also notice that the hostname of the switch is now ProVision-1.

_____
_____
_____

Remove the config2 configuration from the switch.

Switch(config)# erase config config2
Switch(config)# show config files

_____
_____
_____

Task 8: Configuration file management on HP Comware switches

1. Configuration file management on an HP Comware switch

With Comware devices, you have more options in storing and managing multiple configuration files. As you learned, Comware devices have an open flash directory that stores both software images and configuration files as well as other types of files. You can store as many configuration files to the flash as the memory allows. Configuration files always need the **.cfg** extension.

You can **choose a new startup-config** from any of these config files using the *startup saved-configuration* command. The command on its own or with the main option sets the specified config file as the new startup-config. A switch can only have **one main startup-config**. Any file that used to be the main startup-config is retained in flash, but it is no longer the startup-config.
You can optionally **use the backup option** with the *startup saved-configuration* command to select one file as the backup startup-config. The switch executes this file if the main startup-config cannot successfully boot for some reason.

2. Change the configuration file that HP Comware switches use to boot

First, view which file the Comware switch used as the startup configuration file when it booted:

<Comware-1> display startup

Current startup saved-configuration file: _____
Next main startup saved-configuration file:_____
Next backup startup saved-configuration file:_____

In the example output, the switch used **config.cfg**.

Change the switch's hostname to "(Comware-1)" and save the configuration.

<Comware> system-view
[Comware] sysname Comware-1
[Comware-1] save
The current configuration will be written to the device. Are you sure? [Y/N]:
y
Please input the file name(.cfg)[flash:/config.cfg]*
(To leave the existing filename unchanged, press the enter key): <Enter>
Validating file. Please wait....
Saved the current configuration to mainboard device successfully

This will change the hostname and save the configuration to the **config.cfg** file.

Now change the switch hostname to "(Comware-X.)"

<Comware> system-view
[Comware] sysname Comware-X
[Comware-X] quit

Save the modified configuration to a named configuration file, **backup.cfg**. If a file with this name is already stored on the switch, you will be prompted to save this configuration over an existing file. You may want to use a unique name for the file so you do not alter an existing configuration file. In this example, however, the response will be y to overwrite the file.

<Comware-X> save backup.cfg
*The current configuration will be saved to flash:/backup.cfg. Continue? [Y/N]:**y***
flash:/backup.cfg exists, overwrite? [Y/N]:y
Now saving current configuration to the device.

At this point, you have at least two configuration files in flash. The default file has a system name of "Comware-1," and the backup file has a system name of "Comware-X." Change the main startup-config file to backup.cfg by entering:

<Comware-X> startup saved-configuration backup.cfg main
Please wait ...
Setting the master board ...
... Done!

Reboot the switch. If you are prompted to save the configuration, DO NOT.

<Comware-X> reboot
Start to check configuration with next startup configuration file, please wait.
.....DONE!
This command will reboot the device. Current configuration will be lost in next startup if you continue. Continue? [Y/N]: y

Notice the prompt when you log in to the switch:

<Comware-X>

Verify that the backup.cfg configuration file was used to boot the switch.

<Comware-X> display startup
MainBoard:

Current startup saved-configuration file: _____
Next main startup saved-configuration file:_____
Next backup startup saved-configuration file:_____

Now, reset the main startup-config file to "(config.cfg.)"

<Comware-X> startup saved-configuration config.cfg main
Please wait ...
Setting the master board ...
... Done!

Reboot the switch so that it is once again using the **config.cfg** startup-config. If prompted to save the configuration, DO NOT.

<Comware-1> reboot

Start to check configuration with next startup configuration file, please wait.
.....DONE!
Current configuration will be lost, save current configuration? [Y/N] n
This command will reboot the device. Current configuration will be lost in next startup if you continue. Continue? [Y/N]: y

Verify that the **config.cfg** configuration file was used to boot the switch.

<Comware-X> display startup

Current startup saved-configuration file: _____
Next main startup saved-configuration file:_____
Next backup startup saved-configuration file:_____

3. Delete configuration files on HP Comware switches

If you want to delete a configuration file from flash, enter:

<Comware-1> delete backup.cfg

Delete flash:/backup.cfg?[Y/N]: y
%Delete file flash:/backup.cfg...Done.

To verify that the file has been deleted from flash, use the dir command.

<Comware-1> dir

Directory of flash:/

```
   1      -rw-       1983   Apr 26 2000 13:02:12   config.cfg
   2      -rw-        151   Apr 26 2000 13:02:10   system.xml
   3      -rw-    7032287   Apr 26 2000 12:01:32   logfile.log
   4      -rw-       2406   Apr 26 2000 12:30:46   iccrunning.cfg
<-output omitted->
```

Because the delete command places the file in the recycle bin in the Comware flash file system, the file still exists and can be recovered. Verify by viewing all files. File names surrounded by the square brackets indicate a file in the recycle bin.

<Comware-1> dir /all

Directory of flash:/

```
   0      -rw-       1983   Apr 26 2000 13:02:12   config.cfg
   1      -rw-        151   Apr 26 2000 13:02:10   system.xml
<-output omitted->
```

35 -rw- 21624756 Dec 02 2009 13:50:12 s5800_5820x-cmw520-r1109p01.bin
36 -rw- 1983 Apr 26 2000 13:02:28 **[backup.cfg**]

Virtual Local Area Networks (VLANs). Dynamic Host Configuration Protocol (DHCP) Services

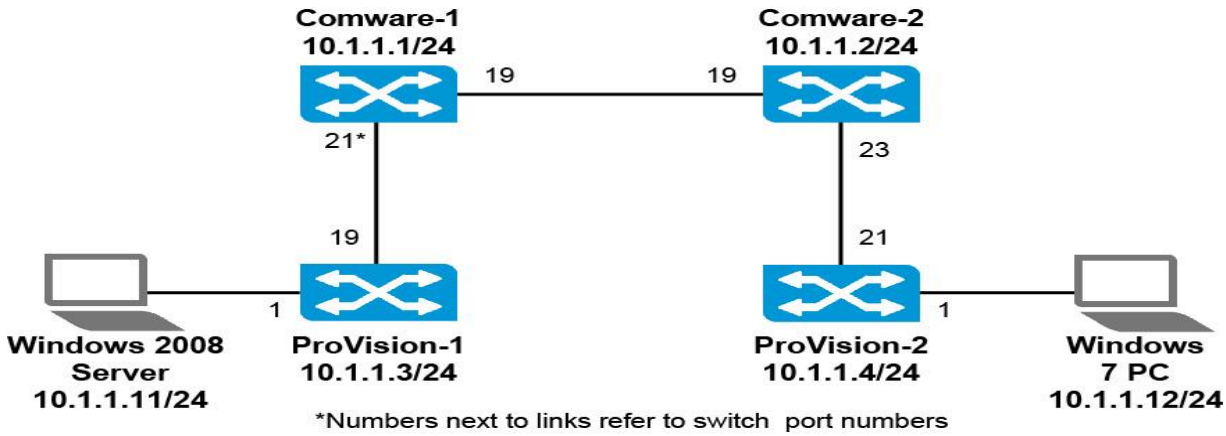
Lab Activity 3

Objectives

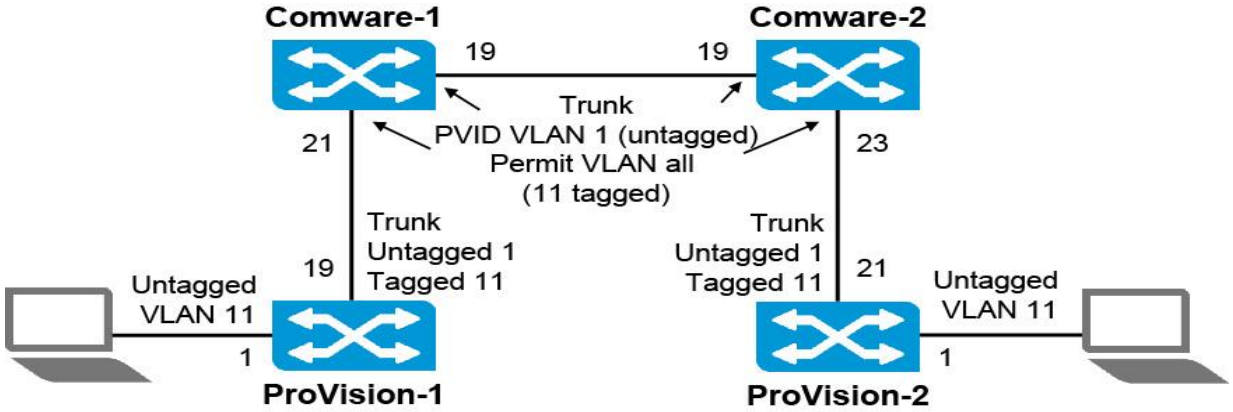
In this exercise, you will configure end-user VLANs on all of your switches and enable routing on the distribution-layer switch to ensure that users in all VLANs can contact each other and the server.

After completing this lab, you will be able

- Configuring VLAN 1, VLAN 11 on an HP switches, server and client
- Configure switch-to-switch links on HP switches
- Add another VLAN - VLAN 12
- Configuration file management on HP switches
- Routing between VLAN 11 and 12
- DHCP server settings on HP switches
- Implement DHCP relay on HP switches



Beginning network topology for the example configuration



Final network topology for the example configuration

Task 1: Explore the CLI on an HP Provision switches

1. Verify that the HP ProVision switch has the correct Lab 2 startup configuration by running the command:

Switch# show running-config

You should see the output.

If the running-config includes other settings, you must return HP ProVision switch *to factory default settings.*

2. Return HP ProVision switch to factory default settings

If the output includes other commands, you can return the ProVision switch to factory default settings using the following command:

ProVision# erase startup-config

During the process of returning the switch to factory default settings, you will be prompted to confirm that you want to reboot the switch; **press y**. The switch will be rebooted.

3. Startup Configs on an HP Provision switches for Lab Activity 3

ProVision-1

```
hostname "ProVision-1"
interface 1
        name "Server"
        exit
interface 2-18
        disable
        exit
interface 19
        name "Comware-1"
        exit
interface 20-24
        disable
        exit
vlan 1
        name "DEFAULT_VLAN"
        untagged 1-24
        ip address 10.1.1.3  255.255.255.0
        exit
snmp-server community "public" unrestricted
```

ProVision-2

```
hostname "ProVision-2"
interface 1
        name "PC"
        exit
interface 2-20
        disable
        exit
interface 21
        name "Comware-2"
        exit
interface 22-24
        disable
        exit
vlan 1
        name "DEFAULT_VLAN"
        untagged 1-24
        ip address 10.1.1.4  255.255.255.0
        exit
snmp-server community "public" unrestricted
```

Task 2: Explore the CLI on an HP Comware switch

1. The Comware switch prompt indicates your current view: <HP>
You can move to the system view by entering the command:
<Comware5> system-view
[Comware5]

Verify that the switch has the correct Lab 2 startup configuration by running the command:
[Comware] display current-configuration

You should see the output.
If the current-configuration includes other settings, you must return HP Comware switch *to factory default settings.*

2. Return HP Comware switch to factory default settings

If the Comware switch is not running the default configuration, you can return it to factory default settings by entering:
<HP> reset saved-configuration

When the following prompt is displayed, **press y** and then <Enter>.

The saved configuration file will be erased. Are you sure? [Y/N]: ***Y***
Configuration file in flash is being cleared.
Please wait ...
MainBoard:
Configuration file is cleared.

You then need to reboot the switch, using the reboot command as shown below. If a prompt is displayed, asking if you want to save the current configuration, press **n** and then press <Enter>. When prompted to continue the reboot, press **y** and then <Enter>.

<HP> reboot
Start to check configuration with next startup configuration file, please wait.....DONE!
*This command will reboot the device. Current configuration will be lost, save current configuration? [Y/N]:****n***
*This command will reboot the device. Continue? [Y/N]:****y***
#May 1 14:00:07:594 2000 Comware DEVM/1/REBOOT:
Reboot device by command.
%May 1 14:00:07:694 2000 Comware DEVM/5/SYSTEM_REBOOT: System is -rebooting now.
Starting.....

3. Startup Configs on an HP Comware switches for Lab Activity 3

Comware-1

```
sysname "Comware-1"
interface Vlan-interface1
        ip address 10.1.1.1  255.255.255.0
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-2
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
        description  Provision-1
interface Ethernet1/0/22
        shutdown
……
```

Comware-2

```
sysname "Comware-2"
interface Vlan-interface1
        ip address 10.1.1.2  255.255.255.0
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-1
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
        shutdown
interface Ethernet1/0/22
        shutdown
interface Ethernet1/0/23
        description  Provision-2
interface Ethernet1/0/24
        shutdown
……
interface Ethernet1/0/48
        shutdown
```

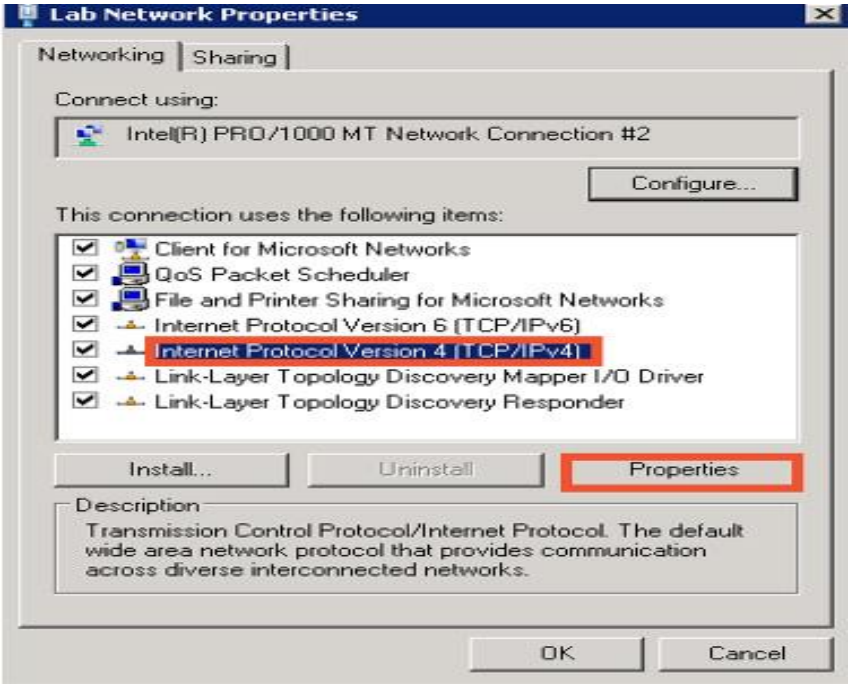
Task 3: Configuring server and client

The four switches shown in Beginning network topology for the example configuration, the server, and the client are configured with the VLAN 1 IP addresses listed in Table.

Switch	VLAN 1	VLAN 11
Comware-1	10.1.1.1	
Comware-2	10.1.1.2	
ProVision-1	10.1.1.3	
ProVision-2	10.1.1.4	
Windows 2008		10.1.11.11
Windows 7		10.1.11.12

1. Configuring IP address on a server and client

Access the Windows 2008 server desktop and configure its IP address.
Access the Properties window, select Internet Protocol version 4 (TCP/IPv4), and click Properties (see Figure).



Enter these settings: IP address = 10.1.11.11; Mask = 255.255.255.0; Gateway = 10.1.11.1

Click OK and then click Close. Open a command prompt on the server. Validate that you have set the IP address correctly.

ipconfig/all

Then you configuring similarly IP address on a Windows 7 PC with these settings: IP address = 10.1.11.12; Mask = 255.255.255.0; Gateway = 10.1.11.1
Task 4: Configuring VLAN 11 on HP switches

1. Configure VLAN 11 on HP ProVision-1 switch

From the global configuration on the ProVision-1 switch, create VLAN 11 and then make port 1 (the Windows 2008 server connection) an untagged member of VLAN 11.

ProVision-1(config)# vlan 11
ProVision-1(vlan-11)# untagged 1
ProVision-1(vlan-11)# exit

Verify that the interface is an untagged member of VLAN 11.

ProVision-1(config)# show vlan 11

```
ProVision-1(config)# show vlan 11
  Status and Counters - VLAN Information - VLAN 11
    VLAN ID : 11
    Name : VLAN11
      Status : Port-based
Voice : No
Jumbo : No
Port Information Mode      Unknown VLAN Status
---------------- -------- ------------ ----------
1                Untagged Learn        Up
```

2. Configure VLAN 11 on HP ProVision-2 switch

Access the ProVision-2 CLI and configure port 1 (the Windows 7 PC connection) as an untagged member of VLAN 11.

ProVision-2(config)# vlan 11
ProVision-2(vlan-11)# untagged 1
ProVision-2(vlan-11)# exit

View the VLANs that are configured on interface 1 and verify that the untagged VLAN is 11.

ProVision-2(config)# show vlan port 1 detail
Status and Counters - VLAN Information - for ports 1

```
VLAN ID Name                 | Status     Voice Jumbo Mode
------- -------------------- + ---------- ----- ----- --------
11      VLAN11               | Port-based No    No    Untagged
```

3. Configure VLAN 11 on HP Comware-1 and Comware-2 switches

Access the Comware-1 CLI and move to system view.
<Comware-1> system

Add VLAN 11.
[Comware-1] vlan 11

Access the Comware-2 CLI and move to system view.
Add VLAN 11.
[Comware-2] vlan 11

4. Test connectivity

Access the server desktop and open a command prompt. Attempt to ping the client.

ping 10.1.11.12

The ping fails. Why?

_____
_____
_____

Task 5: Configure switch-to-switch links on HP switches

1. Configure switch-to-switch links on HP ProVision-1

Access the ProVision-1 CLI and configure the interface that connects to Comware-1 as a tagged member of VLAN 11. (You should already be in the VLAN 11 context.)

ProVision-1(config)# vlan 11 tagged 19

Verify the port membership for VLAN 11. Notice that port statuses are UP since the interfaces are currently up.

ProVision-1(config)# show vlan 11

Status and Counters - VLAN Information - VLAN 11
VLAN ID : 11
Name : VLAN11
Status : Port-based
Voice : No
Jumbo : No

```
Port Information Mode      Unknown VLAN Status
---------------- --------- ------------ ----------
1                Untagged  Learn        Up
19               Tagged    Learn        Up
```

2. Configure switch-to-switch links on Comware-1

Access the Comware-1 CLI.

Move to the Comware-1 port that connects to ProVision-1. Define the port as a trunk and permit the trunk to carry all VLANs configured on the switch.

[Comware-1-vlan11] interface g1/0/21
[Comware-1-GigabitEthernet1/0/21] port link-type trunk
[Comware-1-GigabitEthernet1/0/21] port trunk permit vlan all

Move to the Comware-1 port that connects to Comware-2 and complete the same steps.

[Comware-1-GigabitEthernet1/0/21] interface g1/0/19
[Comware-1-GigabitEthernet1/0/19] port link-type trunk
[Comware-1-GigabitEthernet1/0/19] port trunk permit vlan all

View VLAN 11 and verify that both interfaces carry this VLAN.

[Comware-1] display vlan 11
VLAN ID: 11
VLAN Type: static
Route Interface: Not configured
Description: VLAN 0011
Name: VLAN 0011
Tagged Ports:
GigabitEthernet1/0/19 GigabitEthernet1/0/21
Untagged Ports: none

3. Configure switch-to-switch links on Comware-2

Access the terminal session for the Comware-2 switch.

Move to the Comware-2 port that connects to Comware-1. Define the port as a trunk and permit the trunk to carry all VLANs configured on the switch.

[Comware-2-vlan11] interface g1/0/19
[Comware-2-GigabitEthernet1/0/19] port link-type trunk
[Comware-2-GigabitEthernet1/0/19] port trunk permit vlan all

Move to the Comware-2 port that connects to ProVision-2 and complete the same steps.

[Comware-2-GigabitEthernet1/0/19] interface g1/0/23
[Comware-2-GigabitEthernet1/0/23] port link-type trunk
[Comware-2-GigabitEthernet1/0/23] port trunk permit vlan all

View trunk ports and verify that the two interfaces are trunks that permit VLAN 11. Note the PVID.

```
[Comware-2] display port trunk
Interface                 PVID  VLAN passing
GE1/0/19                     1      1, 11
GE1/0/23                     1      1, 11
```

4.

5. Configure switch-to-switch links on ProVision-2

Access the ProVision-2 CLI.

Define the ProVision-2 port that connects to Comware-2 as a tagged member of VLAN 11. Remember to specify VLAN 11 if you are not already in the VLAN 11 context.

ProVision-2((config)# vlan 11 tagged 21

Verify the port membership for VLAN 11. Notice that port statuses are UP, since the interfaces are currently up.

ProVision-2(config)# show vlan 11

Status and Counters - VLAN Information - VLAN 11

VLAN ID : 11

Name : VLAN11

Status : Port-based

Voice : No

Jumbo : No

```
Port Information Mode     Unknown VLAN Status

---------------- -------- ------------ ----------

1                Untagged Learn        Up

21               Tagged   Learn        Up
```

5. Test connectivity

You have now extended VLAN 11 across your topology. The server and client should be able to reach each other. Validate now.

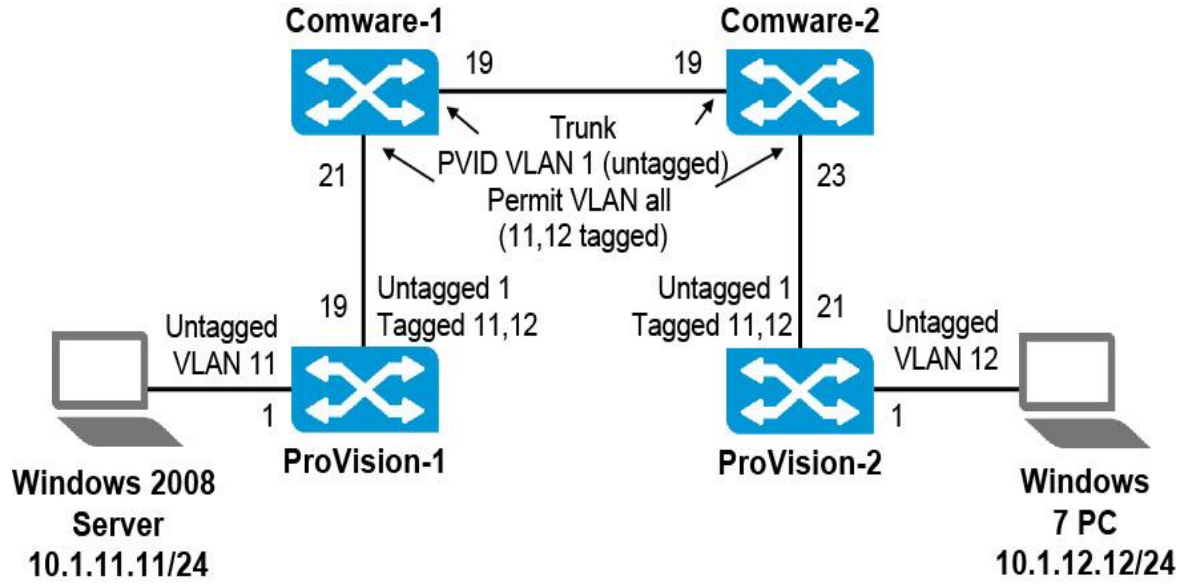
Access the server desktop and open a command prompt. Ping the client and verify success.

ping 10.1.11.12

If your ping succeeds, move directly to the next step.

Task 6: Add another VLAN - VLAN 12

This section builds on the example configuration, adding VLAN 12 as shown in Figure. The network topology also includes VLANs 1 and 11.



1. Add VLAN 12

Access the Windows 7 PC desktop. Change its IP address to 10.1.12.12/24 and set the default gateway address to 10.1.12.1.

Enter the following commands to add VLAN 12 to each switch.
[Comware-1] vlan 12
[Comware-2] vlan 12
ProVision-1(config)# vlan 12
ProVision-2(config)# vlan 12

Make sure that you are at the ProVision-2 CLI and then make sure that you are in the VLAN 12 context. Enter this command:
ProVision-2(vlan-12)# untagged 1

Make the ProVision-2 port that connects to Comware-2 a tagged member of VLAN 21. Enter this command:
ProVision-2(vlan-12)# tagged 21

Access the ProVision-1 CLI. Make sure that you are in the VLAN 12 context. Add VLAN 12 as a tagged VLAN on the ProVision-1 port that connects to Comware-2.
ProVision-1(vlan-12)# tagged 19

2. Verify the VLAN topology

You can now use the following show and display commands to verify that the VLAN topology matches that shown Figure above.

```
ProVision-1# show vlan 12
 Status and Counters - VLAN Information - VLAN 12
<-output omitted->
  Port Information Mode      Unknown VLAN Status
  ---------------- --------- ------------ ----------
  19               Tagged    Learn        Up
<Comware-1> display port trunk
Interface             PVID     VLAN passing
GE1/0/19                 1      1, 11-12,
GE1/0/21                 1      1, 11-12,
<Comware-2> display port trunk
Interface             PVID     VLAN passing
GE1/0/19                 1      1, 11-12,
GE1/0/23                 1      1, 11-12,
ProVision-2# show vlan 12
 Status and Counters - VLAN Information - VLAN 12
<-output omitted->
  Port Information Mode      Unknown VLAN Status
  ---------------- --------- ------------ ----------
  1                Untagged  Learn        Up
  21               Tagged    Learn        Up
```

Task 7: Routing between VLAN 11 and 12

In the example configuration, *endpoints in different VLANs* can no longer reach each other at Layer 2. Nor can they exchange broadcasts such as ARP messages. **When a device needs to reach a device in another subnet, the traffic needs to be routed**. Endpoints that cannot route their own traffic send the traffic to a default gateway for routing.

To allow an endpoint in VLAN 11 and VLAN 12 to communicate, you need to set up the **default gateway** in each VLAN. In this example network, Comware-1 acts as the default gateway. You simply need to assign Comware-1 the default gateway address for each subnet on the associated VLAN.

The switch will route traffic to any network for which it knows a route. It automatically knows a route for any subnet on which it has an IP address. This type of subnet is called a **direct or connected route.** For this activity, you simply want to route between VLAN 11, 10.1.11.0/24 and VLAN 12, 10.1.12.0/24. Just like the client and the server, the switches need a default router if they need to communicate with devices outside of their VLAN. **Comware-1 will be their default router on VLAN 1 using its 10.1.1.1 IP address**.

1. Set up Comware-1 as the default router for VLAN 11 and 12

To set up Comware-1 as the default router for VLAN 11 and VLAN 12, you simply need to assign the switch the default router IP address. You set this address manually on the server and Windows PC when you configured their IP settings.

On the Comware-1 switch, create a Layer 3 interface associated with VLAN 11.

[Comware-1] interface vlan 11
[Comware-1-VlanInterface11] ip address 10.1.11.1 24

On the Comware-1 switch, create a Layer 3 interface for VLAN 12 and set the Comware-1 VLAN 12 IP address to the correct IP address for the default router.

[Comware-1] interface vlan 12
[Comware-1-VlanInterface12] ip address 10.1.12.1 24

You want the server to *be able to reach all of the switches*. Test to determine which switches the server can reach.

Access a command prompt on the server. **Ping these four IP addresses** and observe the results. (*Some pings will be unsuccessful*.)

```
ping 10.1.1.1
ping 10.1.1.2
ping 10.1.1.3
ping 10.1.1.4
```

_____
_____
_____
_____

Why does the ping fail for Comware-2 and the ProVision switches?

_____
_____
_____

2. Set up default routes on the Layer 2 switches

Access the Comware-2 CLI and move to the system view. Configure the default route.

[Comware-2] ip route 0.0.0.0 0 10.1.1.1

Access the ProVision-1 CLI and move to the global configuration context. Configure the default route.

ProVision-1(config)# ip route 0.0.0.0/0 10.1.1.1

Complete the same steps on ProVision-2.
ProVision-2(config)# ip route 0.0.0.0/0 10.1.1.1

Access a command prompt on the server. *Ping these four IP addresses and verify success*.

```
ping 10.1.1.1
ping 10.1.1.2
ping 10.1.1.3
ping 10.1.1.4
```

_____
_____
_____
_____

Task 8: DHCP server settings on HP switches

Up to this point, you have configured your client with a static IP address. You can imagine how time-consuming this process would be in a network with thousands of clients. You would find it difficult to manage changes in the event of mergers and new acquisitions. Duplicate IP addresses could easily occur.

In most networks, clients use DHCP to acquire their IP addresses and other IP settings dynamically. Originally defined in RFC 2131 and updated in 2939, DHCP was based on the Bootstrap Protocol (BOOTP).

DHCP provides the following advantages:

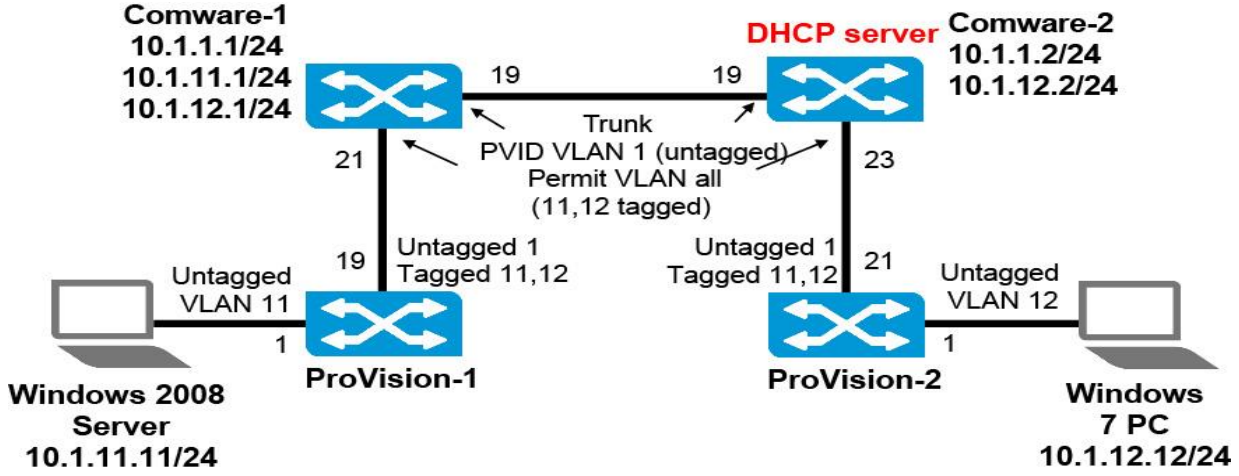
• It reduces the amount of manual configuration on devices.

• It reduces likelihood of configuration errors in devices' IP settings.

• It gives you more administrative control by centralizing IP addressing information and management.

1. Configure DHCP server settings on HP Comware switches

You will now examine an example scenario when the Comware-2 switch will be configured to act as a DHCP server on VLAN 12, subnet 10.1.12.0/24.



To create the DHCP server pool with an ID of 1, enter:

[Comware-2] dhcp server ip-pool 1

[Comware-2-dhcp-pool-1]

The switch prompt shows you move to the DHCP pool context. You first configure the subnet, which is 10.1.12.0/24 in this example:

[Comware-2-dhcp-pool-1] network 10.1.12.0 mask 255.255.255.0

You then configure the default gateway, which is 10.1.12.1 in this example.

[Comware-2-dhcp-pool-1] gateway-list 10.1.12.1

Finally, you configure the lease time. In this example, the lease time is 1 day.

[Comware-2-dhcp-pool-1] expired day 1

Then you exit the DHCP pool context.

[Comware-2-dhcp-pool-1] quit

Next, you configure several settings that will help the DHCP server function better, and you enable the server.

Often subnets include a few devices with fixed IP addresses assigned to them statically. In this example network, 10.1.12.0/24 includes a default router and DHCP server. It is important to exclude these addresses from DHCP. To exclude theses settings, you must be at the system view. For this example, you exclude the first 20 addresses in 10.1.12.0/24 from the DHCP server pool.

[Comware-2] dhcp server forbidden-ip 10.1.12.1 10.1.12.20

For the example configuration, you also configure the DHCP server to ping an IP address to ensure that it is not in use before it assigns that address to a client. You configure the server to perform two pings with a timeout of 750 milliseconds.

[Comware-2] dhcp server ping packets 2

[Comware-2] dhcp server ping timeout 750

You then enable the DHCP server.

[Comware-2] dhcp enable

You can view statistics about the DHCP server and verify that a pool is configured by entering:

[Comware-2] display dhcp server statistics

Global Pool:

Pool Number: 1

<-output omitted->

You can view the IP addresses that the server currently has free to assign to clients.

[Comware-2] display dhcp server free-ip

IP Range from 10.1.12.21 to 10.1.12.254

_____
_____
_____

You can also view the IP addresses the server has assigned clients. The output from this command also lists the MAC address of the client and the lease expiration.

[Comware-2] display dhcp server ip-in-use all

```
Pool utilization: 0.42%

 IP address      Client-identifier/    Lease expiration         Type
                 Hardware address

  10.1.12.21          0050-5697-35ee           Apr 28 2000 13:11:50
Auto:COMMITTED

 --- total 1 entry ---
```

Use the *display dhcp server tree* command to display information about address pool tree.

[Comware-2] display dhcp server tree all

_____
_____
_____

Task 9: Implement DHCP relay on HP switches

Setting up DHCP relay is simple on both ProVision and Comware switches.

1. HP ProVision: Configuring DHCP relay

The ProVision switch needs to meet the requirements for a DHCP relay:

• *It has an IP address on the DHCP clients' VLAN.*

• *It has IP connectivity to the DHCP server (the proper routing is in place).*

In the example setup show in Figure 6-12, you need to add an IP address to the ProVision switch. It already has connectivity to the DHCP server.

ProVision -2(config)# vlan 12 ip address 10.1.12.3/24

Configure the DHCP server's IP address as a helper address on the DHCP clients' VLAN.

ProVision-2(config)# vlan 12 ip helper-address 10.1.1.2

Those simple steps complete the configuration. You do not need to enable DHCP relay, which is always enabled on ProVision switches.

Access the Windows 7 PC desktop and configure its IP address «Obtain an IP address automatically». Type ipconfig/release followed by ipconfig/renew.

Type *ipconfig/all* to confirm that your PC has received an IP address in the correct range through DHCP

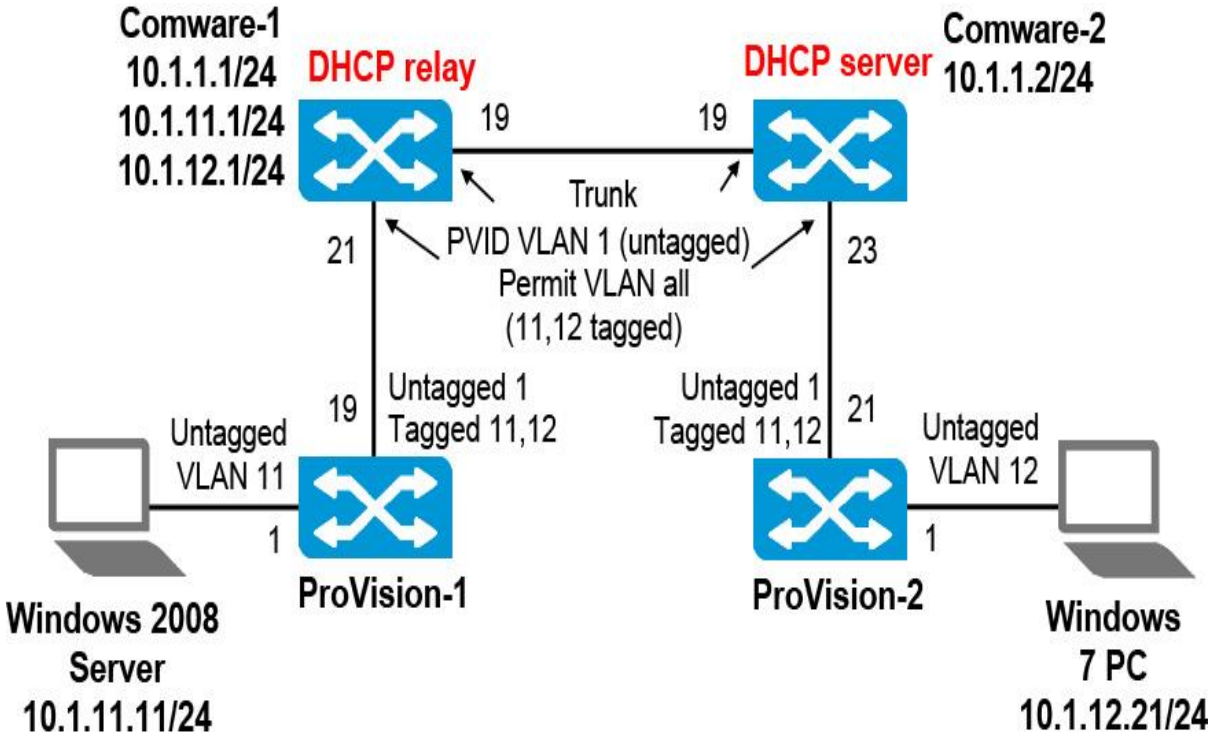
_____

_____

_____

2. HP Comware: Configuring DHCP relay

Comware-1 is the default router for VLAN 12. You want to set it up as a DHCP relay, forwarding DHCP requests in VLAN 12 to the Comware-2 DHCP server residing in VLAN 1.



From the system view on the Comware switch, you enable DHCP services.

[Comware-1] dhcp enable

DHCP is enabled successfully!

You then create a DHCP server group that references the DHCP server address, which is 10.1.1.2 in this example.

[Comware-1] dhcp-server 1 ip 10.1.1.2

You enable DHCP relay on the VLAN interface—VLAN 12 in this example.

[Comware-1] interface vlan 12

You add the server group that you configured globally to the VLAN interface settings.

[Comware-1-Vlan-interface12] dhcp-server 1

[Comware-1-Vlan-interface12] quit

To verify the status of your DHCP relay configuration, enter.

[Comware-1] display dhcp-server 1

Spanning Tree
Lab Activity 4

Objectives

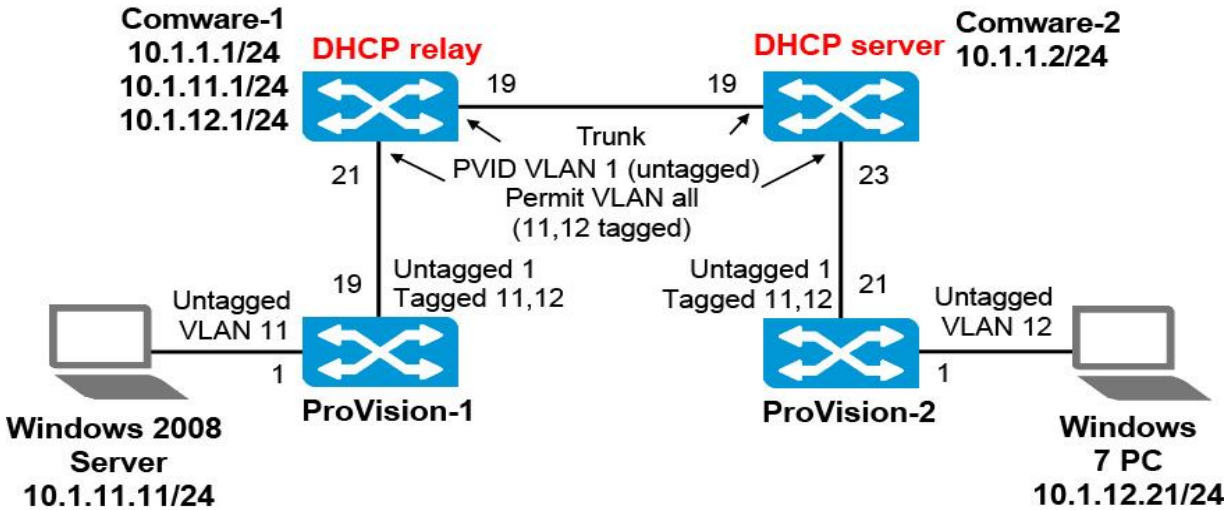
In this exercise, you introduces spanning tree protocol standards, which help switches to manage redundant links without introducing loops and broadcast storms. It focuses on RSTP and MSTP.

Networks deliver critical services to users. Failure of a network link may make the network unavailable to users, resulting in lost time or revenue. To protect a network against these failures, you can install redundant links. Redundant links help to ensure that a path continues to exist across the network even if one link or even one switch fails.

However, simply adding redundant physical links does not ensure that the switches can use those links correctly. Adding redundant Layer 2 links without a protocol to manage the links results in network loops. These loops, in turn, create broadcast storms and mislearned MAC addresses, making the network inaccessible. To function properly, an Ethernet network must have only one active pathway between any two devices.

After completing this lab, you will be able

- Configuration of RSTP root bridge
- Configuration of RSTP redundant links
- Configuration of RSTP. Verify the RSTP topology
- Configure MSTP settings on HP switches
- Configure the instance root settings and set standard costs for Comware switches
- Map the MSTP topology



Starting network configuration

Task 1: Explore the CLI on an HP Provision switches

1. Verify that the HP ProVision switch has the correct Lab 2 startup configuration by running the command:

Switch# show running-config

You should see the output.

If the running-config includes other settings, you must return HP ProVision switch *to factory default settings.*

2. Return HP ProVision switch to factory default settings

If the output includes other commands, you can return the ProVision switch to factory default settings using the following command:

ProVision# erase startup-config

During the process of returning the switch to factory default settings, you will be prompted to confirm that you want to reboot the switch; **press y**. The switch will be rebooted.

3. Startup Configs on an HP Provision switches for Lab Activity 3

ProVision-1

```
hostname "ProVision-1"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
interface 1
name "Server"
exit
interface 2-18
disable
exit
interface 19
name "Comware-1"
exit
interface 20-24
disable
exit
vlan 1
name "DEFAULT_VLAN"
no untagged 1
untagged 2-24
```

```
ip address 10.1.1.3  255.255.255.0
exit
vlan 11
name "VLAN11"
untagged 1
tagged 19
no ip address
exit
vlan 12
name "VLAN12"
tagged 19
no ip address
exit
snmp-server community "public" unrestricted
```

ProVision-2

```
hostname "ProVision-2"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
interface 1
name "Client"
exit
interface 2-20
disable
exit
interface 21
name "Comware-2"
exit
interface 22-24
disable
exit
vlan 1
name "DEFAULT_VLAN"
no untagged 1
untagged 2-24
ip address 10.1.1.4  255.255.255.0
exit
vlan 11
name "VLAN11"
tagged 21
no ip address
exit
vlan 12
name "VLAN12"
```

untagged 1
tagged 21
ip address 10.1.12.3 255.255.255.0
ip helper-address 10.1.1.2
exit
snmp-server community "public" unrestricted

Task 2: Explore the CLI on an HP Comware switch

1. The Comware switch prompt indicates your current view: <HP>
You can move to the system view by entering the command:

<Comware5> system-view
[Comware5]

Verify that the switch has the correct Lab 2 startup configuration by running the command:

[Comware] display current-configuration

You should see the output.

If the current-configuration includes other settings, you must return HP Comware switch *to factory default settings.*

2. Return HP Comware switch to factory default settings

If the Comware switch is not running the default configuration, you can return it to factory default settings by entering:

<HP> reset saved-configuration

When the following prompt is displayed, **press y** and then <Enter>.

The saved configuration file will be erased. Are you sure? [Y/N]: ***Y***
Configuration file in flash is being cleared.
Please wait ...
MainBoard:
Configuration file is cleared.

You then need to reboot the switch, using the reboot command as shown below. If a prompt is displayed, asking if you want to save the current configuration, press **n** and then press <Enter>. When prompted to continue the reboot, press **y** and then <Enter>.

<HP> reboot
Start to check configuration with next startup configuration file, please wait.....DONE!
*This command will reboot the device. Current configuration will be lost, save current configuration? [Y/N]:**n***
*This command will reboot the device. Continue? [Y/N]:**y***
#May 1 14:00:07:594 2000 Comware DEVM/1/REBOOT:
Reboot device by command.
%May 1 14:00:07:694 2000 Comware DEVM/5/SYSTEM_REBOOT: System is - rebooting now.
Starting.....

3. Startup Configs on an HP Comware switches for Lab Activity 3

Comware-1

```
sysname "Comware-1"
vlan 1
vlan 11
vlan 12
interface Vlan-interface1
ip address 10.1.1.1  255.255.255.0
interface Vlan-interface11
ip address 10.1.11.1  255.255.255.0
interface Vlan-interface12
ip address 10.1.12.1  255.255.255.0
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-2
port link-type trunk
port trunk permit vlan all
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
        description  Provision-1
port link-type trunk
port trunk permit vlan all
```

```
interface Ethernet1/0/22
        shutdown
……
interface Ethernet1/0/48
        shutdown
dhcp enable
dhcp-server 1 ip 10.1.1.2
interface Vlan-interface12
        dhcp server 1
address-check enable
```

Comware-2

```
sysname "Comware-2"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
vlan 1
vlan 11
vlan 12
interface Vlan-interface1
ip address 10.1.1.2  255.255.255.0
dhcp server ip-pool 1
        network 10.1.12.0 mask 255.255.255.0
gateway-list 10.1.12.1
expired day 1
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-1
port link-type trunk
port trunk permit vlan all
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
        shutdown
interface Ethernet1/0/22
        shutdown
interface Ethernet1/0/23
        description  Provision-2
port link-type trunk
port trunk permit vlan all
```

interface Ethernet1/0/24
shutdown
……
interface Ethernet1/0/48
shutdown
dhcp enable
dhcp server forbidden-ip 10.1.12.1 10.1.12.20
dhcp server ping packets 2
dhcp server ping timeout 750

Task 3: Configuration of RSTP root bridge

1. Configure Comware-1 as the root

You learned that RSTP sets up the spanning tree based on the root bridge. You will first configure Comware-1 as the primary root bridge, which ensures that it wins the root bridge election.

Access the Comware-1 CLI and move to system view.
Configure Comware-1 as the primary root bridge.
[Comware-1] stp root primary

2. Enable spanning tree on each switch

You will enable spanning tree on the HP switches. Recall that STP is disabled by default on both the Comware and ProVision switches.

Access the Comware-1 CLI and move to system view.
Enable spanning tree on Comware-1.
[Comware-1]stp enable
Access the Comware-2 CLI and move to system view.
Enable spanning tree.
[Comware-2] stp enable

Access the ProVision-1 CLI and move to global configuration mode.
Enable spanning tree.
ProVision-1(config)# spanning-tree
Access the ProVision-2 CLI and move to global configuration mode.
Enable spanning tree.
ProVision-2(config)# spanning-tree

3. Verify the root bridge

You will now verify that Comware-1 has been elected the root bridge, as desired. Enter the following command on the Comware-1 switch. Find the bridge ID, which is listed next to CIST Bridge.

[Comware-1]display stp

```
-------[CIST Global Info][Mode MSTP]-------
CIST Bridge          :0.d07e-28ce-c94f
Bridge Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC       :0.d07e-28ce-c94f / 0
CIST RegRoot/IRPC    :0.d07e-28ce-c94f / 0
CIST RootPortId      :0.0
<-output omitted->
```

Record Comware-1's bridge ID -

_____

Now view the root bridge ID on *Comware-1* and verify that it is this switch's bridge ID.

```
[Comware-1]display stp root

 MSTID Root Bridge ID   ExtPathCost IntPathCost Root Port

   0   0.d07e-28ce-c94f 0           0
```

Record root bridge ID - _____

Enter the same command on *Comware-2*. The root bridge ID should match Comware-1's ID.

```
[Comware-2] display stp root

 MSTID Root Bridge ID   ExtPathCost IntPathCost Root Port

   0   0.d07e-28ce-c94f 20          0           GigabitEthernet1/0/19
```

Record root bridge ID - _____

Enter the following command on *ProVision-1* and verify that the root is Comware-1.

ProVision-2(config)# show spanning-tree root-history cst

Status and Counters - CST Root Changes History

```
MST Instance ID          : 0
Root Changes Counter     : 2
Current Root Bridge ID : 0:d07e28-cec94f
Root Bridge ID        Date       Time
--------------------- --------- ---------
```

Record root bridge ID - _____

Access the ProVision-2 CLI. Use the same command to verify that Comware-1 is this switch's root bridge.

ProVision-2(config)# show spanning-tree root-history cst

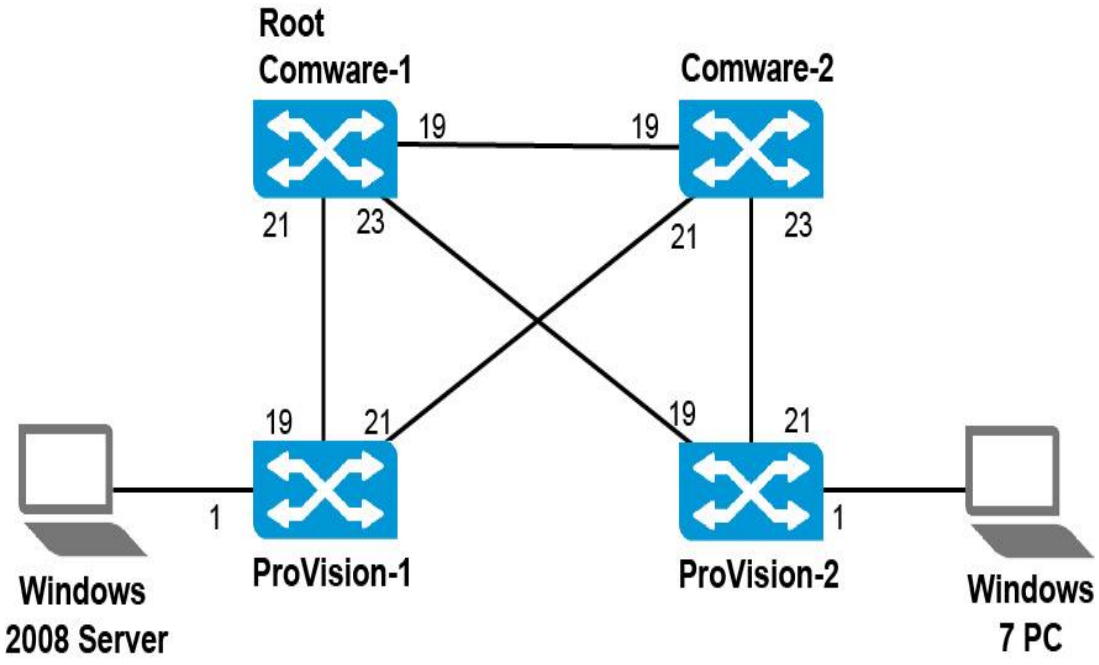
Status and Counters - CST Root Changes History

```
MST Instance ID          : 0
Root Changes Counter     : 2
Current Root Bridge ID : 0:d07e28-cec94f
Root Bridge ID        Date       Time
--------------------- --------- ---------
```

Record root bridge ID - _____

Task 4: Configuration of RSTP redundant links

You will now add the redundant links, as shown in Figure. The links should be configured to carry traffic on all VLANs supported on the switches.



1. Establish the physical link

Access Comware-1 and set up the physical port that connects to ProVision-2.
[Comware-1] interface g1/0/23
[Comware-1-GigabitEthernet1/0/23] port link-type trunk
[Comware-1-GigabitEthernet1/0/23] port trunk permit vlan all
[Comware-1-GigabitEthernet1/0/23] undo shutdown
[Comware-1-GigabitEthernet1/0/23] quit

Access Comware-2 and set up the physical port that connects to ProVision-1.
[Comware-2] interface g1/0/21
[Comware-2-GigabitEthernet1/0/21] port link-type trunk
[Comware-2-GigabitEthernet1/0/21] port trunk permit vlan all
[Comware-2-GigabitEthernet1/0/21] undo shutdown
[Comware-2-GigabitEthernet1/0/21] quit

Access ProVision-1 and set up the physical port that connects to Comware-2.
ProVision-1(config)# vlan 11 tagged 21
ProVision-1(config)# vlan 12 tagged 21
ProVision-1(config)# interface 21 enable

Access ProVision-2 and set up the physical port that connects to Comware-1.
ProVision-2(config)# vlan 11 tagged 19
ProVision-2(config)# vlan 12 tagged 19
ProVision-2(config)# interface 19 enable

2. Verify that the links has come up

Verify that the link between ProVision-1 and Comware-2 is up.
ProVision-1(config)# show interface 21
Status and Counters - Port Counters for port 21
Name :
MAC Address : e4115b-cccc53
Link Status : ***Up***
<-output omitted->

Verify that the link between ProVision-2 and Comware-2 is up.
ProVision-2(config)# show interface 19
Status and Counters - Port Counters for port 19
Name :
MAC Address : e4115b-ccd215
*Link Status :****Up***

Access the Comware-1 CLI. Quickly validate that the port connections are correct by examining the LLDP neighbor table.

[Comware-1]lldp enable
[Comware-1]display lldp neighbor-information

```
System Name   Local Interface   Chassis ID      Port ID
Comware-2     GE1/0/19          d07e-28ce-d31e  GigabitEthernet1/0/19
ProVision-1   GE1/0/21          d4c9-ef85-1680  19
ProVision-2   GE1/0/23          d4c9-ef84-fe80  19
```

_____
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_____

Quickly validate that the port connections are correct by examining the LLDP neighbor table.

[Comware-2]lldp enable
[Comware-2]display lldp neighbor-information

```
System Name   Local Interface   Chassis ID      Port ID
Comware-1     GE1/0/19          d07e-28ce-c94f  GigabitEthernet1/0/19
ProVision-1   GE1/0/21          d4c9-ef85-1680  21
ProVision-2   GE1/0/23          d4c9-ef84-fe80  21
```

_____
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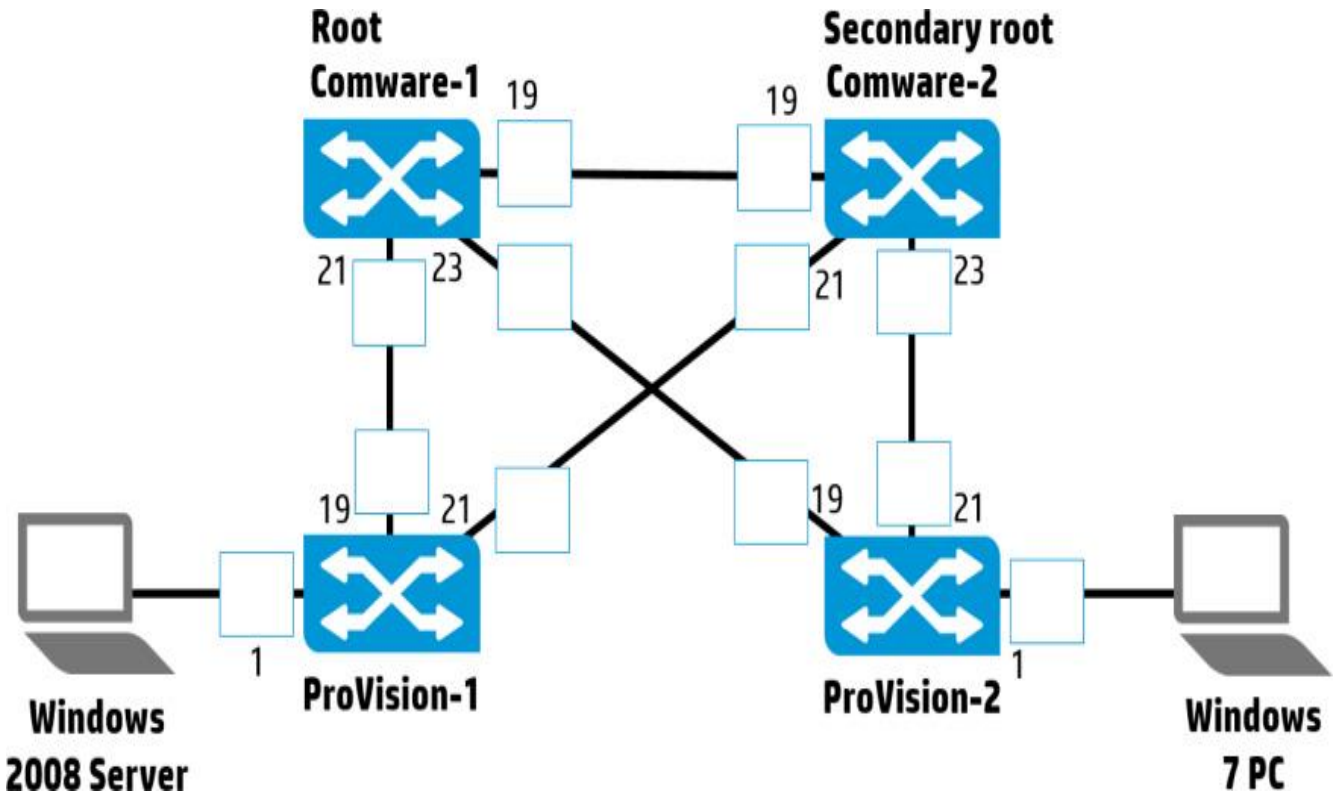
_____

Task 5: Configuration of RSTP. Verify the topology

You will now use *show* and *display* commands to explore the topology created by RSTP. You will now explore the topology. Using Figure, you will **fill in the port role** and indicate blocking ports.

1. RSTP port roles and states in the example network topology



Access the Comware-1 CLI.. Use this command to see a summary of the port role and state for each STP-enabled port.
[Comware-1] display stp brief *(display stp interface 19,21,23)*

```
MSTID   Port                      Role  STP State     Protection
   0    GigabitEthernet1/0/19     DESI  FORWARDING    NONE
   0    GigabitEthernet1/0/21     DESI  FORWARDING    NONE
   0    GigabitEthernet1/0/23     DESI  FORWARDING    NONE
```

Fill in the port roles in Figure. You can abbreviate (such as DP for designated port.) If the state is blocking, draw an X to indicate the blocked link. If the state is forwarding, you do not need to do anything else.

_____
_____
_____
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_____

Use the same command on Comware-2 and fill in the figure.

[Comware-2] display stp brief *(display stp interface 19,21,23)*

```
MSTID  Port                      Role   STP State    Protection
   0   GigabitEthernet1/0/19     ROOT   FORWARDING   NONE
   0   GigabitEthernet1/0/21     DESI   FORWARDING   NONE
   0   GigabitEthernet1/0/23     DESI   FORWARDING   NONE
```

_____

_____

_____

Access the ProVision-1 CLI. Use the following command to view the port state on desired interfaces.

If you want to see both the port role and state, you must use a slightly different command.

```
ProVision-1(config)# show spanning-tree 1,19,21 instance ist
<-output omitted->                                        Designated
Port  Type      Cost  Priority Role       State      Bridge
----- --------- ----- -------- ---------- ---------- --------------
1     100/1000T 20000 128      Designated Forwarding d4c9ef-851680
19    100/1000T 20000 128      Root       Forwarding d07e28-cec94f
21    100/1000T 20000 128      Alternate  Blocking   d07e28-ced31e
```

_____

_____

_____

Access the ProVision-2 CLI. Use this command to fill in the Figure. Remember to add an X to any blocking link.

ProVision-2(config)# show spanning-tree 1,19,21 instance ist

```
                                                          Designated
Port  Type      Cost  Priority Role       State      Bridge
----  --------- ----- -------- ---------- ---------- --------------
1     100/1000T 20000 128      Designated Forwarding d4c9ef-84fe80
19    100/1000T 20000 128      Root       Forwarding d07e28-cec94f
21    100/1000T 20000 128      Alternate  Blocking   d07e28-ced31e
```

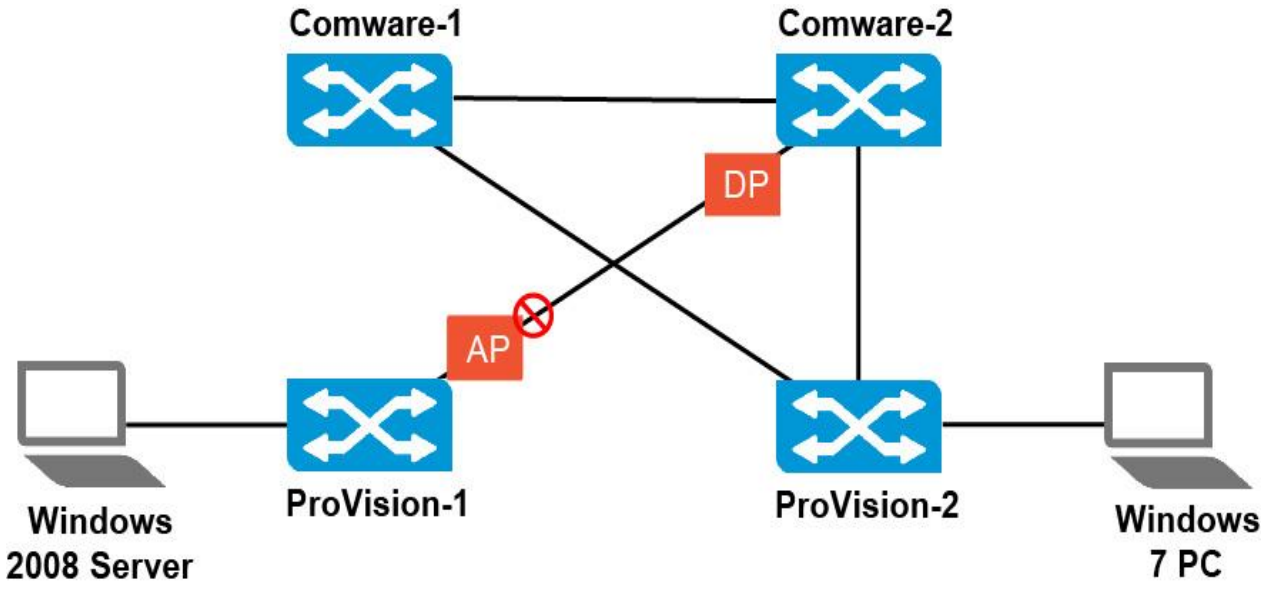
_____

_____

_____

2. Examine a scenario in which ProVision-1 loses its active link to Comware-1 and must failover to its alternate link through Comware-1.

Disable an interface 19 on a ProVision-1
ProVision-1(config)# interface 19 disable



[Comware-1] display stp brief *(display stp interface 19,21,23)*

_____
_____
_____

[Comware-2] display stp brief *(display stp interface 19,21,23)*

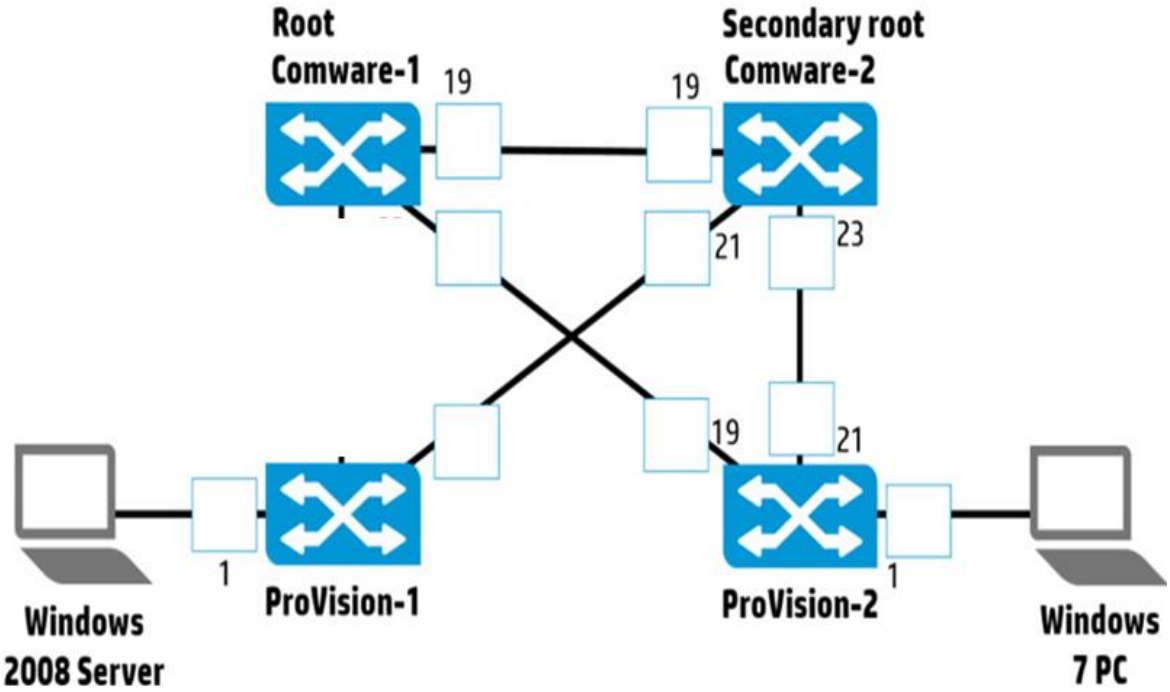
_____
_____
_____

ProVision-1(config)# show spanning-tree 1,19,21 instance ist

_____
_____
_____

ProVision-2(config)# show spanning-tree 1,19,21 instance ist

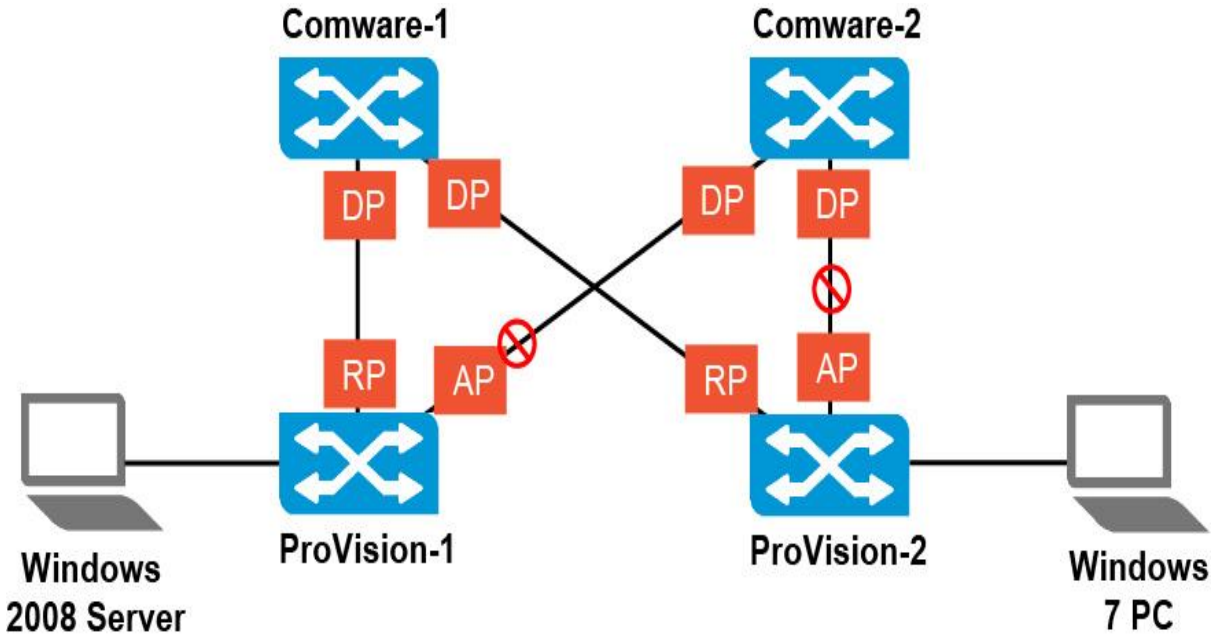
_____
_____
_____



Enable an interface 19 on a ProVision-1
ProVision-1(config)# interface 19 enable

3. Examine a scenario in which Comware-2 loses its active link to Comware-1

Disable an interface 19 on a Comware-2
[Comware-2] interface g1/0/19
[Comware-GigabitEthernet1/0/19] shutdown



[Comware-1] display stp brief *(display stp interface 19,21,23)*

_____
_____
_____

[Comware-2] display stp brief *(display stp interface 19,21,23)*

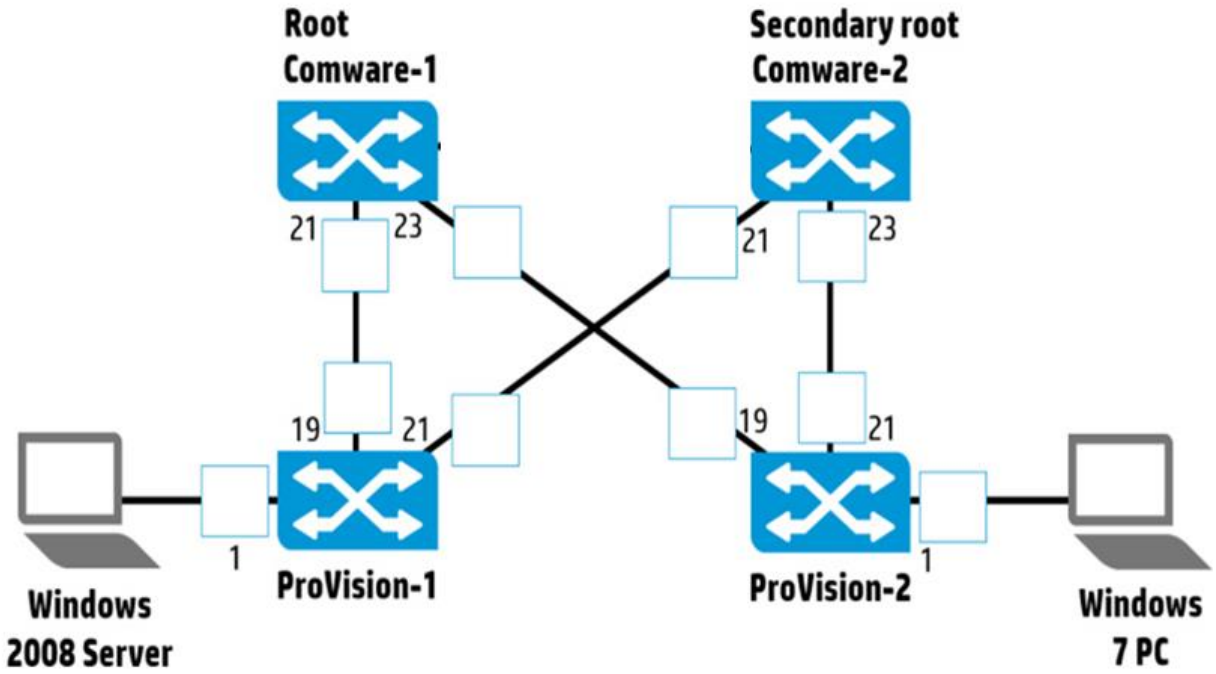
_____
_____
_____

ProVision-1(config)# show spanning-tree 1,19,21 instance ist

_____
_____
_____

ProVision-2(config)# show spanning-tree 1,19,21 instance ist

_____
_____
_____



Enable an interface 19 on a Comware-2
[Comware-2] interface g1/0/19
[Comware-GigabitEthernet1/0/19] undo shutdown

Task 6: Configure MSTP settings on HP switches

1. Configure MSTP settings on Comware-1

Access the Comware-1 CLI and move to the system view. Access the MSTP region view.

Comware-1] stp region-configuration

Establish the settings indicated in the table.

[Comware-1-mst-region] region-name hp
[Comware-1-mst-region] revision-level 1
[Comware-1-mst-region] instance 1 vlan 11
[Comware-1-mst-region] instance 2 vlan 12

Verify the configuration.

```
[Comware-1-mst-region] check region-configuration
 Admin configuration
   Format selector     :0
   Region name         :hp
   Revision level      :1
Configuration digest :0xbe0284d20f4d46a8da89c5d9b3b4f78a
   Instance    Vlans Mapped
   0           1 to 10, 13 to 4094
   1           11
   2           12
```

Activate the configuration.

[Comware-1-mst-region] active region-configuration
[Comware-1-mst-region] quit

2. Configure MSTP settings on Comware-2

Access the Comware-2 CLI and move to system view. Follow the same steps to establish the MSTP region.

[Comware-2] stp region-configuration
[Comware-2-mst-region] region-name hp
[Comware-2-mst-region] revision-level 1
[Comware-2-mst-region] instance 1 vlan 11
[Comware-2-mst-region] instance 2 vlan 12

Verify the configuration. Make sure that the configuration digest matches the digest on Comware-2. If the digest matches, then all settings are compatible.

```
[Comware-2-mst-region] check region-configuration
 Admin configuration
   Format selector     :0
   Region name         :hp
   Revision level      :1
Configuration digest :0xbe0284d20f4d46a8da89c5d9b3b4f78a
   Instance   Vlans Mapped
      0        1 to 10, 13 to 4094
      1        11
      2        12
```

Remember to activate the region.

[Comware-2-mst-region] active region-configuration

[Comware-2-mst-region] quit

3. Configure MSTP settings on ProVision-1

You will now configure the MSTP region on the ProVision switches. Access the terminal session with ProVision-1 and move to the global configuration context. Configure identical MSTP region settings as on the Comware switches.

ProVision-1(config)# spanning-tree config-name hp

ProVision-1(config)# spanning-tree config-revision 1

ProVision-1(config)# spanning-tree instance 1 vlan 11

ProVision-1(config)# spanning-tree instance 2 vlan 12

Verify the settings. (The settings are automatically activated on ProVision switches.) Once again, check the configuration digest against that on the other switches.

```
ProVision-1(config)# show spanning-tree mst-config
 MST Configuration Identifier Information
  MST Configuration Name : hp
  MST Configuration Revision : 1
  MST Configuration Digest : 0xBE0284D20F4D46A8DA89C5D9B3B4F78A
IST Mapped VLANs : 1-10,13-4094
  Instance ID Mapped VLANs
  ----------  ----------------------------------------------
  1           11
  2           12
```

_____
_____
_____

4. Configure MSTP settings on ProVision-2

Access the terminal session with the ProVision-2 switch and move to the global configuration context. Complete the same steps to configure and verify the MSTP region.

ProVision-2(config)# spanning-tree config-name hp
ProVision-2(config)# spanning-tree config-revision 1
ProVision-2(config)# spanning-tree instance 1 vlan 11
ProVision-2(config)# spanning-tree instance 2 vlan 12

Verify the settings.

ProVision-2(config)# show spanning-tree mst-config

_____
_____
_____

Task 7: Configure the instance root settings and set standard costs for Comware switches

Now that the switches are in the same MSTP region, they will *elect a root for each instance*. It is best practice to select different roots for different instances so as to load-balance traffic. Table shows the settings for this example configuration.

Instance	VLANs	Root	Secondary root
0	1 (and all unused)	Comware-1	Comware-2
1	11	Comware-1	Comware-2
2	12	Comware-2	Comware-1

You will also learn how to configure the Comware switches to use 802.1t for their path cost standard. Setting a standard is best practice for RSTP and MSTP.

1. Configure root settings and cost on Comware-1

Access the Comware-1 terminal session and make sure that you are in the system view. To configure the switch as a primary or secondary root, enter:

[Comware-1] stp instance 0 root primary
[Comware-1] stp instance 1 root primary
[Comware-1] stp instance 2 root secondary

Configure the switch to use the 802.1t port cost standard, making the standard consistent with ProVision switches. Make sure to confirm the change.

[Comware-1] stp pathcost dot1t

Cost configuration of every port will be reset and auto-calculation is available after changing current pathcost standard. Continue? [Y/N]:**y**

2. Configure root settings and cost on Comware-2

Access the Comware-2 switch terminal session. Use similar commands to configure this switch as the secondary and primary root of the correct instances. (See Table.)

[Comware-2] stp instance 0 root secondary
[Comware-2] stp instance 1 root secondary
[Comware-2] stp instance 2 root primary

Configure the switch to use the 802.1t port cost standard.

[Comware-2] stp pathcost dot1t

Cost configuration of every port will be reset and auto-calculation is available after changing current pathcost standard. Continue? [Y/N]:**y**

3. Verify the configuration

If all of the switches are operating in the same MSTP region, they should have elected the same switches as root in each instance:

• Comware-1 in instance 0 and 1
• Comware-2 in instance 2

You will now verify that this is the case.

Access the Comware-1 CLI. Verify that it is the root for instances 0 and 1. (Even if you do not remember Comware-1's bridge ID, you can see that it is root because it has no root port.)

[Comware-1] display stp root

```
MSTID Root Bridge ID     ExtPathCost IntPathCost Root Port

  0   0.d07e-28ce-c94f   0           0

  1   0.d07e-28ce-c94f   0           0

  2   0.d07e-28ce-d31e   0           20000       GigabitEthernet1/0/19
```

Record the instances 0 and 1 root bridge ID.

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Access the terminal session for Comware-2. Verify that it is the root for instance 2.

[Comware-2] display stp root

```
MSTID Root Bridge ID   ExtPathCost IntPathCost Root Port

  0   0.d07e-28ce-c94f 0           20000       GigabitEthernet1/0/19
  1   0.d07e-28ce-c94f 0           20000       GigabitEthernet1/0/19
  2   0.d07e-28ce-d31e 0           0
```

Record the instance 2 root bridge ID.

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Access the ProVision-1 CLI and verify that the switch's root for each instance matches the root on the Comware switches. You must enter the show spanning-tree root-history command for each instance separately.

ProVision-1(config)# show spanning-tree root-history ist
Status and Counters - IST Regional Root Changes History
MST Instance ID : 0
Root Changes Counter : 2
Current Root Bridge ID : 0:d07e28-cec94f

_____
<-output omitted->

ProVision-1(config)# show spanning-tree root-history msti 1
Status and Counters - MST Instance Regional Root Changes History
MST Instance ID : 1
Root Changes Counter : 3
Current Root Bridge ID : 0:d07e28-cec94f

_____
<-output omitted->

ProVision-1(config)# show spanning-tree root-history msti 2
Status and Counters - MST Instance Regional Root Changes History
MST Instance ID : 2
Root Changes Counter : 4
Current Root Bridge ID : 0:d07e28-ced31e

_____
<-output omitted->

Complete the same step on ProVision-2. The output should be identical.

ProVision-2(config)# show spanning-tree root-history ist
Status and Counters - IST Regional Root Changes History
MST Instance ID : 0
Root Changes Counter : 2
Current Root Bridge ID : 0:d07e28-cec94f

_____
<-output omitted->

ProVision-2(config)# show spanning-tree root-history msti 1
Status and Counters - MST Instance Regional Root Changes History
MST Instance ID : 1
Root Changes Counter : 3
Current Root Bridge ID : 0:d07e28-cec94f

_____
<-output omitted->

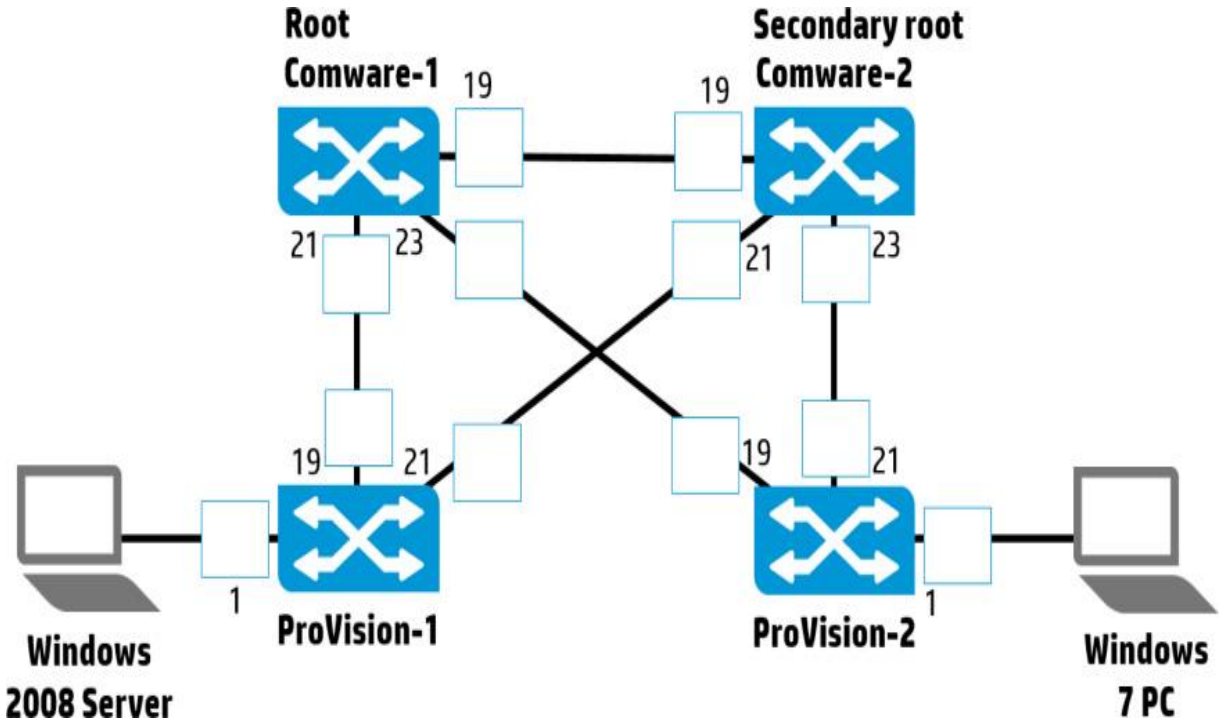
ProVision-2(config)# show spanning-tree root-history msti 2
Status and Counters - MST Instance Regional Root Changes History
MST Instance ID : 2
Root Changes Counter : 4
Current Root Bridge ID : 0:d07e28-ced31e

_____
<-output omitted->

Task 8: Map the topology

Based on what you have learned in this chapter, you should be able to predict the port roles for each switch-to-switch port in each instance. Use Figures to record your predictions.

1. Map the topology in instance 0



Access the terminal session with Comware-1. View the port roles for instance 0. Check them against your predictions and adjust if necessary.

```
[Comware-1] display stp instance 0 brief
 MSTID   Port                      Role  STP State     Protection
    0    GigabitEthernet1/0/19     DESI  FORWARDING    NONE
    0    GigabitEthernet1/0/21     DESI  FORWARDING    NONE
    0    GigabitEthernet1/0/23     DESI  FORWARDING    NONE
```

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Access the terminal session with Comware-2. View the port roles for instance 0. Check them against your predictions and adjust if necessary.

```
[Comware-2] display stp instance 0 brief
 MSTID   Port                      Role  STP State     Protection
    0    GigabitEthernet1/0/19     ROOT  FORWARDING    NONE
    0    GigabitEthernet1/0/21     DESI  FORWARDING    NONE
    0    GigabitEthernet1/0/23     DESI  FORWARDING    NONE
```

Access the terminal session with ProVision-1. View the port roles for instance 0 (also called the IST). Check them against your predictions and adjust if necessary. Remember that you will find the port roles and states at the bottom of the output.

```
ProVision-1(config)# show spanning-tree 1,19,21 instance ist

<-output omitted->

                                                                Designated
Port Type      Cost  Priority Role       State      Bridge
---- --------- ----- -------- ---------- ---------- -------------
1    100/1000T Auto  128      Designated Forwarding d07e28-cec94f
19   100/1000T 20000 128      Root       Forwarding d07e28-cec94f
21   100/1000T 20000 128      Alternate  Blocking   d07e28-cec94f
```

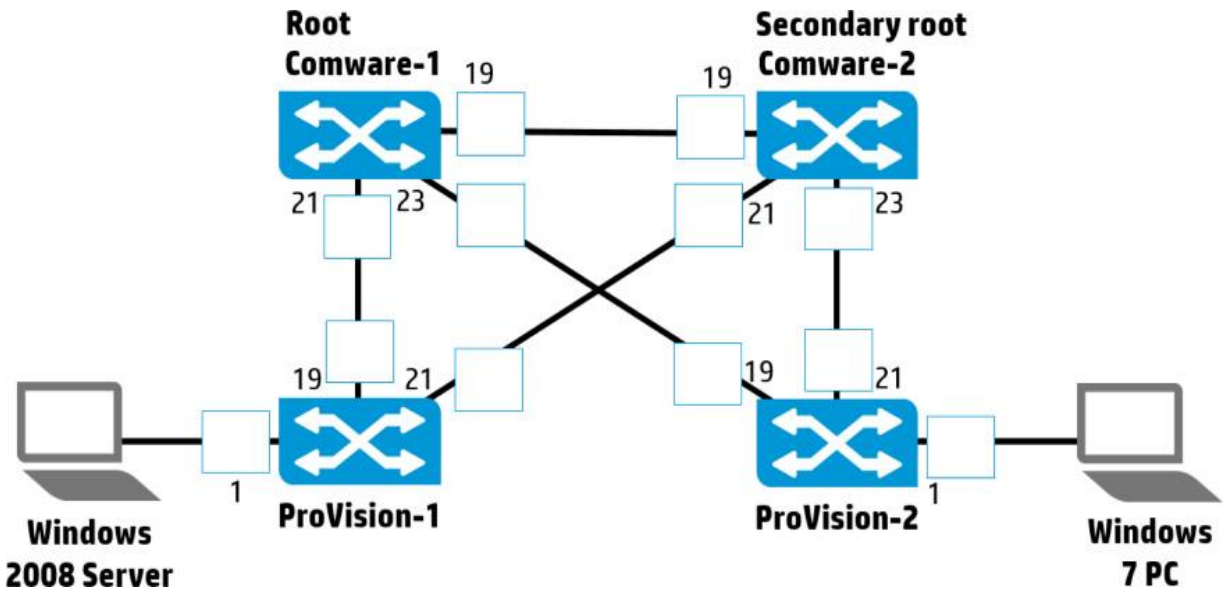
Access the terminal session with ProVision-2. View the port roles for instance 0. Check them against your predictions and adjust if necessary.

```
ProVision-2(config)# show spanning-tree 1,19,21 instance ist

<-output omitted->

Designated
Port Type      Cost  Priority Role       State      Bridge
---- --------- ----- -------- ---------- ---------- -----------
1    100/1000T Auto  128      Designated Forwarding d07e28-cec94f
19   100/1000T 20000 128      Root       Forwarding d07e28-cec94f
21   100/1000T 20000 128      Alternate  Blocking   d07e28-cec94f
```

2. Map the topology in instance 1



[Comware-1] display stp instance 1 brief

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[Comware-2] display stp instance 1 brief

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ProVision-1(config)# show spanning-tree 1,19.21 instance 1

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ProVision-1(config)# show spanning-tree 1,19.21 instance 1

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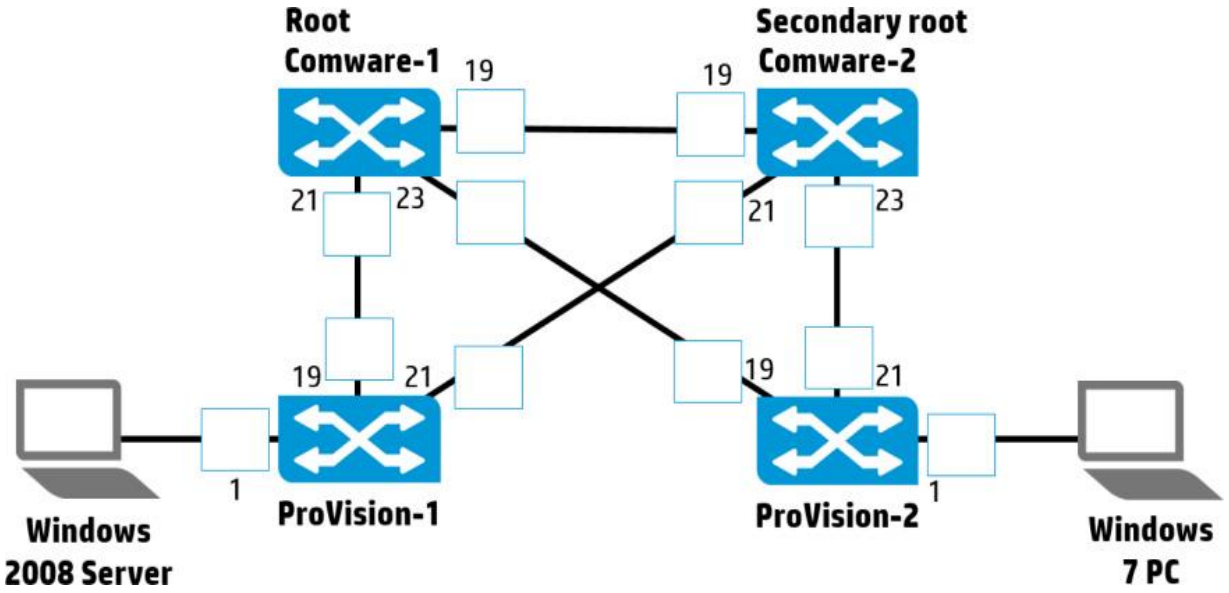
3. Map the topology in instance 2



[Comware-1] display stp instance 2 brief

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[Comware-2] display stp instance 2 brief

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_____
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ProVision-1(config)# show spanning-tree 1,19.21 instance 2

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_____
_____
_____

ProVision-1(config)# show spanning-tree 1,19.21 instance 2

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Link Aggregation
Lab Activity 5

Objectives

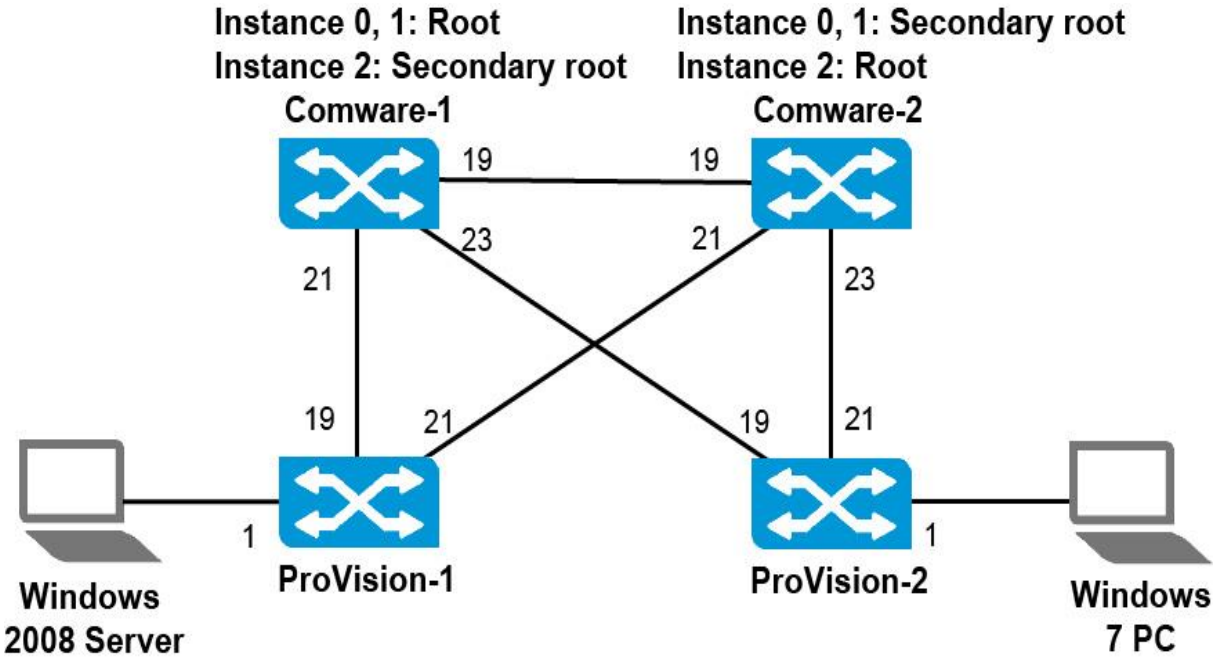
In this section, a redundant link will be added between Comware-1 and Comware-2 in the example network shown in Figure . You will then consider how MSTP handles the new topology.

When you simply add a link between two switches, RSTP/MSTP sees it as another redundant link. It blocks the link as an alternate path to the root for Comware-2. The new link adds a bit of resiliency, but it does not add any bandwidth to the connection.

You define an aggregated link on the switch and add physical interfaces to that aggregated link. Now, from the point of view of the switch, the aggregated link is the logical link—not the individual physical interfaces.

After completing this lab, you will be able

- Add redundant links between the same two switches
- Observe MSTP with the new link
- Set up a manual aggregated link
- Configure an aggregated link between a Comware and ProVision switch
- Set up an LACP aggregated link
- Configure an LACP aggregated link



Starting network configuration

Task 1: Explore the CLI on an HP Provision switches

1. Verify that the HP ProVision switch has the correct Lab 2 startup configuration by running the command:

Switch# show running-config

You should see the output.

If the running-config includes other settings, you must return HP ProVision switch *to factory default settings.*

2. Return HP ProVision switch to factory default settings

If the output includes other commands, you can return the ProVision switch to factory default settings using the following command:

ProVision# erase startup-config

During the process of returning the switch to factory default settings, you will be prompted to confirm that you want to reboot the switch; **press y**. The switch will be rebooted.

3. Startup Configs on an HP Provision switches for Lab Activity 3

ProVision-1

```
hostname "ProVision-1"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
interface 1
        name "Server"
        exit
interface 2-18
        disable
        exit
interface 19
        name "Comware-1"
        exit
interface 20-24
        disable
        exit
interface 21
        enable
        exit
```

```
vlan 1
        name "DEFAULT_VLAN"
        no untagged 1
        untagged 2-24
        ip address 10.1.1.3  255.255.255.0
        exit
vlan 11
        name "VLAN11"
        untagged 1
        tagged 19
        tagged 21
        no ip address
        exit
vlan 12
        name "VLAN12"
        tagged 19
        tagged 21
        no ip address
        exit
snmp-server community "public" unrestricted
spanning-tree
spanning-tree config-name hp
spanning-tree config-revision 1
spanning-tree instance 1 vlan 11
spanning-tree instance 2 vlan 12
```

ProVision-2

```
hostname "ProVision-2"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
interface 1
        name "Client"
        exit
interface 2-20
        disable
        exit
interface 19
        enable
        exit
interface 21
        name "Comware-2"
        exit
```

```
interface 22-24
        disable
        exit
vlan 1
        name "DEFAULT_VLAN"
        no untagged 1
        untagged 2-24
        ip address 10.1.1.4  255.255.255.0
        exit
vlan 11
        name "VLAN11"
        tagged 19
        tagged 21
        no ip address
        exit
vlan 12
        name "VLAN12"
        untagged 1
        tagged 19
        tagged 21
        ip address 10.1.12.3 255.255.255.0
        ip helper-address 10.1.1.2
        exit
snmp-server community "public" unrestricted
spanning-tree
spanning-tree config-name hp
spanning-tree config-revision 1
spanning-tree instance 1 vlan 11
spanning-tree instance 2 vlan 12
```

Task 2: Explore the CLI on an HP Comware switch

1. The Comware switch prompt indicates your current view: <HP>
You can move to the system view by entering the command:
<Comware5> system-view
[Comware5]

Verify that the switch has the correct Lab 2 startup configuration by running the command:

[Comware] display current-configuration

You should see the output.

If the current-configuration includes other settings, you must return HP Comware switch *to factory default settings.*

2. Return HP Comware switch to factory default settings

If the Comware switch is not running the default configuration, you can return it to factory default settings by entering:

<HP> reset saved-configuration

When the following prompt is displayed, **press y** and then <Enter>.

The saved configuration file will be erased. Are you sure? [Y/N]: ***Y***
Configuration file in flash is being cleared.
Please wait ...
MainBoard:
Configuration file is cleared.

You then need to reboot the switch, using the reboot command as shown below. If a prompt is displayed, asking if you want to save the current configuration, press **n** and then press <Enter>. When prompted to continue the reboot, press **y** and then <Enter>.

<HP> reboot
Start to check configuration with next startup configuration file, please wait.....DONE!
*This command will reboot the device. Current configuration will be lost, save current configuration? [Y/N]:****n***
*This command will reboot the device. Continue? [Y/N]:****y***
#May 1 14:00:07:594 2000 Comware DEVM/1/REBOOT:
Reboot device by command.
%May 1 14:00:07:694 2000 Comware DEVM/5/SYSTEM_REBOOT: System is -rebooting now.
Starting.....

3. Startup Configs on an HP Comware switches for Lab Activity 3

Comware-1

```
sysname "Comware-1"
vlan 1
vlan 11
vlan 12
interface Vlan-interface1
        ip address 10.1.1.1  255.255.255.0
```

```
interface Vlan-interface11
        ip address 10.1.11.1  255.255.255.0
interface Vlan-interface12
        ip address 10.1.12.1  255.255.255.0
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-2
        port link-type trunk
        port trunk permit vlan all
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
        description  Provision-1
        port link-type trunk
        port trunk permit vlan all
interface Ethernet1/0/22
        shutdown
interface Ethernet1/0/23
        port link-type trunk
        port trunk permit vlan all
        undo shutdown
interface Ethernet1/0/24
        shutdown
……
interface Ethernet1/0/48
        shutdown
dhcp enable
dhcp-server 1 ip 10.1.1.2
interface Vlan-interface12
        dhcp server 1
        address-check enable
stp root primary
stp enable
lldp enable
stp region-configuration
        region-name hp
        revision-level 1
        instance 1 vlan 11
        instance 2 vlan 12
        active region-configuration
```

```
stp instance 0 root primary
stp instance 1 root primary
stp instance 2 root secondary
stp pathcost dot1t
```

Comware-2

```
sysname "Comware-2"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
vlan 1
vlan 11
vlan 12
interface Vlan-interface1
        ip address 10.1.1.2  255.255.255.0
dhcp server ip-pool 1
        network 10.1.12.0 mask 255.255.255.0
        gateway-list 10.1.12.1
        expired day 1
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-1
        port link-type trunk
        port trunk permit vlan all
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
        port link-type trunk
        port trunk permit vlan all
        undo shutdown
interface Ethernet1/0/22
        shutdown
interface Ethernet1/0/23
        description  Provision-2
        port link-type trunk
        port trunk permit vlan all
interface Ethernet1/0/24
        shutdown
……
interface Ethernet1/0/48
        shutdown
```

```
dhcp enable
dhcp server forbidden-ip 10.1.12.1 10.1.12.20
dhcp server ping packets 2
dhcp server ping timeout 750
stp enable
lldp enable
stp region-configuration
    region-name hp
    revision-level 1
    instance 1 vlan 11
    instance 2 vlan 12
    active region-configuration
stp instance 0 root secondary
stp instance 1 root secondary
stp instance 2 root primary
stp pathcost dot1t
```

Task 3: Verify MSTP settings from Lab Activity 4

You can verify MSTP settings by accessing the Comware-1 and Comware-2 CLI and viewing the MSTP root settings:

[Comware-1] display stp brief

MSTID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/19	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/19	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/19	ROOT	FORWARDING	NONE
2	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/23	DESI	FORWARDING	NONE

[Comware-2] display stp brief

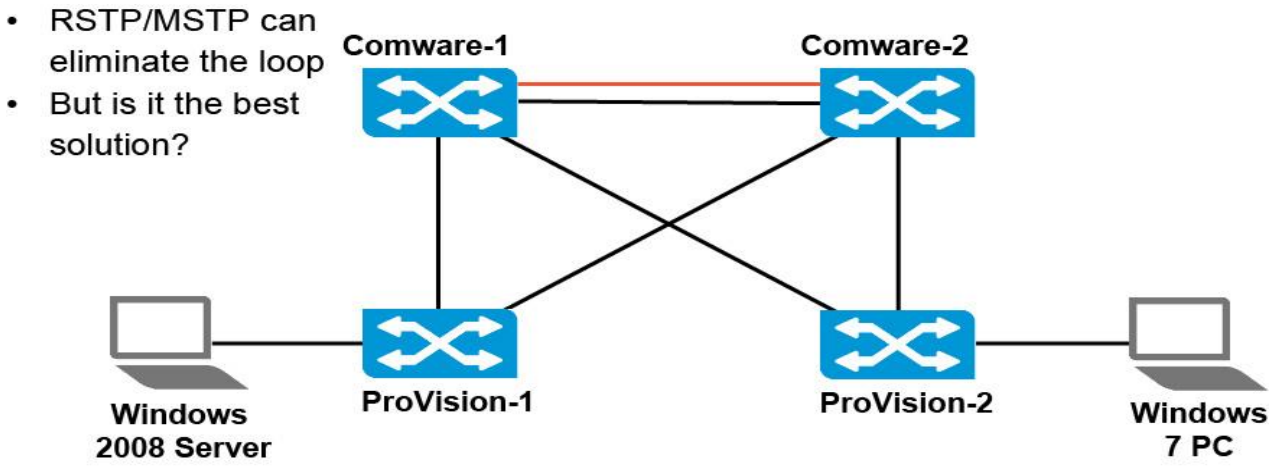
MSTID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/19	ROOT	FORWARDING	NONE
0	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/19	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/19	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/23	DESI	FORWARDING	NONE

Task 4: Add redundant links between the same two switches

You will now add a redundant link between Comware-1 and Comware-2.

These instructions were developed for a remote lab environment that has permanent connections between switches, so you simply need to enable the second interface on each switch to provide a redundant link. If you are performing the instructions in a different test environment, you will need to add a second physical connection between Comware-1 and Comware-2.

1. Add redundant links on a Comware-1



On Comware-1, move to the second physical port that connects to Comware-2.

<Comware-1> system-view
[Comware-1] interface g1/0/20

Configure this interface as a trunk port that supports all VLANs.
[Comware-1-GigabitEthernet1/0/20] port link-type trunk
[Comware-1-GigabitEthernet1/0/20] port trunk permit vlan all
[Comware-1-GigabitEthernet1/0/20] undo shutdown
[Comware-1-GigabitEthernet1/0/20] quit

2. Add redundant links on a Comware-2

Access Comware-2. Follow similar steps to configure the other side of the link.
<Comware-2> system-view
[Comware-2] interface g1/0/20
[Comware-2-GigabitEthernet1/0/20] port link-type trunk
[Comware-2-GigabitEthernet1/0/20] port trunk permit vlan all
[Comware-2-GigabitEthernet1/0/20] undo shutdown
[Comware-2-GigabitEthernet1/0/20] quit

3. Verify the new link

Verify that the new link is passing traffic in the correct VLANs.

[Comware-1] display port trunk

```
Interface   PVID  VLAN passing
GE1/0/19    1      1, 11-12,
GE1/0/20    1      1, 11-12,
GE1/0/21    1      1, 11-12,
GE1/0/23    1      1, 11-12,
```

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Verify that the new link is passing traffic in the correct VLANs.

[Comware-2] display port trunk

```
Interface   PVID  VLAN passing
GE1/0/19    1 1,   11-12,
GE1/0/20    1 1,   11-12,
GE1/0/21    1 1,   11-12,
GE1/0/23    1 1,   11-12,
```

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Verify that Comware-1 detects Comware-2 as an LLDP neighbor on both interfaces.

[Comware-1] display lldp neighbor-information

```
System Name  Local Interface  Chassis ID      Port ID
Comware-2    GE1/0/19         d07e-28ce-d31e  GigabitEthernet1/0/19
Comware-2    GE1/0/20         d07e-28ce-d31e  GigabitEthernet1/0/20
ProVision-1  GE1/0/21         d4c9-ef85-1680  19
ProVision-2  GE1/0/23         d4c9-ef84-fe80  19
```

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Task 5: Observe MSTP with the new link

You will now examine how MSTP handles the two links between Comware-1 and Comware-2. You should be familiar with the HP display and show commands for STP from Lab Activity 4.

1. Closely examine the MSTP topology for Comware-1, looking at the status of the two links to Comware-2 in all instances.

[Comware-1] display stp brief

```
MSTID Port                      Role  STP State     Protection
 0    GigabitEthernet1/0/19     DESI  FORWARDING    NONE
 0    GigabitEthernet1/0/20     DESI  FORWARDING    NONE
 0    GigabitEthernet1/0/21     DESI  FORWARDING    NONE
 0    GigabitEthernet1/0/23     DESI  FORWARDING    NONE
 1    GigabitEthernet1/0/19     DESI  FORWARDING    NONE
 1    GigabitEthernet1/0/20     DESI  FORWARDING    NONE
 1    GigabitEthernet1/0/21     DESI  FORWARDING    NONE
 1    GigabitEthernet1/0/23     DESI  FORWARDING    NONE
 2    GigabitEthernet1/0/19     ROOT  FORWARDING    NONE
 2    GigabitEthernet1/0/20     ALTE  DISCARDING    NONE
 2    GigabitEthernet1/0/21     DESI  FORWARDING    NONE
 2    GigabitEthernet1/0/23     DESI  FORWARDING    NONE
```

2. Closely examine the MSTP topology for Comware-2, looking at the status of the ports.

[Comware-2] display stp brief

```
MSTID  Port                      Role  STP State     Protection
 0     GigabitEthernet1/0/19     ROOT  FORWARDING    NONE
 0     GigabitEthernet1/0/20     ALTE  DISCARDING    NONE
 0     GigabitEthernet1/0/21     DESI  FORWARDING    NONE
 0     GigabitEthernet1/0/23     DESI  FORWARDING    NONE
 1     GigabitEthernet1/0/19     ROOT  FORWARDING    NONE
 1     GigabitEthernet1/0/20     ALTE  DISCARDING    NONE
 1     GigabitEthernet1/0/21     DESI  FORWARDING    NONE
 1     GigabitEthernet1/0/23     DESI  FORWARDING    NONE
 2     GigabitEthernet1/0/19     DESI  FORWARDING    NONE
 2     GigabitEthernet1/0/20     DESI  FORWARDING    NONE
 2     GigabitEthernet1/0/21     DESI  FORWARDING    NONE
 2     GigabitEthernet1/0/23     DESI  FORWARDING    NONE
```

Does this new link add bandwidth to the connection between Comware-1 and Comware-2?

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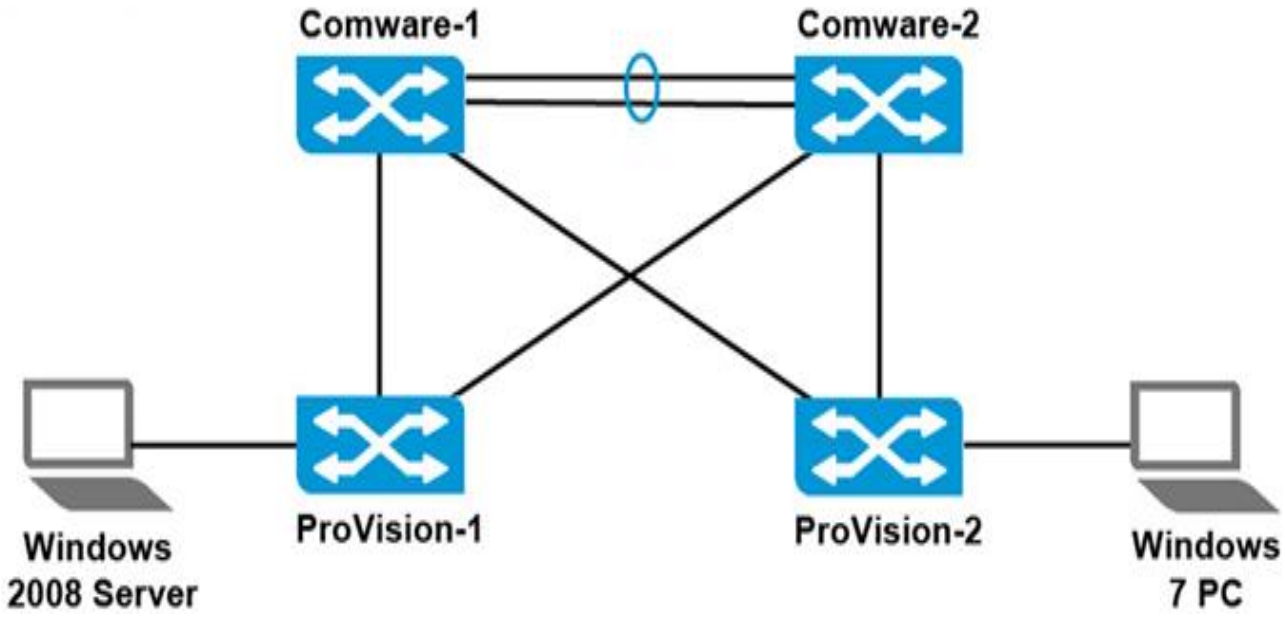
Task 6: Set up a manual aggregated link

This section provides the steps for configuring manual aggregated links, *sometimes called static aggregated links on Comware switches*. These aggregated links do not use any protocol to establish the aggregated links. On each switch, you simply select the physical interfaces that you want for the aggregated link and assign them to the link aggregation interface.

1. Configure an aggregated link between the Comware switches

An aggregated link is a logical interface, and on Comware switches, you create a bridge-aggregation interface as the logical interface for each aggregated link. You then assign physical interfaces to the logical interface.



Access the Comware-1 CLI and move to system view. Create a bridge-aggregation interface with ID 1.

[Comware-1] link-aggregation group 1 mode manual

Assign the two ports that connect to Comware-2 to the link-aggregation group 1.

[Comware-1] interface g1/0/19
[Comware-1-GigabitEthernet1/0/19] port link-aggregation group 1
[Comware-1-GigabitEthernet1/0/19] interface g1/0/20
[Comware-1-GigabitEthernet1/0/20] port link-aggregation group 1
[Comware-1-GigabitEthernet1/0/20] quit

On Comware-1, display the details of the aggregated link. Note that both interfaces have U, or Unselected, status.

[Comware-1] display link-aggregation verbose

```
Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing
Port Status: S -- Selected, U -- Unselected
Flags:  A -- LACP_Activity, B -- LACP_Timeout, C -- Aggregation,
        D -- Synchronization, E -- Collecting, F -- Distributing,
        G -- Defaulted, H -- Expired
Aggregation Interface: Bridge-Aggregation1
Aggregation Mode: Static
Loadsharing Type: Shar
  Port     Status    Oper-Key
--------------------------------------------
```

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Access the Comware-2 CLI and move to system view. On Comware-2, follow similar steps to configure a manual aggregated link with the two interfaces that connect to Comware-1.

[Comware-2] link-aggregation group 1 mode manual

Assign the two ports that connect to Comware-1 to the link-aggregation group 1.
[Comware-2] interface g1/0/19
[Comware-2-GigabitEthernet1/0/19] port link-aggregation group 1
[Comware-2-GigabitEthernet1/0/19] interface g1/0/20
[Comware-2-GigabitEthernet1/0/20] port link-aggregation group 1
[Comware-2-GigabitEthernet1/0/20] quit

2. Observe the aggregated link between the Comware switches

On Comware-2, display the details of the aggregated link. Note that both interfaces have **S**, or Selected, status.

[Comware-2] display link-aggregation verbose

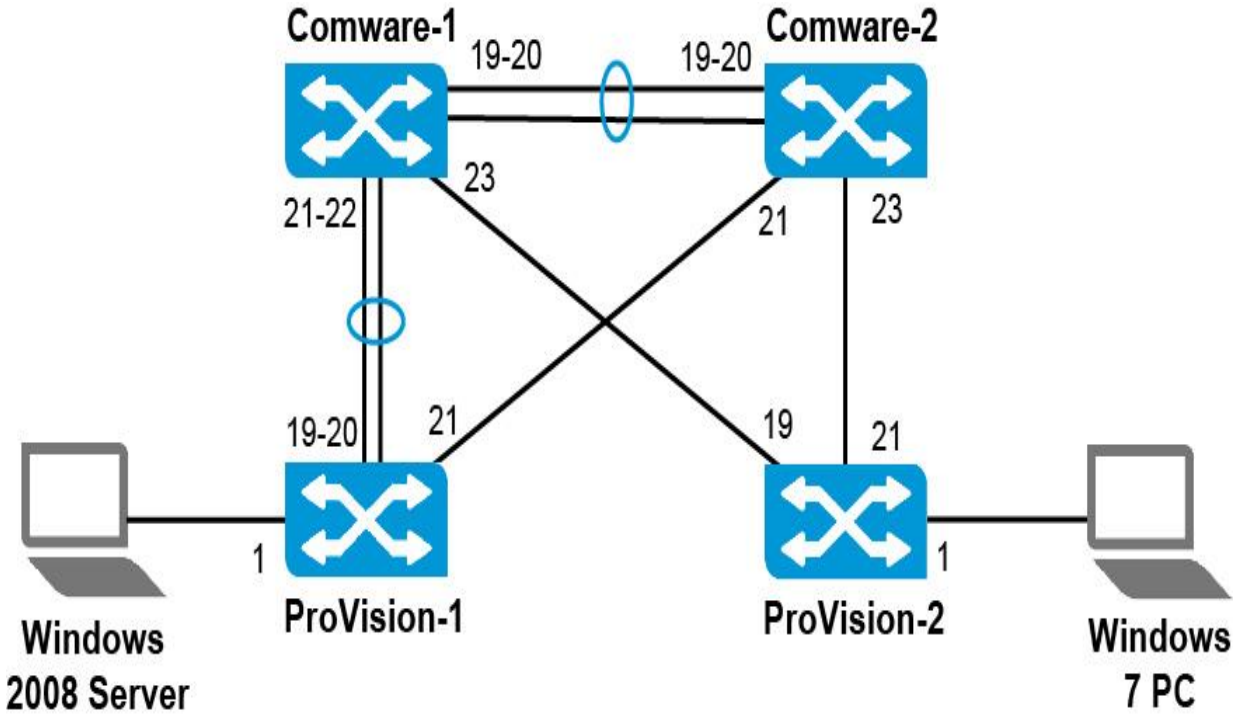
```
Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing
Port Status: S -- Selected, U -- Unselected
Flags:  A -- LACP_Activity, B -- LACP_Timeout, C -- Aggregation,
        D -- Synchronization, E -- Collecting, F -- Distributing,
        G -- Defaulted, H -- Expired
Aggregation Interface: Bridge-Aggregation1
Aggregation Mode: Static
Loadsharing Type: Shar
  Port      Status    Oper-Key
  ---------------------------------------------
```

On Comware-2, examine the MSTP topology. Notice that you no longer see ports 19 and 20, but the bridge-aggregation interface instead.

[Comware-2] display stp brief

```
MSTID   Port                Role   STP State     Protection
  0     Bridge-Aggregation1   ROOT   FORWARDING    NONE
  0     GigabitEthernet1/0/21 DESI   FORWARDING    NONE
  0     GigabitEthernet1/0/23 DESI   FORWARDING    NONE
  1     Bridge-Aggregation1   ROOT   FORWARDING    NONE
  1     GigabitEthernet1/0/21 DESI   FORWARDING    NONE
  1     GigabitEthernet1/0/23 DESI   FORWARDING    NONE
  2     Bridge-Aggregation1   DESI   FORWARDING    NONE
  2     GigabitEthernet1/0/21 DESI   FORWARDING    NONE
  2     GigabitEthernet1/0/23 DESI   FORWARDING    NONE
```

3. Configure an aggregated link between a Comware and ProVision switch



Access the Comware-1 CLI. Create bridge-aggregation interface 2 and assign the link that connects to ProVision-1 to it.

[Comware-1] link-aggregation group 2 mode manual
[Comware-1] interface g1/0/21
[Comware-1-GigabitEthernet1/0/21] port link-aggregation group 2
[Comware-1] quit

Add the second port that connects to ProVision-1 to the aggregated link. Also enable the interface.

[Comware-1] interface g1/0/22
[Comware-1-GigabitEthernet1/0/22] port link-type trunk
[Comware-1-GigabitEthernet1/0/22] port trunk permit vlan all
[Comware-1-GigabitEthernet1/0/22] port link-aggregation group 2
[Comware-1-GigabitEthernet1/0/22] undo shutdown
[Comware-1-GigabitEthernet1/0/22] quit

View the aggregated link.

[Comware-1] display link-aggregation verbose

```
Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing
Port Status: S -- Selected, U -- Unselected
Flags:  A -- LACP_Activity, B -- LACP_Timeout, C -- Aggregation,
        D -- Synchronization, E -- Collecting, F -- Distributing,
        G -- Defaulted, H -- Expired
Aggregation Interface: Bridge-Aggregation1
Aggregation Mode: Static
Loadsharing Type: Shar
  Port     Status    Oper-Key
-------------------------------------------
```

Note that interface g1/0/22 is unselected (U status) because the interface is down (you have not enabled the link on the ProVision-1 side). But observe that g1/0/21 is now selected (S status). Begin to think about what has changed since you checked the status previously. You will now configure the ProVision-1 side of the aggregated. On ProVision switches, you also define a logical interface for the aggregated link. The interfaces are called trunks (not to be confused with Comware trunk ports) and are labeled trk1, trk2, and so on. You define the trunk with the same command that you use to assign ports to it.

Access the ProVision-1 CLI and move to global configuration mode. Assign the two interfaces that connect to Comware-1 to trk1. The trunk option indicates that this is a manual aggregated link.

ProVision-1(config)# trunk 19-20 trk1 trunk

Enable the second interface in the aggregated link.
ProVision-1(config)# interface 20 enable

On ProVision switches, you must define the VLAN settings on the trunk interface.
ProVision-1(config)# vlan 11 tag trk1
ProVision-1(config)# vlan 12 tag trk1

4. Observe the second aggregated link

You will now view the aggregated link on the ProVision switch and verify that it has come up. On ProVision-1, enter:

ProVision-1(config)# show trunks

Load Balancing Method: L3-based (Default), L2-based if non-IP traffic

```
Port    | Name              Type       | Group  Type
------ + ---------------- --------- + ------ --------
19      |                   100/1000T | Trk1   Trunk
20      |                   100/1000T | Trk1   Trunk
```

Also verify the VLAN memberships. Notice that the trk1 interface appears as a VLAN member instead of the physical interfaces of 19 and 20.

ProVision-1(config)# show vlan 11

Status and Counters - VLAN Information - VLAN 11

```
VLAN ID : 11
Name : VLAN11
Status : Port-based
Voice : No
Jumbo : No
Port Information Mode      Unknown VLAN Status
  --------------- -------- ------------ ----------
  1               Untagged Learn        Up
  21              Tagged   Learn        Up
  Trk1            Tagged   Learn        Up
```

ProVision-1(config)# show vlan 12

```
Status and Counters - VLAN Information - VLAN 12
 VLAN ID : 12
 Name : VLAN12
 Status : Port-based
 Voice : No
 Jumbo : No
 Port Information Mode      Unknown VLAN Status
 --------------- --------- ------------ ----------
 21              Tagged    Learn        Up
 Trk1            Tagged    Learn        Up
```

View the MSTP topology for instance 0. Again notice that trk1, as a single logical port, is forwarding.

ProVision-1(config)# show spanning-tree instance ist

<-output omitted->

```
                                                  Designated
Port  Type      Cost   Priority Role       State      Bridge
----- --------- ------ -------- ---------- ---------- -----
1     100/1000T 20000  128      Designated Forwarding d07e28-cec94f
<-output omitted->
21    100/1000T 20000  128      Alternate  Blocking   d07e28-cec94f
<-output omitted->
Trk1            20000  64       Root       Forwarding d07e28-cec94f
```

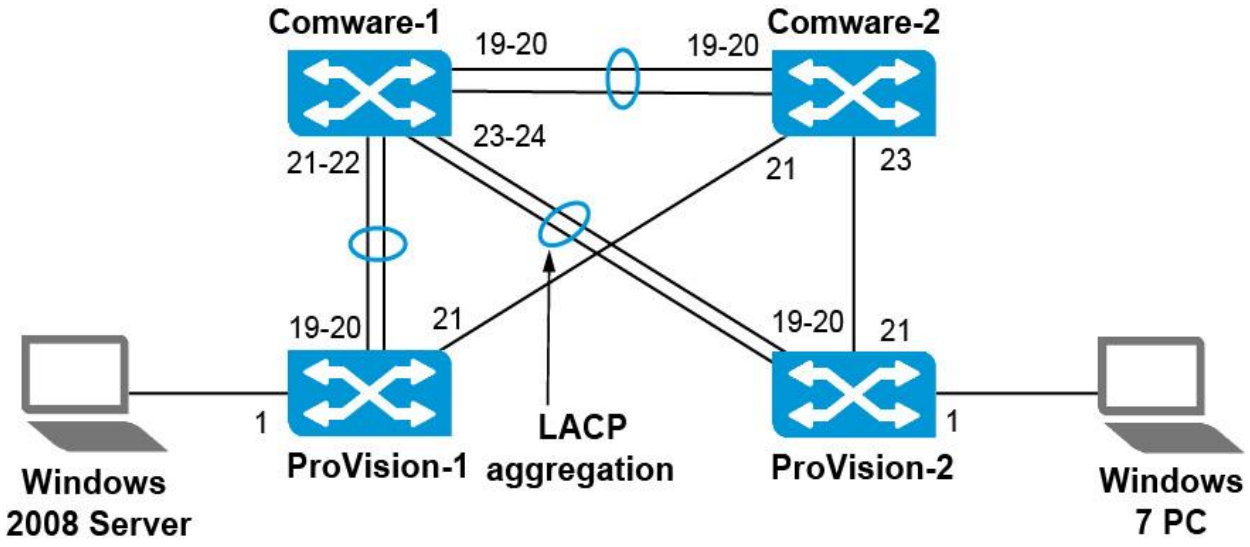
On Comware-1, view a summary of the aggregated links. Verify that the both ports are now selected for BAGG 2.

[Comware-1] display link-aggregation summary
Aggregation Interface Type:
BAGG -- Bridge-Aggregation, RAGG -- Route-Aggregation
Aggregation Mode: S -- Static, D -- Dynamic
Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing
Actor System ID: 0x8000, d07e-28ce-c94f

AGG Interface	AGG Mode	Partner ID	Select Ports	Unselect Ports	Share Type
BAGG1	S	none	2	0	Shar
BAGG2	S	none	2	0	Shar

Task 7: Set up an LACP aggregated link

This section outlines the steps for adding an LACP aggregated link between Comware-1 and ProVision-2 on the example network shown in Figure. This example network uses the settings established in “Example configuration: Set up a manual aggregated link”.



1. Configure an LACP aggregated link

Access the *Comware-1* CLI and move to the system view. Create BAGG 3. Enable LACP on this interface. (The command uses the dynamic option, but the mode is actually static LACP; Comware switches do not support dynamic LACP.)

[Comware-1] link-aggregation group 3 mode static
[Comware-1] interface g1/0/23
[Comware-1-GigabitEthernet1/0/23] port link-aggregation group 3
[Comware-1-GigabitEthernet1/0/23] interface g1/0/24
[Comware-1-GigabitEthernet1/0/24] port link-type trunk
[Comware-1-GigabitEthernet1/0/24] port trunk permit vlan all
[Comware-1-GigabitEthernet1/0/24] port link-aggregation group 3
[Comware-1-GigabitEthernet1/0/24] undo shutdown
[Comware-1-GigabitEthernet1/0/24] quit

Access the *ProVision-2* CLI. Move to the global configuration context. Create a static LACP aggregated link on the two ports that connect to Comware-1.

ProVision-2(config)# trunk 19-20 trk1 lacp

Enable interface 20.
ProVision-2(config)# interface 20 enable

Tag VLAN 11 and 12 on the aggregated link (trk1).
ProVision-2(config)# vlan 11 tagged trk1
ProVision-2(config)# vlan 12 tagged trk1

2. View the aggregated link

You will now examine the aggregated link.
View the trunk on ProVision-2.

ProVision-2(config)# show trunks
Load Balancing Method: L3-based (Default), L2-based if non-IP traffic

```
Port    | Name             Type          Group  Type
------ + ---------------- ---------- + ------ --------
19      |                   100/1000T | Trk1   LACP
20      |                   100/1000T | Trk1   LACP
```

LACP provides more information about the aggregated link. View LACP information on ProVision-2.

ProVision-2(config)# show lacp

```
                                LACP

        LACP    Trunk    Port             LACP     Admin   Oper
Port    Enabled Group    Status   Partner Status   Key     Key
------- ------- -------- -------- ------- -------- ------- -----
19      Active  Trk1     Up       Yes     Success  0       562
20      Active  Trk1     Up       Yes     Success  0       562
```

You can also view information specific to the local side of the aggregated link. For example, you can see this ProVision-2's system ID and that the links are aggregated.

ProVision-2# show lacp local

LACP Local Information.
System ID: d4c9ef-84fe80

```
                 LACP                    Tx       Rx Timer
Port  Trunk      Mode       Aggregated   Timer    Expired
----- ---------- ---------- ------------ -------- ---------
19    Trk1       Active     Yes          Slow     No
20    Trk1       Active     Yes          Slow     No
```

And you can view information about the peer. On ProVision-2 note that both peer interfaces have the same system ID and operational key.

ProVision-2# show lacp peer

LACP Peer Information.
System ID: d4c9ef-84fe80

```
Local  Local                        Port      Oper  LACP      Tx
Port   Trunk  System ID      Port   Priority  Key   Mode      Timer
-----  ------ -------------- -----  --------- ----- --------- -----
19     Trk1   d07e28-cec94f  23     32768     3     Active    Slow
20     Trk1   d07e28-cec94f  24     32768     3     Active    Slow
```

Access the Comware-1 CLI. Verify the status of the aggregated link on Comware-1.

[Comware-1] display link-aggregation verbose

Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing

```
Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing
Port Status: S -- Selected, U -- Unselected
Flags:  A -- LACP_Activity, B -- LACP_Timeout, C -- Aggregation,
        D -- Synchronization, E -- Collecting, F -- Distributing,
        G -- Defaulted, H -- Expired
Aggregation Interface: Bridge-Aggregation1
Aggregation Mode: Static
Loadsharing Type: Shar
  Port     Status    Oper-Key
  ---------------------------------------------
```

Also view a summary of the aggregated links on Comware-1.

<Comware-1> display link-aggregation summary

```
Aggregation Interface Type:
BAGG -- Bridge-Aggregation, RAGG -- Route-Aggregation
Aggregation Mode: S -- Static, D -- Dynamic
Loadsharing Type: Shar -- Loadsharing, Non3 -- Non-Loadsharing
Actor System ID: 0x8000, d07e-28ce-c94f
AGG        AGG  Partner ID              Select Unselect Share
Interface  Mode                         Ports  Ports    Type
--------------------------------------------------------------------
BAGG1      S    none                     2      0        Shar
BAGG2      S    none                     2      0        Shar
BAGG3      D    0xfe80, d4c9-ef84-fe80   2      0        Shar
```

_____
_____
_____
_____
_____
_____
_____

Task 8: Observe load sharing

Verify connectivity in VLAN 1, from ProVision-2, ping Comware-1 (10.1.1.1), Comware-2 (10.1.1.2), and ProVision-1 (10.1.1.3).

ProVision-2(config)# ping 10.1.1.1
10.1.1.1 is alive, time = 2 ms
ProVision-2(config)# ping 10.1.1.2
10.1.1.2 is alive, time = 5 ms
ProVision-2(config)# ping 10.1.1.3
is alive, time = 2 ms

Now you will observe how traffic flows over the physical interfaces within the aggregated link. On ProVision-2, clear the interface statistics and start up the interface menu display.

ProVision-2(config)# clear statistics global
ProVision-2(config)# show interface display

On ProVision-2 you can see the Trk1 interface is displayed. You should already see traffic traversing both links in a trunk from things like STP BPDUs and miscellaneous traffic from the Windows 7 and 2008 computers (like NetBIOS and IP6 management traffic if enabled). Keep this console window open.

Status and Counters - Port Counters

Port	Total Bytes	Total Frames	Errors Rx	Drops Tx	Flow Ctrl	Bca* Lim*
16	0	0	0	0	off	0
17	0	0	0	0	off	0
18	0	0	0	0	off	0
19-Trk1	6723	41	0	0	off	0
20-Trk1	1750	8	0	0	off	0
21	5437	34	0	0	off	0
22	0	0	0	0	off	0
23	0	0	0	0	off	0
24	0	0	0	0	off	0
25	0	0	0	0	off	0
26	0	0	0			

_____
_____19_____
_____20_____
_____21_____
_____

Access the Comware-1 CLI. Return to user view. Send 500 pings to ProVision-2.

<Comware-1> ping -c 500 10.1.1.4

On ProVision-2, look at the statistics for the interfaces in Trk1. You should see statistics for both ports. The statistics *for one of the ports* will probably increase *more rapidly* depending on how your switches choose links for the conversation.

```
                    Status and Counters - Port Counters

                                                                  Flow  Bca*
 Port   Total Bytes   Total Frames  Errors Rx Drops Tx Ctrl   Lim*
-----  -----------  -------------  --------- -------- ----- ---*
16                0              0         0        0  off    0
17                0              0         0        0  off    0
18                0              0         0        0  off    0
19-Trk1      20,841            143         0        0  off    0
20-Trk1       8659             51         0        0  off    0
21           14,431             87         0        0  off    0
22                0              0         0        0  off    0
23                0              0         0        0  off    0
24                0              0         0        0  off    0
25                0              0         0        0  off    0
26                0              0         0        0  off    0
```

_____
_____19_____
_____20_____
_____21_____
_____

Now start another conversation. Access a terminal session with Comware-2 and return to user view. Begin pinging ProVision-2.

<Comware-2> ping -c 500 10.1.1.4

On ProVision-2, look at the statistics for the interfaces in Trk1. With another conversation, you are more likely to see traffic on both links.

```
Status and Counters - Port Counters

                                                                Flow Bca*
Port    Total Bytes Total Frames  Errors Rx  Drops Tx  Ctrl Lim*
------  ----------- -------------  ---------  --------- ---- ---*
16                0              0          0         0  off  0
17                0              0          0         0  off  0
18                0              0          0         0  off  0
19-Trk1      67,542            437          0         0  off  0
20-Trk1      34,626            312          0         0  off  0
21           36,011            135          0         0  off  0
22                0              0          0         0  off  0
23                0              0          0         0  off  0
24                0              0          0         0  off  0
25                0              0          0         0  off  0
26                0              0          0         0  off  0
Actions->   Back     Show details     Reset     Help
```

_____
_____19_____
_____20_____
_____21_____
_____
_____
_____

Press Enter on the Back option to back out of the display. Then press Ctrl+c. On Comware-1 and on Comware-2, press **Ctrl+c** to end the pings.

IP Routing

Lab Activity 6

Objectives

Many HP ProVision switches support routing, even though it is disabled by default, and the vast majority of HP Comware switches support routing. This Lab Activity teaches you more about IP routing.

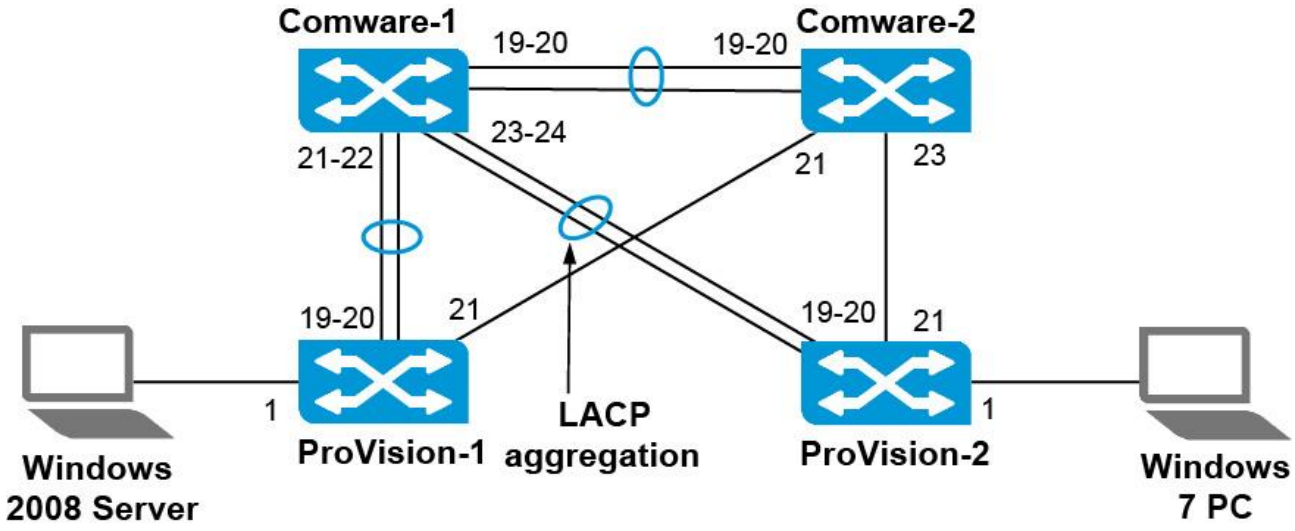
The routing switch uses direct routes and indirect routes.

Direct routes are for local networks on which the routing device has an IP address itself. Direct routes are associated with a Layer 3 forwarding interface such as a VLAN. Such direct routes are automatically added to the routing table when you configure the IP address on the device.

An indirect route, on the other hand, is a route to a remote network, which does not exist on the routing device. You must configure this route on the device manually, or the device must learn it dynamically with a routing protocol. an indirect route includes a destination network address and the next hop—the next device that will forward the packet to its final destination. This next hop is sometimes called the gateway.

After completing this lab, you will be able:

- Set up a network topology to explore IP routing
- Create static IP routes
- Create redundant static IP routes
- Setting up a basic OSPF configuration



Starting network configuration

Task 1: Explore the CLI on an HP Provision switches

1. Verify that the HP ProVision switch has the correct Lab 2 startup configuration by running the command:

Switch# show running-config

You should see the output.

If the running-config includes other settings, you must return HP ProVision switch *to factory default settings.*

2. Return HP ProVision switch to factory default settings

If the output includes other commands, you can return the ProVision switch to factory default settings using the following command:

ProVision# erase startup-config

During the process of returning the switch to factory default settings, you will be prompted to confirm that you want to reboot the switch; **press y**. The switch will be rebooted.

3. Startup Configs on an HP Provision switches for Lab Activity 3

ProVision-1

```
hostname "ProVision-1"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
interface 1
name "Server"
exit
interface 2-18
disable
exit
interface 19
name "Comware-1"
exit
interface 20-24
disable
exit
interface 21
        enable
        exit
```

```
vlan 1
name "DEFAULT_VLAN"
no untagged 1
untagged 2-24
ip address 10.1.1.3  255.255.255.0
exit
vlan 11
name "VLAN11"
untagged 1
tagged 19
tagged 21
no ip address
exit
vlan 12
name "VLAN12"
tagged 19
tagged 21
no ip address
exit
snmp-server community "public" unrestricted
spanning-tree
spanning-tree config-name hp
spanning-tree config-revision 1
spanning-tree instance 1 vlan 11
spanning-tree instance 2 vlan 12
```

ProVision-2

```
hostname "ProVision-2"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
interface 1
name "Client"
exit
interface 2-20
disable
exit
interface 19
enable
exit
interface 21
name "Comware-2"
exit
```

```
interface 22-24
disable
exit
vlan 1
name "DEFAULT_VLAN"
no untagged 1
untagged 2-24
ip address 10.1.1.4  255.255.255.0
exit
vlan 11
name "VLAN11"
tagged 19
tagged 21
no ip address
exit
vlan 12
name "VLAN12"
untagged 1
tagged 19
tagged 21
ip address 10.1.12.3 255.255.255.0
ip helper-address 10.1.1.2
exit
snmp-server community "public" unrestricted
        spanning-tree
spanning-tree config-name hp
spanning-tree config-revision 1
spanning-tree instance 1 vlan 11
spanning-tree instance 2 vlan 12
```

Task 2: Explore the CLI on an HP Comware switch

1. The Comware switch prompt indicates your current view: <HP>
You can move to the system view by entering the command:
<Comware5> system-view
[Comware5]

Verify that the switch has the correct Lab 2 startup configuration by running the command:
[Comware] display current-configuration

You should see the output.

If the current-configuration includes other settings, you must return HP Comware switch *to factory default settings.*

2. Return HP Comware switch to factory default settings

If the Comware switch is not running the default configuration, you can return it to factory default settings by entering:

<HP> reset saved-configuration

When the following prompt is displayed, **press y** and then <Enter>.

The saved configuration file will be erased. Are you sure? [Y/N]: ***Y***
Configuration file in flash is being cleared.
Please wait ...
MainBoard:
Configuration file is cleared.

You then need to reboot the switch, using the reboot command as shown below. If a prompt is displayed, asking if you want to save the current configuration, press **n** and then press <Enter>. When prompted to continue the reboot, press **y** and then <Enter>.

<HP> reboot
Start to check configuration with next startup configuration file, please wait.....DONE!
*This command will reboot the device. Current configuration will be lost, save current configuration? [Y/N]:****n***
*This command will reboot the device. Continue? [Y/N]:****y***
#May 1 14:00:07:594 2000 Comware DEVM/1/REBOOT:
Reboot device by command.
%May 1 14:00:07:694 2000 Comware DEVM/5/SYSTEM_REBOOT: System is -rebooting now.
Starting.....

3. Startup Configs on an HP Comware switches for Lab Activity 3

Comware-1
sysname "Comware-1"
vlan 1
vlan 11
vlan 12
interface Vlan-interface1
ip address 10.1.1.1 255.255.255.0

```
interface Vlan-interface11
ip address 10.1.11.1  255.255.255.0
interface Vlan-interface12
ip address 10.1.12.1  255.255.255.0
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-2
port link-type trunk
port trunk permit vlan all
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
        description  Provision-1
port link-type trunk
port trunk permit vlan all
interface Ethernet1/0/22
        shutdown
interface Ethernet1/0/23
port link-type trunk
port trunk permit vlan all
undo shutdown
interface Ethernet1/0/24
        shutdown
……
interface Ethernet1/0/48
        shutdown
dhcp enable
dhcp-server 1 ip 10.1.1.2
interface Vlan-interface12
        dhcp server 1
address-check enable
stp root primary
stp enable
lldp enable
stp region-configuration
        region-name hp
revision-level 1
instance 1 vlan 11
instance 2 vlan 12
```

active region-configuration
stp instance 0 root primary
stp instance 1 root primary
stp instance 2 root secondary
stp pathcost dot1t

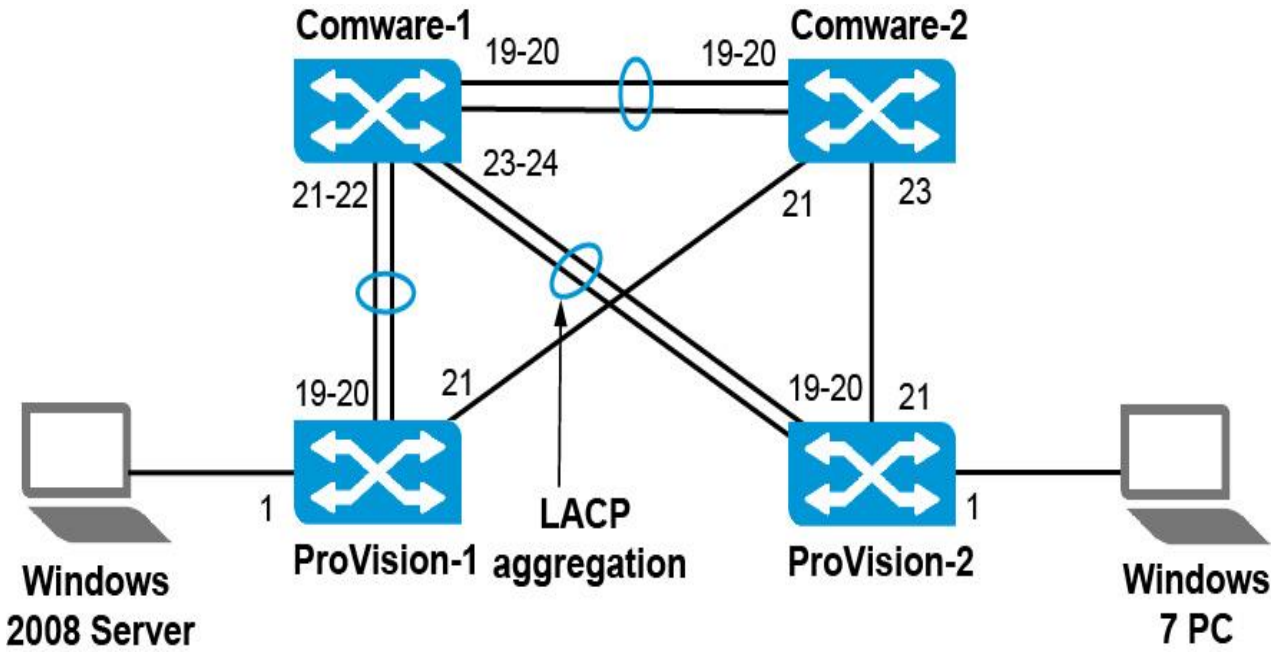
Comware-2

```
sysname "Comware-2"
ip route 0.0.0.0  0.0.0.0  10.1.1.1
vlan 1
vlan 11
vlan 12
interface Vlan-interface1
ip address 10.1.1.2  255.255.255.0
dhcp server ip-pool 1
        network 10.1.12.0 mask 255.255.255.0
gateway-list 10.1.12.1
expired day 1
interface Ethernet1/0/1
        shutdown
……
interface Ethernet1/0/18
        shutdown
interface Ethernet1/0/19
        description  Comware-1
port link-type trunk
port trunk permit vlan all
interface Ethernet1/0/20
        shutdown
interface Ethernet1/0/21
port link-type trunk
port trunk permit vlan all
undo shutdown
interface Ethernet1/0/22
        shutdown
interface Ethernet1/0/23
        description  Provision-2
port link-type trunk
port trunk permit vlan all
interface Ethernet1/0/24
        shutdown
……
interface Ethernet1/0/48
        shutdown
```

dhcp enable
dhcp server forbidden-ip 10.1.12.1 10.1.12.20
dhcp server ping packets 2
dhcp server ping timeout 750
stp enable
lldp enable
stp region-configuration
region-name hp
revision-level 1
instance 1 vlan 11
instance 2 vlan 12
active region-configuration
stp instance 0 root secondary
stp instance 1 root secondary
stp instance 2 root primary
stp pathcost dot1t

Task 3: Verify MSTP and link aggregation settings from Lab Activity 5

This section sets up a network topology that will be used later in this chapter to illustrate IP routing. It also explores additional concepts related to MSTP.
In a small, simple network topology, direct routes with a few default routes work well. For example, in a simple network topology, all the VLANs might use the same default router, which routes traffic between its connected networks.



You can verify MSTP settings by accessing the Comware-1 and Comware-2 CLI and viewing the MSTP root settings:

[Comware-1] display stp brief

MSTID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/19	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/19	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/19	ROOT	FORWARDING	NONE
2	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/23	DESI	FORWARDING	NONE

[Comware-2] display stp brief

MSTID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/19	ROOT	FORWARDING	NONE
0	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/19	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/23	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/19	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/21	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/23	DESI	FORWARDING	NONE

Also view a summary of the aggregated links on Comware-1.

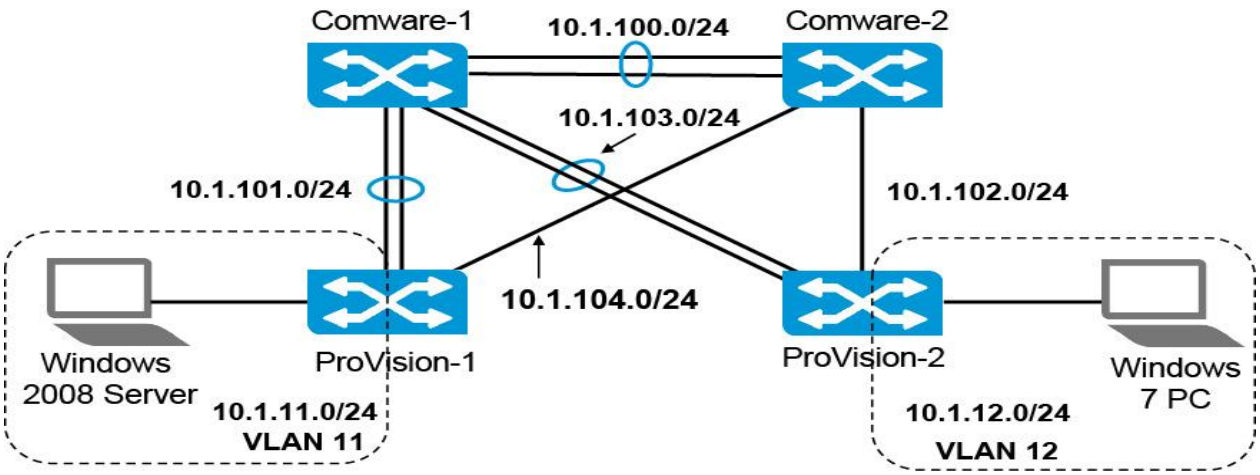
<Comware-1> display link-aggregation summary

```
Aggregation Interface Type:
BAGG -- Bridge-Aggregation, RAGG -- Route-Aggregation
Aggregation Mode: S -- Static, D -- Dynamic
Loadsharing Type: Shar -- Loadsharing, Non8 -- Non-Loadsharing
Actor System ID: 0x8000, d07e-28ce-c94f
AGG         AGG  Partner ID              Select Unselect Share
Interface   Mode                         Ports  Ports    Type
--------------------------------------------------------------------------
BAGG1       S    none                     2      0        Shar
BAGG2       S    none                     2      0        Shar
BAGG3       D    0xfe80, d4c9-ef84-fe80   2      0        Shar
```

_____
_____
_____
_____

Task 4: Set up a network topology to explore IP routing

The network topology shown in Figure below, however, is somewhat more complex There is a Layer 3 hop between each switch, and each switch acts as a routing switch This network topology requires indirect routes



1. Configure the VLAN and IP topology on Comware-1

In the new VLAN and IP topology, shown in Table, Comware-1 assigns a different VLAN and subnet for each connection to another switch. Table indicates the VLAN and IP address for each connection. The instructions below outline how to make these changes to the example network.

Connection to	VLAN	IP address
Comware-2	100	10.1.100.1/24
ProVision-1	101	10.1.101.1/24
ProVision-2	103	10.1.103.1/24

Access the Comware-1 CLI and move to system view. Remove VLANs 11 and 12.

[Comware-1] undo vlan 11
[Comware-1] undo vlan 12

Create three VLANs: 100, 101, and 103.

[Comware-1] vlan 100
[Comware-1-vlan100] vlan 101
[Comware-1-vlan101] vlan 103

Change each interface to an access port and assign the interface to the VLAN indicated in Table.

[Comware-1-vlan103] interface e1/0/19
[Comware-1-tEthernet1/0/19] port link-type access
[Comware-1-tEthernet1/0/19] port access vlan 100

[Comware-1-tEthernet1/0/19] interface e1/0/20
[Comware-1-tEthernet1/0/20] port link-type access
[Comware-1-tEthernet1/0/20] port access vlan 100

[Comware-1-tEthernet1/0/20] interface e1/0/21
[Comware-1-tEthernet1/0/21] port link-type access
[Comware-1-tEthernet1/0/21] port access vlan 101

[Comware-1-tEthernet1/0/21] interface e1/0/22
[Comware-1-tEthernet1/0/22] port link-type access
[Comware-1-tEthernet1/0/22] port access vlan 101

[Comware-1-tEthernet1/0/22] interface e1/0/23
[Comware-1-tEthernet1/0/23] port link-type access
[Comware-1-tEthernet1/0/23] port access vlan 103

[Comware-1-tEthernet1/0/23] interface e1/0/24
[Comware-1-tEthernet1/0/24] port link-type access
[Comware-1-tEthernet1/0/24] port access vlan 103

[Comware-1-tEthernet1/0/24] quit

Verify the VLAN configuration.

```
[Comware-1] display vlan 100
VLAN ID: 100
VLAN Type: static
Route Interface: not configured
Description: VLAN 0100
Name: VLAN 0100
Tagged Ports: none
Untagged Ports:
  Bridge-Aggregation1
  GigabitEthernet1/0/19 GigabitEthernet1/0/20
```

```
[Comware-1] display vlan 101
VLAN ID: 101
VLAN Type: static
Route Interface: not configured
Description: VLAN 0101
Name: VLAN 0101
Tagged Ports: none
Untagged Ports:
  Bridge-Aggregation2
  GigabitEthernet1/0/21 GigabitEthernet1/0/22
```

```
[Comware-1] display vlan 103
VLAN ID: 103
VLAN Type: static
Route Interface: not configured
```

```
Description: VLAN 0103
Name: VLAN 0103
Tagged Ports: none
Untagged Ports:
  Bridge-Aggregation3
  GigabitEthernet1/0/23 GigabitEthernet1/0/24
```

Create a Layer 3 interface for each VLAN and assign it the IP address indicated in Table.

[Comware-1] interface vlan-interface 100
[Comware-1-Vlan-interface100] ip address 10.1.100.1 24
[Comware-1-Vlan-interface100] quit

[Comware-1] interface vlan-interface 101
[Comware-1-Vlan-interface101] ip address 10.1.101.1 24
[Comware-1-Vlan-interface101] quit

[Comware-1] interface vlan-interface 103
[Comware-1-Vlan-interface103] ip address 10.1.103.1 24
[Comware-1-Vlan-interface103] quit

Verify the configuration. Note that Comware-1 still has the VLAN 1 IP address, but that VLAN is down. Verify that the three new IP interfaces are up.

[Comware-1] display interface Vlan-interface

```
The brief information of interface(s) under route mode:
Interface Link Protocol-link Protocol type Main IP
NULL0     UP   UP(spoofing)   NULL          --
Vlan1     DOWN DOWN            ETHERNET      10.1.1.1
Vlan100   UP   UP              ETHERNET      10.1.100.1
Vlan101   UP   UP              ETHERNET      10.1.101.1
Vlan103   UP   UP              ETHERNET      10.1.103.1
<-output omitted->
```

2. Configure the VLAN and IP topology on Comware-2

Comware-2 also assigns a different VLAN and subnet for each connection to another switch. You will begin by making the connections just to Comware-1 and ProVision-1. Table indicates the VLAN and IP address for each connection.

Connection to	VLAN	IP address
Comware-1	100	10.1.100.2/24
ProVision-1	104	10.1.104.2/24
Provision-1	**102**	**10.1.102.2/24**

Access a terminal session with Comware-2 and move to system view. 9. Remove VLANs 11 and 12.

[Comware-2] undo vlan 11
[Comware-2] undo vlan 12

Create two VLANs: 100 and 104.

[Comware-2] vlan 100
[Comware-2-vlan100] vlan 104
[Comware-2-vlan100] vlan 102

Change the connections to Comware-1 and ProVision-1 to access ports. Assign the VLANs indicated in Table.

[Comware-2-vlan104] interface e1/0/19
[Comware-2-tEthernet1/0/19] port link-type access
[Comware-2-tEthernet1/0/19] port access vlan 100

[Comware-2-tEthernet1/0/19] interface e1/0/20
[Comware-2-tEthernet1/0/20] port link-type access
[Comware-2-tEthernet1/0/20] port access vlan 100

[Comware-2] interface e1/0/21
[Comware-2-Ethernet1/0/21] port link-type access
[Comware-2-Ethernet1/0/21] port access vlan 104
[Comware-2-Ethernet1/0/21] quit

[Comware-2] interface e1/0/23
[Comware-2-Ethernet1/0/23] port link-type access
[Comware-2-Ethernet1/0/23] port access vlan 102
[Comware-2-Ethernet1/0/23] quit

Verify your VLAN configuration.

```
[Comware-2] display vlan 100
VLAN ID: 100
VLAN Type: static
Route Interface: not configured
Description: VLAN 0100
Name: VLAN 0100
Tagged Ports: none
Untagged Ports:
  Bridge-Aggregation1
  GigabitEthernet1/0/19 GigabitEthernet1/0/20
```

```
[Comware-2] display vlan 104
VLAN ID: 104
VLAN Type: static
Route Interface: not configured
Description: VLAN 0104
Name: VLAN 0104
Tagged Ports: none
Untagged Ports:
  GigabitEthernet1/0/21
```

Create a Layer 3 interface for each VLAN and assign it the IP address indicated in Table .

[Comware-2] interface vlan-interface 100
[Comware-2-Vlan-interface100] ip address 10.1.100.2 24
[Comware-2-Vlan-interface100] quit

[Comware-2] interface vlan-interface 104
[Comware-2-Vlan-interface104] ip address 10.1.104.2 24
[Comware-2-Vlan-interface104] quit

[Comware-2] interface vlan-interface 102
[Comware-2-Vlan-interface102] ip address 10.1.102.2 24
[Comware-2-Vlan-interface102] quit

Verify the configuration.

[Comware-2] display interface Vlan-interface

```
The brief information of interface(s) under route mode:
Interface Link Protocol-link Protocol type Main IP
NULL0 UP UP(spoofing) NULL --
Vlan1 DOWN DOWN ETHERNET 10.1.1.2
Vlan100 UP UP ETHERNET 10.1.100.2
Vlan104 UP UP ETHERNET 10.1.104.2
<-output omitted->
```

3. Configure the VLAN and IP topology on ProVision-1

ProVision-1 also assigns a different VLAN and subnet for each connection to another switch. Table indicates the VLAN and IP address for each connection. You will now make these changes.

Connection to	VLAN	IP address
Comware-1	101	10.1.101.3/24
Comware-2	104	10.1.104.3/24
Servers	11	10.1.11.1/24

Access a terminal session with ProVision-1. Move to the global configuration context. 17. Remove VLAN 12.

ProVision-1(config)# no vlan 12

Remove VLAN 11 from the connections to Comware-1 and Comware-2.

ProVision-1(config)# no vlan 11 tagged trk1,21

Create the two new VLANs. Assign each to the proper connection as an untagged VLAN.

ProVision-1(config)# vlan 101
ProVision-1(vlan-101)# untagged trk1
ProVision-1(vlan-101)# exit

ProVision-1(config)# vlan 104
ProVision-1(vlan-104)# untagged 21
ProVision-1(vlan-104)# exit

Verify your VLAN configuration.

```
ProVision-1(config)# show vlan 101
Status and Counters - VLAN Information - VLAN 101
VLAN ID : 101
Name : VLAN101
Status : Port-based
Voice : No
Jumbo : No
  Port Information Mode      Unknown VLAN Status
  ---------------- --------- ------------ ----------

Trk1               Untagged Learn          Up
```

```
ProVision-1(config)# show vlan 104
Status and Counters - VLAN Information - VLAN 104
VLAN ID : 104
Name : VLAN104
Status : Port-based
Voice : No
Jumbo : No
  Port Information Mode      Unknown VLAN Status
  ---------------- --------- ------------ ----------
  21               Untagged Learn          Up
```

```
ProVision-1(config)# show vlan 11
Status and Counters - VLAN Information - VLAN 11
VLAN ID : 11
Name : VLAN11
Status : Port-based
Voice : No
Jumbo : No
  Port Information Mode      Unknown VLAN Status
  ---------------- --------- ------------ ----------

  1                Untagged Learn          Up
```

Assign each VLAN the IP addresses indicated in Table.

ProVision-1(config)# vlan 101 ip address 10.1.101.3/24
ProVision-1(config)# vlan 104 ip address 10.1.104.3/24
ProVision-1(config)# vlan 11 ip address 10.1.11.1/24

Verify the configuration.

```
ProVision-1(config)# show ip

Internet (IP) Service

  IP Routing : Disabled

  Default Gateway :

  Default TTL : 64

  Arp Age : 20

  Domain Suffix :

  DNS server :

                |                                        Proxy ARP
 VLAN           | IP Config IP Address Subnet Mask   Std  Local
 -------------- + --------- ---------- ------------- ---- -----
 DEFAULT_VLAN   | Manual    10.1.1.3   255.255.255.0 No   No
 VLAN11         | Manual    10.1.11.1  255.255.255.0 No   No
 VLAN101        | Manual    10.1.101.3 255.255.255.0 No   No
 VLAN104        | Manual    10.1.104.3 255.255.255.0 No   No
```

You have set up VLAN 101 (subnet 10.1.100.0/24) and VLAN 104 (subnet 10.1.104.0/24) on both sides of the link. Ping Comware-1 and Comware-2 from ProVision-1.

ProVision-1(config)# ping 10.1.101.1

_____

ProVision-1(config)# ping 10.1.104.2

_____

View the IST roles for the connections to Comware-1 and Comware-2. (The new VLANs are part of the IST.)

```
ProVision-1(config)# show spanning-tree trk1,21 instance ist

<-output omitted->

                                                    Designated
Port Type      Cost  Priority Role      State      Bridge
---- --------- ----- -------- --------- ---------- -------------
21   100/1000T 20000 128      Alternate Blocking   d07e28-cec94f
Trk1           20000  64      Root      Forwarding d07e28-cec94f
```

4. Disable spanning tree on the links between ProVision-1 and Comware-2 to allow routing over all links.

ProVision-1(config)# spanning-tree 21 bpdu-filter

Verify that ProVision-1 can now ping Comware-2.

ProVision-1(config)# ping 10.1.104.2

---

5. Configure the VLAN and IP topology on ProVision-2

ProVision-2 also assigns a different VLAN and subnet to each connection to another switch. Table indicates the VLAN and IP address for each connection. You will now make these changes.

Connection to	VLAN	IP address
Comware-1	103	10.1.103.4/24
Comware-2	102	10.1.102.4/24
Clients	12	10.1.12.1/24

Access a terminal session with ProVision-2. Move to the global configuration mode. Remove VLAN 11.

ProVision-2(config)# no vlan 11

Remove VLAN 12 from the connections to Comware-1 and Comware-2.

ProVision-2(config)# no vlan 12 tagged trk1,21

Create the two new VLANs. Assign each to the proper connection as an untagged VLAN.

ProVision-2(config)# vlan 102
ProVision-2(vlan-102)# untagged 21
ProVision-2(vlan-102)# exit
ProVision-2(config)# vlan 103
ProVision-2(vlan-103)# untagged trk1
ProVision-2(vlan-102)# exit

Verify your VLAN configuration.

```
ProVision-2(config)# show vlan 102

Status and Counters - VLAN Information - VLAN 102

VLAN ID : 102

Name : VLAN102

Status : Port-based

Voice : No

Jumbo : No

  Port Information Mode      Unknown VLAN Status

  ---------------- --------- ------------ ----------

  21                 Untagged Learn          Up
```

```
ProVision-2(config)# show vlan 103

Status and Counters - VLAN Information - VLAN 103

VLAN ID : 103

Name : VLAN103

Status : Port-based

Voice : No

Jumbo : No

  Port Information Mode      Unknown VLAN Status

  ---------------- --------- ------------ ----------

  Trk1               Untagged Learn          Up
```

```
ProVision-2(config)# show vlan 12

Status and Counters - VLAN Information - VLAN 12

VLAN ID : 12
Name : VLAN12
Status : Port-based
Voice : No
Jumbo : No

  Port Information Mode      Unknown VLAN Status
  ---------------- --------- ------------ ----------
  1                Untagged  Learn        Up
```

Assign each VLAN the IP addresses indicated in Table.

ProVision-2(config)# vlan 102 ip address 10.1.102.4/24
ProVision-2(config)# vlan 103 ip address 10.1.103.4/24
ProVision-2(config)# vlan 12 ip address 10.1.12.1/24
Verify the configuration.

```
ProVision-2(config)# show ip
Internet (IP) Service
  IP Routing : Disabled
<-output omitted->
```

```
                |                                          Proxy ARP
 VLAN           | IP Config  IP Address  Subnet Mask    Std  Local
 -------------- + ---------- ----------- -------------- ---------
 DEFAULT_VLAN   | Manual     10.1.1.4    255.255.255.0  No   No
 VLAN12         | Manual     10.1.12.1   255.255.255.0  No   No
 VLAN102        | Manual     10.1.102.4  255.255.255.0  No   No
 VLAN103        | Manual     10.1.103.4  255.255.255.0  No   No
```

You have set up VLAN 103 (subnet 10.1.103.0/24) and VLAN 102 (subnet 10.1.102.0/24) on both sides of the link. You should be able to ping Comware-1 and Comware-2 from ProVision-2.

ProVision-2(config)# ping 10.1.103.1

ProVision-2(config)# ping 10.1.102.2

---

6. Disable spanning tree on the links between ProVision-1 and Comware-2 to allow routing over all links.

ProVision-2(config)# spanning-tree 21 bpdu-filter

Verify that ProVision-2 can now ping Comware-2.

ProVision-2(config)# ping 10.1.102.2

---

7. Configure a static IP address on the client

When you changed the logical topology, you disrupted connectivity between the Windows client, its default gateway, and the DHCP server in the example network. This section outlines how to assign the client a static IP address.

Access the Windows 7 PC desktop.

Select TCP/IP version 4 and click Properties.

Change the client's IP address to 10.1.12.12/24. Set the default gateway address to 10.1.12.1.

After you have set the address, remember to click OK in the Properties window and then Close.

Open a command prompt. Validate that you have set the IP address correctly.

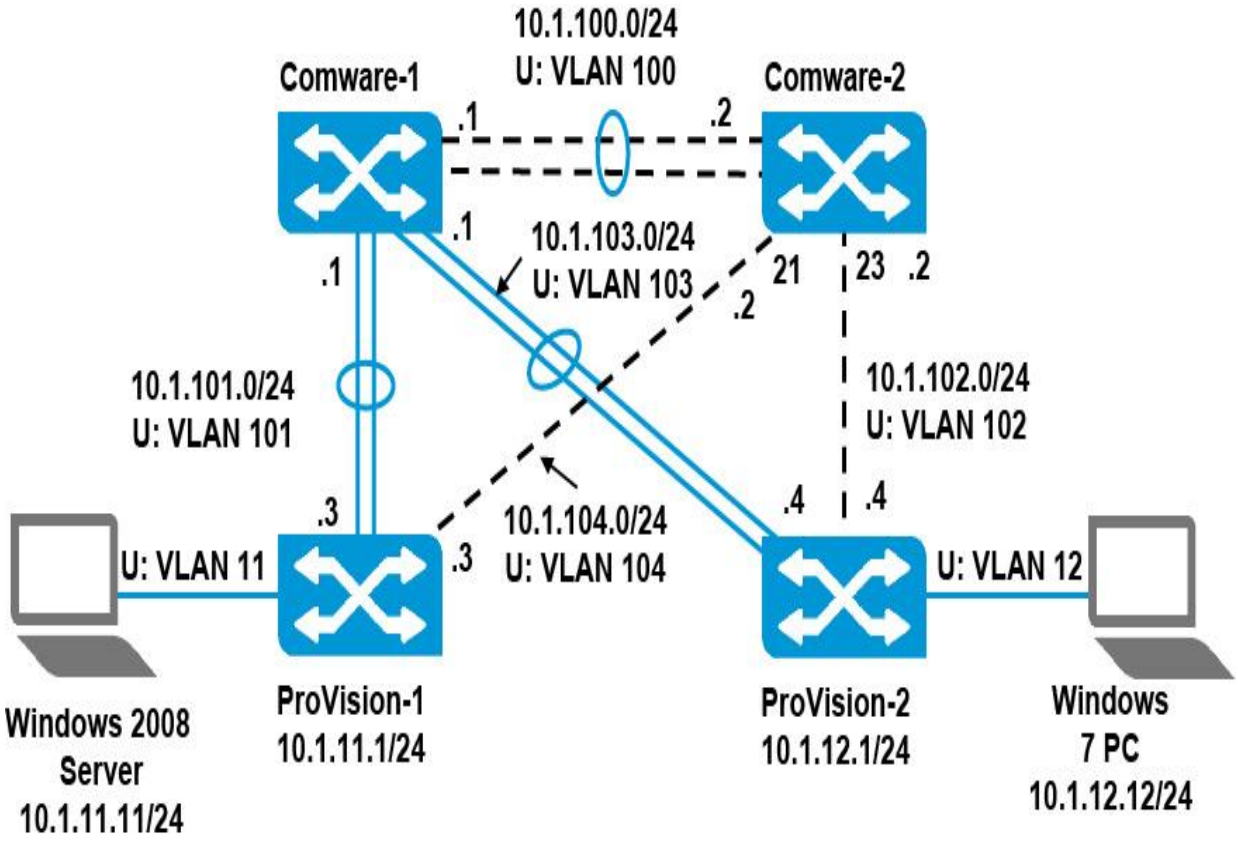
ipconfig

Ping the default gateway and verify success.

ping 10.1.12.1

Task 5: Create static IP routes

This section builds on the example network established in "Example configuration: Set up a network topology to explore IP routing". In this section, you will learn how to set up static routes on ProVision-1, ProVision-2, and Comware-1 to enable connectivity between the server in 10.1.11.0/24 and the PC in 10.1.12.0/24, as shown in Figure.



You will use default routes on the ProVision switches, which are using Comware-1 as their single next hop for all other destinations. You will create routes to specific destination networks on Comware-1, which needs to route some traffic to ProVision-1 and some traffic to ProVision-2.

1. Configure the static routes

Table lists the routes required to establish the path between the server and Windows PC.

Switch	Destination network	Next hop
ProVision-1	10.1.12.0/24 or 0.0.0.0/0	10.1.101.1
Comware-1	10.1.12.0/24	10.1.103.4
	10.1.11.0/24	10.1.101.3
ProVision-2	10.1.11.0/24 or 0.0.0.0/0	10.1.103.1

Access the ProVision-1 CLI and move to the global configuration mode context. Enable IP routing.

ProVision-1(config)# ip routing

Create a default route through Comware-1 at 10.1.101.1.

ProVision-1(config)# ip route 0.0.0.0/0 10.1.101.1

View the IP routing table on *ProVision-1*.

```
ProVision-1(config)# show ip route

                          IP Route Entries

 Destination     Gateway  VLAN  Type       Sub-Type Metric  Dist.
 --------------- -------- ---- ---------- --------- ------- -----
 0.0.0.0/0       10.1.101.1 101 static                1       1
 10.1.11.0/24    VLAN11       11 connected             1       0
 10.1.101.0/24   VLAN101     101 connected             1       0
 10.1.104.0/24   VLAN104     104 connected             1       0
 127.0.0.0/8     reject           static              0       0
 127.0.0.1/32    lo0              connected           1       0
```

2. Use trace routes to learn the topology

A trace route lists each routing hop between the device that executes the trace route and the destination. (Intervening devices at Layer 2 do not show up in the trace route.)

To allow your trace routes to succeed, you must enable these functions on the Comware-1.

[Comware-1] ip ttl-expires enable

[Comware-1] ip unreachables enable

Access the Windows 2008 server desktop and open a command prompt. Execute a trace route to the Windows 7 PC (10.1.12.12).

```
tracert -d 10.1.12.12
Tracing route to 10.1.12.12 over a maximum of 30 hops
  1    <1 ms    <1 ms     1 ms  10.1.11.1
  2     *        *        *     Request timed out.
  3     *        *        *     Request timed out.
```

Notice that the trace fails after one hop. Press <Ctrl+C> to end it.

Why did the routing fail?

_____

_____

_____

Access the Comware-1 CLI and move to system view. Examine the routing table to validate that Comware-1 has no route to 10.1.12.0/24.

```
[Comware-1] display ip routing-table
Routing Tables: Public
       Destinations : 8        Routes : 8

Destination/Mask   Proto   Pre  Cost      NextHop         Interface

10.1.100.0/24      Direct  0    0         10.1.100.1      Vlan100
10.1.100.1/32      Direct  0    0         127.0.0.1       InLoop0
10.1.101.0/24      Direct  0    0         10.1.101.1      Vlan101
10.1.101.1/32      Direct  0    0         127.0.0.1       InLoop0
10.1.103.0/24      Direct  0    0         10.1.103.1      Vlan103
10.1.103.1/32      Direct  0    0         127.0.0.1       InLoop0
127.0.0.0/8        Direct  0    0         127.0.0.1       InLoop0
127.0.0.1/32       Direct  0    0         127.0.0.1       InLoop0
```

Create the static route to 10.1.12.0/24 through ProVision-2 at 10.1.103.4. (Refer to Figure 9-14 as needed.)

[Comware-1] ip route-static 10.1.12.0 24 10.1.103.4

Also create the static route for return traffic to 10.1.11.0/24. The next hop is ProVision-1 at 10.1.101.3.

[Comware-1] ip route-static 10.1.11.0 24 10.1.101.3

View the new routes in the IP routing table.

```
 [Comware-1] display ip routing-table
Routing Tables: Public
        Destinations : 10        Routes : 10

Destination/Mask Proto   Pre  Cost      NextHop         Interface

10.1.11.0/24     Static  60   0         10.1.101.3      Vlan101
10.1.12.0/24     Static  60   0         10.1.103.4      Vlan103
10.1.100.0/24    Direct  0    0         10.1.100.1      Vlan100
10.1.100.1/32    Direct  0    0         127.0.0.1       InLoop0
10.1.101.0/24    Direct  0    0         10.1.101.1      Vlan101
10.1.101.1/32    Direct  0    0         127.0.0.1       InLoop0
10.1.103.0/24    Direct  0    0         10.1.103.1      Vlan103
10.1.103.1/32    Direct  0    0         127.0.0.1       InLoop0
127.0.0.0/8      Direct  0    0         127.0.0.1       InLoop0
127.0.0.1/32      Direct 0    0         127.0.0.1       InLoop0
```

Access the Windows 2008 server and do the trace route again.

```
tracert -d 10.1.12.12
Tracing route to 10.1.12.12 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  10.1.11.1
  2     1 ms     1 ms     1 ms  10.1.101.1
  3     *        *        *     Request timed out.
  4     *        *        *     Request timed out.
```

Notice that the trace fails after two hops. Press <Ctrl+C> to end it.

Why does the trace route fail after two hops?

_____
_____
_____

Access the ProVision-2 CLI and move to the global configuration mode context. Enable IP routing.

ProVision-2(config)# ip routing

Create a default route through Comware-1 at 10.1.103.1.

ProVision-2(config)# ip route 0.0.0.0/0 10.1.103.1

View the IP routing table

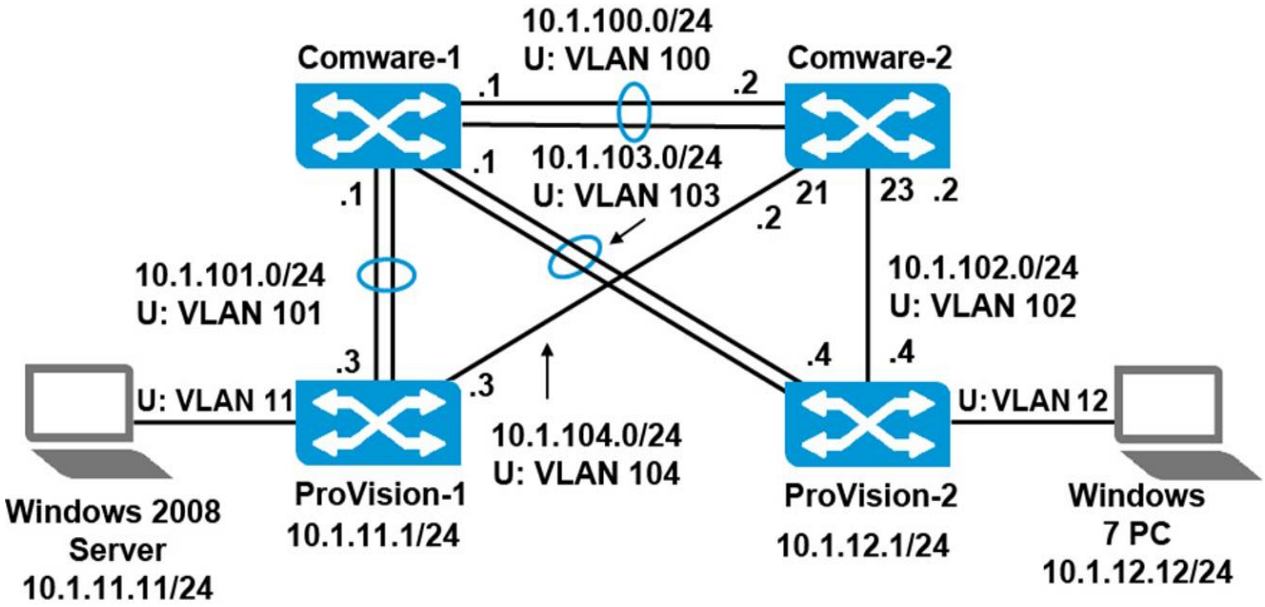
```
ProVision-2(config)# show ip route

                IP Route Entries

Destination     Gateway         VLAN Type        Sub-Type   Metric Dist.
--------------- --------------- ---- ----------- ---------- ------ -----
0.0.0.0/0       10.1.103.1      103  static                  1      1
10.1.12.0/24    VLAN12          12   connected               1      0
10.1.102.0/24   VLAN102         102  connected               1      0
10.1.103.0/24   VLAN103         103  connected               1      0
127.0.0.0/8     reject               static                  0      0
127.0.0.1/32    lo0                  connected               1      0
```

Access the Windows 2008 server and start the trace route again. It should be successful.

```
tracert -d 10.1.12.12
Tracing route to 10.1.12.12 over a maximum of 30 hops
1     <1 ms     <1 ms     <1 ms   10.1.11.1
2      1 ms      1 ms      1 ms   10.1.101.1
3     <1 ms     <1 ms     <1 ms   10.1.103.4
4      4 ms     <1 ms     <1 ms   10.1.12.12
Trace complete.
```

Task 6: Create redundant static IP routes

This section builds on the network topology established in "Example configuration: Create static IP routes". The example network is shown in Figure. In this section you will learn how to set up routes to enable redundancy for the ProVision-1 links.



1. Set up static routes on Comware-2

You will configure ProVision-1 to route traffic through Comware-2, so you must set up routing on Comware-2.

Access the Comware-2 CLI and move to the system view. Create a static route to 10.1.12.0/24 through ProVision-2 at 10.1.102.4.

[Comware-2] ip route-static 10.1.12.0 24 10.1.102.4

Create a static route to 10.1.11.0/24 through ProVision-1 at 10.1.104.3.

[Comware-2] ip route-static 10.1.11.0 24 10.1.104.3

Check the routes.

```
[Comware-2] display ip routing
Routing Tables: Public
         Destinations : 10        Routes : 10
Destination/Mask   Proto   Pre  Cost      NextHop         Interface
10.1.11.0/24       Static  60   0           10.1.104.3    GE1/0/21
10.1.12.0/24       Static  60   0           10.1.102.4    GE1/0/23
10.1.100.0/24      Direct  0    0           10.1.100.2    Vlan100
10.1.100.2/32      Direct  0    0           127.0.0.1     InLoop0
10.1.102.0/24      Direct  0    0           10.1.102.2    GE1/0/23
10.1.102.2/32      Direct  0    0           127.0.0.1     InLoop0
10.1.104.0/24      Direct  0    0           10.1.104.2    GE1/0/21
10.1.104.2/32      Direct  0    0           127.0.0.1     InLoop0
127.0.0.0/8        Direct  0    0           127.0.0.1     InLoop0
127.0.0.1/32       Direct  0    0           127.0.0.1     InLoop0
```

Trace routes use pings with successively higher TTLs to trace each hop in the route. They also require routers to send ICMP unreachable messages when they receive a ping with an expired TTL. By default, Comware devices ignore ICMP messages with TTLs and do not respond with ICMP unreachable messages. To allow your trace routes to succeed, you must enable these functions on the Comware-2.

[Comware-2] ip ttl-expires enable
[Comware-2] ip unreachables enable

2. Create a second default route on ProVision-1

You will now create a default route on ProVision-1 through Comware-2. You will first assign the route to the default metric and administrative distance and observe the behavior. You will then assign the route a higher metric and observe the behavior.

Access the ProVision-1 CLI and move to the global configuration mode context. Create a default route through Comware-2 at 10.1.104.2.

ProVision-1(config)# ip route 0.0.0.0/0 10.1.104.2

View the IP routing table and verify that you see both routes. As you see, they have the same metric and administrative distance.

ProVision-1(config)# show ip route

```
                                IP Route Entries

Destination     Gateway      VLAN Type      Sub-Type  Metric Dist.
--------------- ------------ ---- --------- --------  ------ ----
0.0.0.0/0       10.1.101.1   101            static    1      1
0.0.0.0/0       10.1.104.2   104            static    1      1
10.1.11.0/24    VLAN11        11            connected 1      0
10.1.101.0/24   VLAN101      101            connected 1      0
10.1.104.0/24   VLAN104      104            connected 1      0
127.0.0.0/8     reject                      static    0      0
127.0.0.1/32    lo0                       connected 1      0
```

Access the Windows 2008 server desktop and open a command prompt. Execute a trace route to the Windows 7 PC (10.1.12.12).

tracert -d 10.1.12.12

Tracing route to 10.1.12.12 over a maximum of 30 hops

```
1     <1 ms     <1 ms      1 ms   10.1.11.1
2     <1 ms     <1 ms      1 ms   10.1.104.2
3     <1 ms     <1 ms      1 ms   10.1.103.4
4     <1 ms     <1 ms      1 ms   10.1.12.12
```

tracert -d 10.1.12.1

Tracing route to 10.1.12.12 over a maximum of 30 hops

```
1     <1 ms     <1 ms      1 ms   10.1.11.1
2     <1 ms     <1 ms      1 ms   10.1.101.1
3     <1 ms     <1 ms      1 ms   10.1.12.1
```

As you see, ProVision-1 is using both routes, assigning some traffic to one and other traffic to the other. ProVision-1 has a higher bandwidth connection to Comware-1, so now you will make ProVision-1 prefer the route through Comware-1.

Return to the ProVision-1 CLI. Delete the current route through Comware-2. Then add the route with a metric of 10.

ProVision-1(config)# no ip route 0.0.0.0/0 10.1.104.2

ProVision-1(config)# ip route 0.0.0.0/0 10.1.104.2 metric 10

View the IP routing table and see that only the route through Comware-1 is present. The other route does not display in the active routing table because it has a higher metric and is not preferred.

ProVision-1(config)# show ip route

```
                        IP Route Entries

Destination     Gateway     VLAN Type       Sub-Type   Metric   Dist.
--------------- ----------- ---- ---------- ---------- -------- ----
0.0.0.0/0       10.1.101.1  101             static     1        1
10.1.11.0/24    VLAN11       11             connected  1        0
10.1.101.0/24   VLAN101     101             connected  1        0
10.1.104.0/24   VLAN104     104             connected  1        0
127.0.0.0/8     reject                      static     0        0
127.0.0.1/32    lo0                         connected  1        0
```

You will now observe failover to the higher metric route. Disable the links to Comware-1.

ProVision-1(config)# interface 19,20 disable

View the IP routing table and see that it now contains the route through Comware-2.

ProVision-1(config)# show ip route

```
                        IP Route Entries

Destination     Gateway     VLAN Type       Sub-Type   Metric   Dist.
--------------- ----------- ---- ---------- ---------- -------- ----
0.0.0.0/0       10.1.104.2  104             static     10       1
10.1.11.0/24    VLAN11       11             connected  1        0
10.1.104.0/24   VLAN104     104             connected  1        0
127.0.0.0/8     reject                      static     0        0
127.0.0.1/32    lo0                         connected  1        0
```

Access the Windows 2008 server desktop and open a command prompt. Execute a trace route to the Windows 7 PC (10.1.12.12).

tracert -d 10.1.12.12

Tracing route to 10.1.12.12 over a maximum of 30 hops

```
1      <1 ms      <1 ms       1 ms   10.1.11.1
2      <1 ms      <1 ms       1 ms   10.1.104.2
3      *    *          *     Request timed out
```

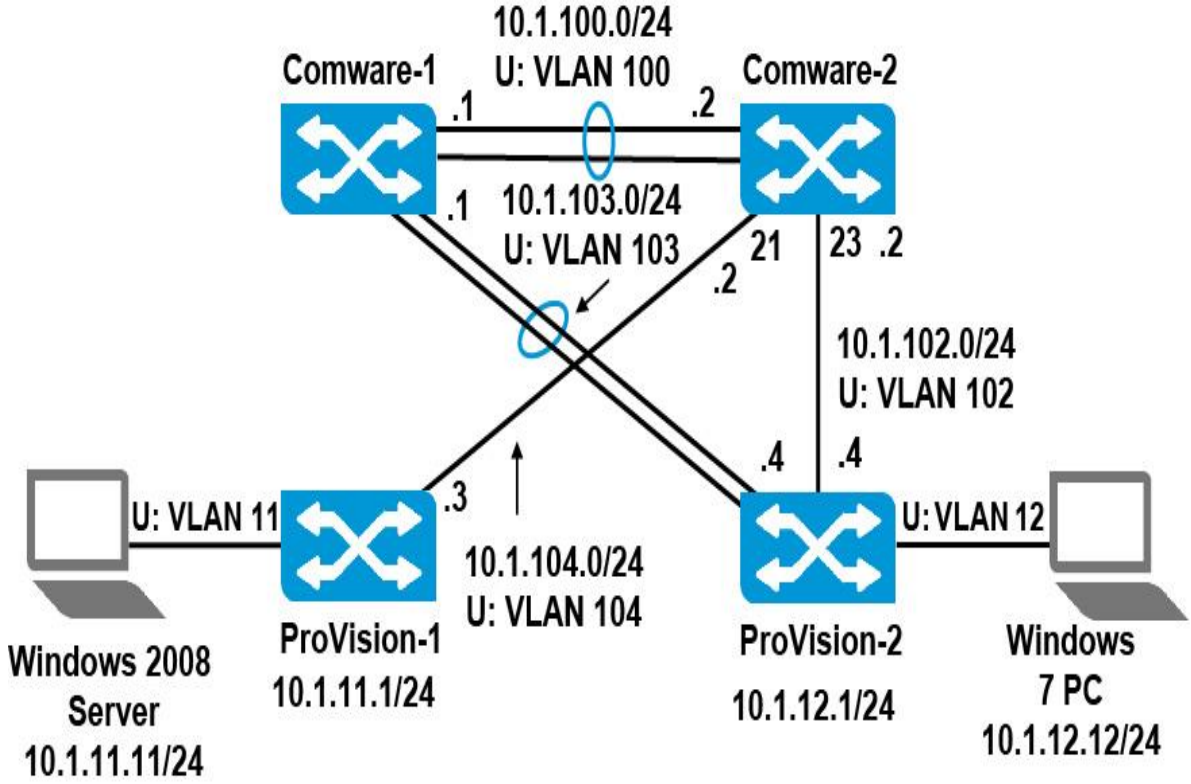
As you see the trace route fails. Press <Ctrl+c> to end it.

You already saw that ProVision-1 started using the redundant route. Why is connectivity still disrupted?

_____
_____
_____

3. Create a redundant route on Comware-1

As shown in Figure, connectivity is disrupted because ProVision-2 routes return traffic to Comware-1, and Comware-1 cannot route traffic back to 10.1.11.0/24. It needs a redundant route through Comware-2, as well.



Access the Comware-1 CLI. Move to system view. Examine the routing table to validate that Comware-1 has no active route to 10.1.11.0/24.

```
[Comware-1] display ip routing
Routing Tables: Public
         Destinations : 7        Routes : 7

Destination/Mask  Proto  Pre  Cost      NextHop         Interface
10.1.12.0/24      Static 60   0         10.1.103.4      Vlan103
10.1.100.0/24     Direct 0    0         10.1.100.1      Vlan100
10.1.100.1/32     Direct 0    0         127.0.0.1       InLoop0
10.1.103.0/24     Direct 0    0         10.1.103.1      Vlan103
10.1.103.1/32     Direct 0    0         127.0.0.1       InLoop0
127.0.0.0/8       Direct 0    0         127.0.0.1       InLoop0
127.0.0.1/32      Direct 0    0         127.0.0.1       InLoop0
```

Create the redundant static route to 10.1.11.0/24 through Comware-2 at 10.1.100.2. Set the administrative distance, preference, to 70, which is higher than the default. (Comware does not allow you to set a metric for a static route.)

[Comware-1] ip route-static 10.1.11.0 24 10.1.100.2 preference 70

View the new route in the IP routing table.

```
[Comware-1] display ip routing
Routing Tables: Public
         Destinations : 8        Routes : 8

Destination/Mask  Proto  Pre  Cost      NextHop         Interface
10.1.11.0/24      Static 70   0         10.1.100.2      Vlan100
10.1.12.0/24      Static 60   0         10.1.103.4      Vlan103
10.1.100.0/24     Direct 0    0         10.1.100.1      Vlan100
10.1.100.1/32     Direct 0    0         127.0.0.1       InLoop0
10.1.103.0/24     Direct 0    0         10.1.103.1      Vlan103
10.1.103.1/32     Direct 0    0         127.0.0.1       InLoop0
127.0.0.0/8       Direct 0    0         127.0.0.1       InLoop0
127.0.0.1/32      Direct 0    0         127.0.0.1       InLoop0
```

Access the Windows 2008 server and start the trace route again. It is now successful. (Refer to Figure 9-19 as needed.)

tracert -d 10.1.12.12
Tracing route to 10.1.12.12 over a maximum of 30 hops

```
1     <1 ms     <1 ms      1 ms   10.1.11.1
2     <1 ms     <1 ms      1 ms   10.1.104.2
3     <1 ms     <1 ms      1 ms   10.1.103.4
4     <1 ms     <1 ms      1 ms   10.1.12.12
```

Return to the terminal session with ProVision-1. Restore the failed link.
ProVision-1(config)# interface 19,20 enable

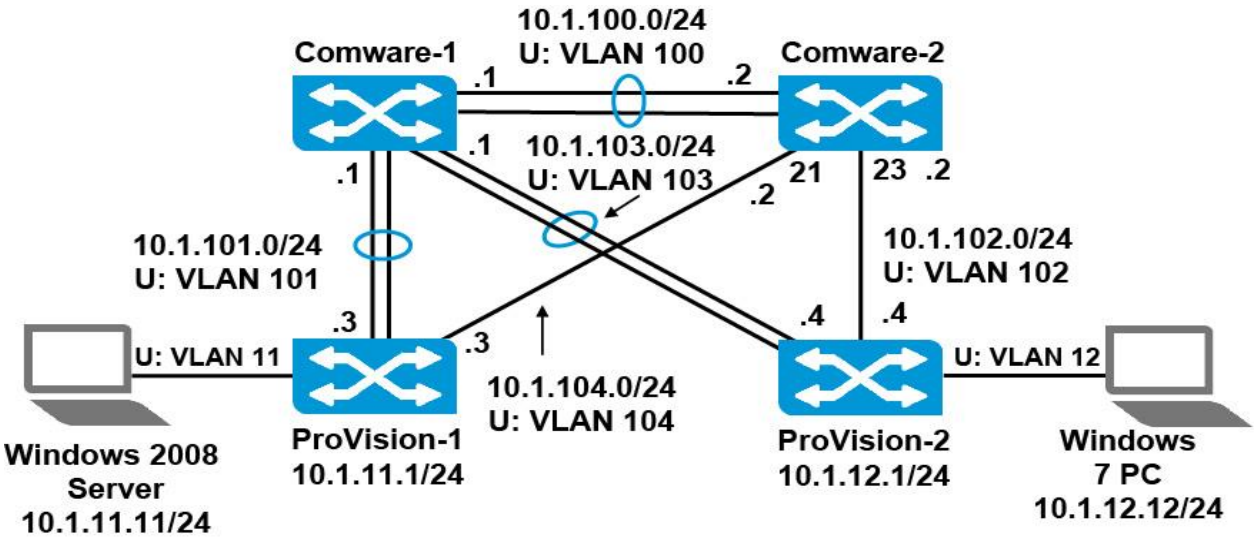
Observe that Comware-1 is using its preferred route through ProVision-1 again.

```
[Comware-1] display ip routing
Routing Tables: Public
         Destinations : 10        Routes : 10
Destination/Mask   Proto   Pre  Cost      NextHop         Interface
10.1.11.0/24       Static 60    0         10.1.101.3      Vlan101
10.1.12.0/24       Static 60    0         10.1.103.4      Vlan103
10.1.100.0/24      Direct 0     0         10.1.100.1      Vlan100
10.1.100.1/32      Direct 0     0         127.0.0.1       InLoop0
10.1.101.0/24      Direct 0     0         10.1.101.1      Vlan101
10.1.101.1/32      Direct 0     0         127.0.0.1       InLoop0
10.1.103.0/24      Direct 0     0         10.1.103.1      Vlan103
10.1.103.1/32      Direct 0     0         127.0.0.1       InLoop0
127.0.0.0/8        Direct 0     0         127.0.0.1       InLoop0
127.0.0.1/32       Direct 0     0         127.0.0.1       InLoop0
```

Save the current configuration on each of the switches. For ProVision, use the write memory command. For Comware, use the [save] command.

Task 7: Setting up a basic OSPF configuration

This section builds on the example network established in "Example configuration: Create redundant static IP routes". This section outlines the steps for setting up OSPF on the network shown in Figure.



1. Configure OSPF on ProVision-1

Access the ProVision-1 CLI. Move to global configuration mode. Set the router ID to 10.0.0.3. In this case, the router ID simply identifies the ProVision-1 to other OSPF routers. It is not an IP address. (Other HP training gives guidelines for configuring the router ID on a loopback interface so that you can ping it.)

ProVision-1(config)# ip router-id 10.0.0.3

Move to the OSPF configuration mode.

ProVision-1(config)# router ospf

Create area 0.

ProVision-1(ospf)# area 0

Enable OSPF.

ProVision-1(ospf)# enable

6. Access each of the switch's active VLANs. Enable OSPF and place the VLAN in area 0.

ProVision-1(ospf)# vlan 11
ProVision-1(vlan-11)# ip ospf area 0
ProVision-1(vlan-11)# vlan 101
ProVision-1(vlan-101)# ip ospf area 0
ProVision-1(vlan-101)# vlan 104
ProVision-1(vlan-104)# ip ospf area 0
ProVision-1(vlan-104)# exit

If you want, you can make VLAN 11 a passive interface, which prevents the switch making neighbors on the interface.

ProVision-1(config)# vlan 11 ip ospf passive

Verify that OSPF is enabled on the VLAN interfaces. Note that area 0 is also called the backbone area.

ProVision-1(config)# show ip ospf interface

OSPF Interface Status

```
IP Address   Status   Area ID   State Auth-type Cost   Pri Passive
---------- ------- --------- ----- --------- ----- --- ------
10.1.11.1  enabled  backbone WAIT  none      1     1   no
10.1.101.3 enabled  backbone WAIT  none      1     1   no
10.1.104.3 enabled  backbone WAIT  none      1     1   no
```

2. Configure OSPF on Comware-1

Access the Comware-1 CLI and move to system view. Enable an OSPF process. At the same time, set the router ID. (Comware switches support multiple processes with different IDs. You just need one process, and you will use ID 1.)

[Comware-1] ospf 1 router-id 10.0.0.1

Create area 0.

[Comware-1-ospf-1] area 0

Assign all subnets connected to the switch to this area. Remember that you use wildcard bits rather than a subnet mask.

[Comware-1-ospf-1-area-0.0.0.0] network 10.1.100.0 0.0.0.255
[Comware-1-ospf-1-area-0.0.0.0] network 10.1.101.0 0.0.0.255
[Comware-1-ospf-1-area-0.0.0.0] network 10.1.103.0 0.0.0.255

Comware-1 and ProVision-1 are both running OSPF on 10.1.101.0/24. Verify that they are communicating with each other as neighbors (or peers). Also that they have achieved the Full state, which indicates that they have shared topology information.

```
[Comware-1-ospf-1-area-0.0.0.0] display ospf peer

                OSPF Process 1 with Router ID 10.0.0.1
                     Neighbor Brief Information

Area: 0.0.0.0

Router ID   Address      Pri Dead-Time  Interface    State
10.0.0.3    10.1.101.3   1   32         Vlan101      Full/DR
```

3. Configure OSPF on Comware-2

Access the Comware-2 CLI and move to system view. Enable an OSPF process and set the router ID.

[Comware-2] ospf 1 router-id 10.0.0.2

Create area 0.

[Comware-2-ospf-1] area 0

Assign all subnets connected to the switch to this area.

[Comware-2-ospf-1-area-0.0.0.0] network 10.1.100.0 0.0.0.255
[Comware-2-ospf-1-area-0.0.0.0] network 10.1.102.0 0.0.0.255
[Comware-2-ospf-1-area-0.0.0.0] network 10.1.104.0 0.0.0.255

Comware-2 should now be OSPF neighbors with Comware-1 and ProVision-1, which are already running OSPF on the same networks. Verify and check for the Full state.

If you do not see both peers, wait about 30 seconds or a minute and try again.

```
[Comware-2-ospf-1-area-0.0.0.0] display ospf peer

                 OSPF Process 1 with Router ID 10.0.0.2
                      Neighbor Brief Information

 Area: 0.0.0.0
 Router ID  Address      Pri Dead-Time Interface  State
 10.0.0.1   10.1.100.1   1   37        Vlan100    Full/DR
 10.0.0.3   10.1.104.3   1   38        GE1/0/21   Full/DR
```

4. Configure OSPF on ProVision-2

Access the ProVision-2 CLI and move to global configuration mode. Set the router ID.

ProVision-2(config)# ip router-id 10.0.0.4

Move to the OSPF configuration mode.

ProVision-2(config)# router ospf

Create area 0.

ProVision-2(ospf)# area 0

Enable OSPF.

ProVision-2(ospf)# enable

Access each of the switch's active VLANs. Enable OSPF and place the VLAN in area 0. Note that if you do not specify an area, the switch automatically uses area 0.

ProVision-2(ospf)# vlan 12
ProVision-2(vlan-12)# ip ospf
ProVision-2(vlan-12)# vlan 102
ProVision-2(vlan-102)# ip ospf
ProVision-2(vlan-102)# vlan 103
ProVision-2(vlan-103)# ip ospf
ProVision-2(vlan-103)# exit

If you want, you can make VLAN 12 a passive interface.

ProVision-2(config)# vlan 12 ip ospf passive

Verify that ProVision-2 is OSPF neighbors with the two connected switches, Comware-1 and Comware-2. Also verify that the state is Full for each.

ProVision-2(config)# show ip ospf neighbor

OSPF Neighbor Information

Router ID	Pri	IP Address	NbIfState	State	Rxmt QLen	Events	Helper Status
10.0.0.2	1	10.1.102.2	DR	FULL	0	6	None
10.0.0.1	1	10.1.103.1	DR	FULL	0	6	None

5. Verify the solution

You can now verify that the switches have learned the routes.

View routes on ProVision-1. You should see that the switch has learned a route to every subnet in your topology. You should also see that the switch has multiple routes to some destinations such as 10.1.12.0/24. Also notice the “ospf” route type and distance.

ProVision-1(config)# show ip route

IP Route Entries

Destination	Gateway	VLAN	Type	Sub-Type	Metric	Dist.
0.0.0.0/0	10.1.101.1	101	static		1	1
10.1.11.0/24	VLAN11	11	connected		1	0
10.1.12.0/24	10.1.101.1	101	ospf	IntraArea	3	110
10.1.12.0/24	10.1.104.2	104	ospf	IntraArea	3	110
10.1.100.0/24	10.1.101.1	101	ospf	IntraArea	2	110
10.1.100.0/24	10.1.104.2	104	ospf	IntraArea	2	110
10.1.101.0/24	VLAN101	101	connected		1	0
10.1.102.0/24	10.1.104.2	104	ospf	IntraArea	2	110
10.1.103.0/24	10.1.101.1	101	ospf	IntraArea	2	110
10.1.104.0/24	VLAN104	104	connected		1	0
127.0.0.0/8	reject		static		0	0
127.0.0.1/32	lo0		connected		1	0

ProVision-1 still has its static default route. When will ProVision-1 use the OSPF routes and when will it use the static default route?

ProVision-1 will use the OSPF routes for routing traffic to all the subnets in your network because these routes are more specific. ProVision-1 will only use the static default route when it needs to route traffic to a destination for which it does not have a specific route.

View IP routes on ProVision-2 and see that it has learned routes to all subnets. You can filter the display for just OSPF routes.

ProVision-2(config)# show ip route ospf

```
                        IP Route Entries
Destination     Gateway      VLAN Type  Sub-Type    Metric  Dist.
--------------- ------------ ---- ----- ----------- ------- -----
10.1.11.0/24    10.1.102.2   102  ospf  IntraArea   3       110
10.1.11.0/24    10.1.103.1   103  ospf  IntraArea   3       110
10.1.100.0/24   10.1.102.2   102  ospf  IntraArea   2       110
10.1.100.0/24   10.1.103.1   103  ospf  IntraArea   2       110
10.1.101.0/24   10.1.103.1   103  ospf  IntraArea   2       110
10.1.104.0/24   10.1.102.2   102  ospf  IntraArea   2       110
```

View IP routes on Comware-1 and see that it has learned routes to all networks. Notice that Comware-1 has learned just one route to 10.1.12.0/24. Notice that OSPF is listed as the protocol, and the preference (administrative distance) is 10 for Comware.

```
[Comware-1] display ip routing
Routing Tables: Public
         Destinations : 12        Routes : 14
Destination/Mask  Proto   Pre  Cost      NextHop         Interface
10.1.11.0/24      OSPF    10   2         10.1.101.3      Vlan101
10.1.12.0/24      OSPF    10   2         10.1.103.4      Vlan103
10.1.100.0/24     Direct  0    0         10.1.100.1      Vlan100
10.1.100.1/32     Direct  0    0         127.0.0.1       InLoop0
10.1.101.0/24     Direct  0    0         10.1.101.1      Vlan101
10.1.101.1/32     Direct  0    0         127.0.0.1       InLoop0
10.1.102.0/24     OSPF    10   2         10.1.100.2      Vlan100
                  OSPF    10   2         10.1.103.4      Vlan103
10.1.103.0/24     Direct  0    0         10.1.103.1      Vlan103
10.1.103.1/32     Direct  0    0         127.0.0.1       InLoop0
10.1.104.0/24     OSPF    10   2         10.1.101.3      Vlan101
                  OSPF    10   2         10.1.100.2      Vlan100
127.0.0.0/8       Direct  0    0         127.0.0.1       InLoop0
127.0.0.1/32      Direct  0    0         127.0.0.1       InLoop0
```

You can also view just OSPF routes on Comware switches. View OSPF routes on Comware-2. Note that you can see which switch, identified by its router ID, advertised each route. For example, ProVision-2 (10.0.0.4) advertises 10.1.12.0/24, which is connected to it.

```
<Comware-2>display ospf routing
          OSPF Process 1 with Router ID 10.0.0.2
                Routing Tables
 Routing for Network
Destination     Cost  Type    NextHop       AdvRouter    Area
10.1.102.0/24   1     Transit 10.1.102.2    10.0.0.2     0.0.0.0
10.1.103.0/24   2     Transit 10.1.102.4    10.0.0.1     0.0.0.0
10.1.103.0/24   2     Transit 10.1.100.1    10.0.0.1     0.0.0.0
10.1.104.0/24   1     Transit 10.1.104.2    10.0.0.3     0.0.0.0
10.1.11.0/24    2     Stub    10.1.104.3    10.0.0.3     0.0.0.0
10.1.12.0/24    2     Stub    10.1.102.4    10.0.0.4     0.0.0.0
10.1.100.0/24   1     Transit 10.1.100.2    10.0.0.1     0.0.0.0
10.1.101.0/24   2     Transit 10.1.100.1    10.0.0.3     0.0.0.0
10.1.101.0/24   2     Transit 10.1.104.3    10.0.0.3     0.0.0.0
Total Nets: 9
Intra Area: 9  Inter Area: 0  ASE: 0  NSSA: 0
```

Access the Windows 2008 server desktop and open a command prompt.

Execute a trace route to the Windows 7 PC (10.1.12.12).

tracert -d 10.1.12.12

Tracing route to 10.1.12.12 over a maximum of 30 hops

```
Tracing route to 10.1.12.12 over a maximum of 30 hops
  1    <1 ms    <1 ms     1 ms  10.1.11.1
  2    <1 ms    <1 ms     1 ms  10.1.104.2
  3    <1 ms    <1 ms     1 ms  10.1.102.4
<1 ms    <1 ms     1 ms  10.1.12.12
```

Execute a trace route to 10.1.12.1.

tracert -d 10.1.12.1

```
Tracing route to 10.1.12.1 over a maximum of 30 hops
  1    <1 ms    <1 ms     1 ms  10.1.11.1
  2    <1 ms    <1 ms     1 ms  10.1.101.1
  3    <1 ms    <1 ms     1 ms  10.1.12.1
```

Save the current configuration on each of the switches. For ProVision, use the write memory command. For Comware, use the ***save command***.