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Гніденко М.П.

Налаштування локальних комп'ютерних мереж

**Лабораторний практикум
з навчальної дисципліни
“Конвергентна мережна інфраструктура”
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Гніденко М.П.

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Лабораторний практикум призначений для формування практичних навичок налаштування локальних комп'ютерних мереж під час вивчення курсу “Конвергентна мережна інфраструктура”. Лабораторний практикум сприяє вивченню фундаментальних концепцій та загальних процедур, які дозволять розробляти та розгортати мережеві реалізації для клієнтів. Докладено всіх зусиль, щоб цей практикум максимально повно та максимально точно відображав реальні зусилля, які необхідно реалізовувати під час професійної діяльності.

Оскільки цінність технології визначається тим, наскільки вона важлива для діяльності бізнесу, студенти повинні вміти аналізувати вимоги бізнесу та визначати, як їх можна задовольнити, впроваджуючи певну технологію. Щоб допомогти студентам засвоїти навички критичного мислення, необхідні для аналізу вимог, надання рекомендацій та усунення неполадок, використовуються бізнес-сценарії протягом усього практикуму.

Лабораторний практикум призначено для студентів, аспірантів і викладачів, які планують підготуватися до міжнародної сертифікації рівня HP Accredited Technical Associate (HP ATA) – Networks.

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Introduction

This book is designed to provide information about the topics covered on the Designing & Deploying Network Solutions HPE ATA certification exam. The course is designed to teach fundamental concepts, common procedures, and analysis skills that will enable candidates to design and deploy networking implementations for customers. Every effort has been made to make this book as complete and as accurate as possible, but no warranty of fitness is implied.

Because the value of technology is determined by how significant it is to the performance of the business, students need to be able to analyze business requirements and determine how they can be met by implementing a specific technology. To help students learn the critical thinking skills they need to analyze requirements, make recommendations, and troubleshoot problems, business scenarios are used throughout the course to guide the discussions.

In some cases, these scenarios can be used to support group activities. In other cases, they simply call out a real-world use for a technology or product.

Lab activities are available to reinforce concepts and give students hands-on experience working with real equipment. An accompanying guide describes how to set up and present the lab activities.

The default topologies for each lab have all links connected that remote labs use or hardwired connections for links between the switches and VMware clients. To prevent L2 loops, the default startup configs for each switch disables these ports (ports 1-6). Students are instructed to enable the appropriate ports as part of the lab activities.

Care must be taken to not enable ports that cause an L2 loop.

Instruct students to NOT enable any ports until specifically asked to do so in the lab activity. HP switches do not enable spanning tree by default and STP is not enabled until Lab Activity 5. Indications of a broadcast storm include the inability to access the CLI of the switches or to RDP to the VMware clients.

If possible, students should be paired into groups for lab activities. However, if there is an odd number of students, the labs can be completed by one student. Determine, if possible, which student would be the best candidate to work alone. The instructor may be required to help with the configuration of some of the equipment, as necessary.

The lab activities were developed on HP switches with the latest software version (ProVision). The servers and clients in each lab group have the following software: TFTPd32n – TFTP server, including a SYSLOG and SNTP server; TfGen - freeware traffic generator. The Windows Server machine in each lab group is configured with DNS and DHCP to support the optional tasks in Lab Activity 3. The DNS server is used in the Lab Activity 3 to illustrate E-Series switch usage of IP services. Configuration is minimal. The DHCP server is used throughout the course to provide IP addressing to clients and to demonstrate the use and configuration of DHCP relay.

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. The company needs 24 x 7 operation and wants to increase its bandwidth and add wireless access. For this activity, you will be configuring two edge switches and a routing switch.

After completing this lab, you will be able to:

- Explore the HP switch CLI
- Examine command history
- Define the switch hostname
- Configure usernames and passwords
- Assign an IP address to the VLAN 1 interface
- Check basic connectivity

Begin this activity by assigning each team member either Edge_1 or Edge_2. Each team member should begin each activity by configuring this switch and then collaborate with other group members on the configuration of the distribution-layer and the remaining access-layer switch.

Do not enable any ports until instructed specifically to do so.

At the end of this activity, your lab topology will be similar to that shown in Figure 1-1.

Note

In the IP address in the figure, the x in the second octet stands for your group number. For instance, the router in group 1 will have an address of 10.1.1/24, the router in group 2 will have an address of 10.2.1/24, and so forth. This will ensure that each group's devices are in a separate network. Consult your facilitator to ensure you are using the correct group number.

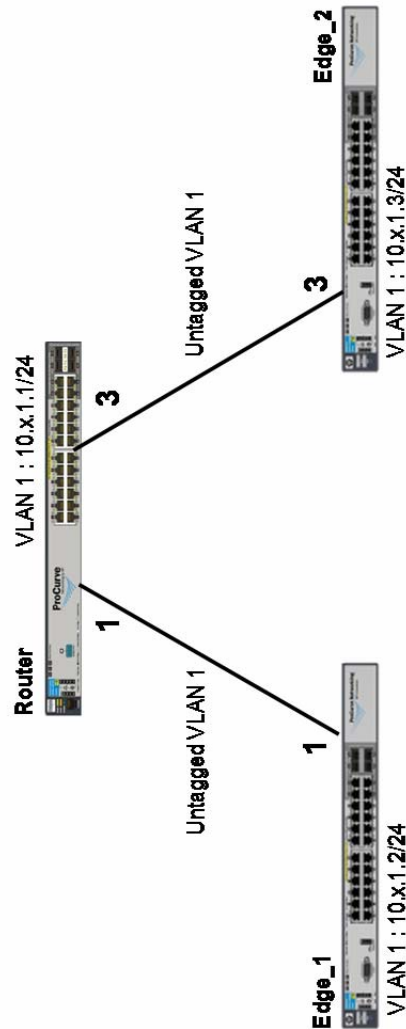


Figure 1-1: Final topology in Lab Activity 1.

Task 1: Explore the CLI on an HP Switch

In the first task, you will explore basic CLI options. Begin this task by configuring the access-layer switches (Edge_1 and Edge_2 in Figure 1-1). After you complete Task 1 and Task 2 on each of these switches, collaborate with your group on the configuration of the router for the remaining tasks.

1. Each team member, select either Edge_1 or Edge_2 and establish a console/serial connection to the switch. (See *Appendix B – Accessing and Using the Remote Lab* for help with connecting to the switch.)

2. What prompt is displayed after you access the switch?

3. 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 "..."):

Running configuration:

```
...
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-28
  ip address dhcp-bootp
  exit
snmp-server community "public" unrestricted
```

4. If the running-config includes other settings, please inform the facilitator before proceeding.
5. Begin your exploration of the HP switch CLI by typing ? (or pressing **[Tab]**) at the prompt. The CLI will display all commands available at this level. Some important commands available at this level include:

- **show**, which enables you to examine current configuration parameters
- **copy**, which enables you to back up switch configuration
- connectivity test tools such as **ping** and **traceroute**

6. Type **exit** and press **Enter**.

How has the prompt changed?

This indicates you have entered the **Operator** level.

7. Type ? What are the main differences between commands available at the manager and operator levels?

8. Type **enable** and press **Enter** to return to the manager level.

9. Type **co** followed by a [Tab]. What does the CLI display?

You can use **tab completion** to determine what commands are available. The CLI will display a list of all available commands that begin with letters before the tab.

10. Type **con** followed by [Tab]. What does the CLI display?

If only one available command begins with a string entered into the CLI, you can complete the command by pressing [Tab]. Also, you can execute any command as soon as you have entered an unambiguous character string. For instance, **con [Enter]** will have the same effect as **configure [Enter]** at the Manager level.

11. Press **Enter** to navigate to the global configuration context (**config**)#.
12. Press [Tab] again. What does the CLI display now?

-
13. Most commands have additional help information available at the CLI. To find out more about command usage and syntax, append **help** to the end of the command. For example, try the following:

```
Switch(config)# copy help
Switch(config)# show running-config help
Switch(config)# show ping help
```

Task 2: Examine command history

1. Examine command history by entering **show history**. What does the output show?

2. Press the **Up** arrow on the keypad. Then press **Enter**. How did the CLI respond?

3. Enter **show history**. 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 of the **show running-config** command.


```
Switch(config)# repeat <index_number>
```

4. Press any key to stop the command from repeating.
5. Enter **repeat 1** again, followed by a ?.

What available options are displayed?

Note

Options shown in uppercase are variable fields that must be replaced with data (i.e., replace CMDLIST with the actual position number in the **show history** list). Lowercase options are the actual available command parameters.

6. By default, the **repeat** command without any options causes the CLI to repeat the last command indefinitely until <ctrl> c is pressed.

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
```

7. Save your configuration using the **write memory** command.

Task 3: Configure usernames and passwords

You will configure the secure management settings on either Edge_1 or Edge_2 in this lab. In a production environment, you would configure the settings on each switch; however, for this lab you are simply practicing configuring the settings.

Note

If you are completing this lab without a partner, you can practice setting up secure management on Edge_1 only.

1. Explore the options for the **password** command:

```
Switch(config)# password ?
```

What are the primary options for the password command?

2. In this task, you will configure usernames and passwords for the manager and operator levels.

Note

It is critically important that you use the username and passwords included in the steps below. A forgotten or mistyped username and password may result in the remote switch being unusable for the remainder of the lab session.

- a. Configure the operator username and password:

```
Switch(config)# password operator user-name techsupport
```

- b. The CLI will display a prompt for the password. Type **password** and press **Enter**. Confirm the password by re-entering at the confirmation prompt.

- c. Configure the manager username and password:

```
Switch(config)# password manager user-name admin
```

The CLI will display a prompt for the password value. Type **password** and press **Enter**. Confirm the password by re-entering at the confirmation prompt.

3. Type **logout** to log out of the management interface. Type **yes** or **y** when prompted to confirm logout and to save the current configuration.
4. Press **Enter** several times to re-enter the CLI. How is the prompt different from the prompt shown when you first accessed the switch?
-

5. Enter the operator username and password (**techsupport** and **password**) to regain access to the CLI. What prompt is displayed?
-

6. Type **logout** to log out of the CLI.

7. Enter the manager username and password (**admin** and **password**) at the password prompt. What prompt is displayed?
-

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

```
Switch(config)# no password all
```

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

Task 4: Configure a hostname

1. Navigate to the **(config)#** context. The following prompt displays:

```
Switch(config)#
```

2. The global configuration context provides the commands necessary to complete most of the steps in this activity. Type **?** to see a list of available commands.

- Define a hostname for your switch. Use the name (either **Edge_1** or **Edge_2**) shown in the Figure 1-1. The prompt will immediately change to display your new hostname.

```
Switch(config)# hostname <switch_name>
```

Task 5: Configure the VLAN 1 IP interface

- Next, you will configure the IP information for the VLAN 1 interface. Type **vlan 1** and press **Enter** to enter the VLAN 1 configuration context. What prompt is displayed?

- Use the information shown in the table below to configure an IP address. All addresses will use a 24-bit mask. Replace the text within the triangle brackets (<>) with the appropriate values.

```
Switch(vlan-1)# ip address <ip_address>/<prefix>
```

Note

The x in the second octet should be replaced with your Lab Group number.

Table 1-1: IP addresses

Switch	IP address
Edge_1	10.x.1.2/24
Edge_2	10.x.1.3/24

- Save your configuration changes to the switch memory.

```
Switch(vlan-1)# write memory
```

- Select a team member to configure a hostname and VLAN 1 IP address for the Router switches. The tables below list the configuration parameters for these switches.

Table 1-2: Router parameters

Parameters	Value
Hostname	Router
VLAN 1 ip address	10.x.1.1/24

Task 6: Enable and verify connectivity between the switches

- At the CLI of any switch, enter:

```
Switch# show ip route
```

The configured IP address for VLAN 1 does not display. Why?

-
2. Enable links between the Router and each Edge switch. Use the Lab Diagram (Figure 1-1) for reference.

Do not enable more than one link between each switch.

```
Edge_1(config)# interface 1 enable
Edge_2(config)# interface 3 enable
Router(config)# interface 1,3 enable
```

3. At the CLI of any switch, enter:

```
Switch# show ip route
```

What information is displayed?

4. Enter:

```
Switch# show vlans
```

What information is displayed?

5. 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?

6. Enter:

```
Switch# show lldp info remote-device
```

What information is displayed?

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

```
Switch# show lldp info remote-device <port>
```

How is the information displayed different from information displayed by entering **show lldp**?

8. Ping the VLAN 1 interfaces of all switches from the CLI to ensure connectivity. **Do not continue this lab activity until ping is successful between all interfaces.**

VLAN 1 interfaces

VLAN 1 address	Devices	Ping Successful?
10.x.1.1	Router	
10.x.1.2	Edge_1	
10.x.1.3	Edge_2	

Task 7: Examine the status of ports that connect your switches

- At the CLI of one of Edge_1, Edge_2, or Edge_3, type **show interface ?** to examine the options for monitoring the status of ports on your switch.
- To examine the status of all ports on your switch, enter:

```
Switch# show interface brief
```

Which ports are "up"?

What other information is displayed?

3. Type **show interface** to view additional information about port status.
What are some of the differences between this command and the **show interface brief** command?

4. View information only about the ports that are enabled. You can enter an individual port, a range of port numbers (1-6) or a list of ports separated by commas (1-2,6). To view only the connected ports on Edge_2, you would enter:
Edge_2# show interface <port_number,port_number>

! **Tip!**
show interface custom provides a customized view of port monitoring fields.
show interface display provides a dynamic view of monitoring fields.
Experiment with these commands if time permits.

5. Configure a friendly port name for the interface on Edge_1 and Edge_2 connected to the Router.
Switch(int-id)# name Router
6. On the Router, configure friendly names for the ports connected to the Edge switches.

Task 8 (optional): Examine configuration options for Ethernet interfaces

HP switches support extensive configuration of Ethernet interface parameters, including speed, duplex settings, and friendly port names. In this task, you will explore these settings.

1. Using the CLI of your Edge switch, enter the configuration context for the port connected to your distribution-layer switch.
Switch (config)# interface <port_number>
2. Type ? to view a list of command options. The commands that appear first, alphabetically, are native to this context. Commands that appear after these commands, such as **ping** and **traceroute**, are not directly applicable to port configuration but can be executed within the context.

Some important port-specific options are:

- **enable** - By default, ports on HP switches are enabled.
- **disable**
- **speed-duplex** - By default, all ports on HP switches auto-negotiate speed and duplex. However, administrators can define settings using this command.
- **mdix-mode** - By default, all ports on HP switches automatically detect whether the connected cable is crossover or straight-through and adjust accordingly. Using this command, administrators can force a setting.
- **name** - This option enables you to set a "friendly name" for each port, which can make it easier to identify a port in the CLI and other management interfaces. Lab activities for this course suggest you configure port names that identify the device to which each port is connected.

3. Enter the **speed-duplex**, **mdix-mode**, and **name** commands in Step 2, followed by a **?**, to examine available options. For example to see the options for **speed-duplex**, enter:

```
Switch(int-id)# speed-duplex ?
```

Task 9 (optional): Explore the menu interface

HP switches offer a menu interface as an alternative to the CLI. Although the menu interface does not support all the command and configuration options available at the CLI, it does provide a convenient interface for configuring and monitoring basic parameters.

1. Enter **menu** at the CLI. The terminal will display a menu similar to Figure 1-2.

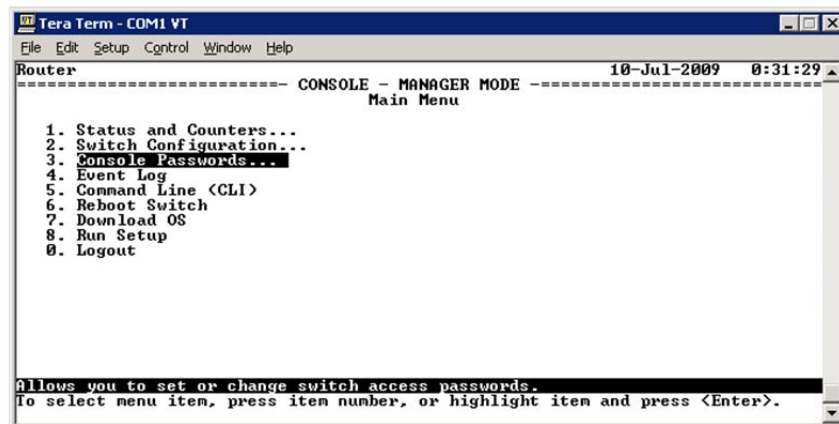


Figure 1-2 Menu Interface

2. You can navigate the menu interface with the keyboard arrows or by pressing a number of one of the items in the menu. Press **3** to view the options for

setting console passwords. Press **1** or **2** to view options for setting the operator or manager password.

How do the options differ from the options available in the CLI?

3. Press **Enter** then **0** to return to the Main Menu. Press **2**, then **4** to view IP address information. Does the display reflect the configuration completed earlier?

4. Press **Enter** to return to the **Switch Configuration Menu**. Press **2**, then **4** to view port configuration information.
5. Press **E**. How did the interface change?

6. Press the **Spacebar**. How did the display change?

7. Press the **Tab** key. How did the display change?

8. Press **Enter** to return to the navigation bar. Press **C**.

9. Press **0** to return to the main menu.

10. Press **5** to return to the CLI.

11. On each switch, save the configurations to the switch's flash memory:

```
Switch# write memory
```


Command reference

Description	Command syntax
Move from manager level to global configuration context	<code>configure</code>
Define hostname on switch	<code>hostname</code>
Configure password protection for configuration levels	<code>password</code>
Configure IP address for an interface	<code>ip address <ip/mask></code>
Displays tagged/untagged VLAN status of ports	<code>interface <int number></code>
Save configuration changes	<code>write memory</code>
Move from global configuration context to VLAN configuration context	<code>vlan <vlan-id></code>
Log out of management interface	<code>logout</code>
Show IP addressing information	<code>show ip</code>
Show LLDP information for connected device	<code>show lldp info remote-device</code>
Show information for Ethernet ports	<code>show interface</code>
Exits from a configuration level. For instance, this command would move from a VLAN configuration context to the global configuration context.	<code>exit</code>
Access manager privilege level	<code>enable</code>

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Managing Switch Software Images and Configuration Files

Lab Activity 2

Objectives

To complete the basic configuration of your switches, you will manage the switch software and configuration files. In this activity, you will update the secondary flash (software) to match the primary flash. You will also create and examine multiple configuration files.

After completion of this lab, you will be able to:

- Update secondary flash software
- Use the multiple configuration feature to store a base configuration on your switch
- Examine event logs

At the end of this activity, your lab topology will be similar to Figure 2-1.

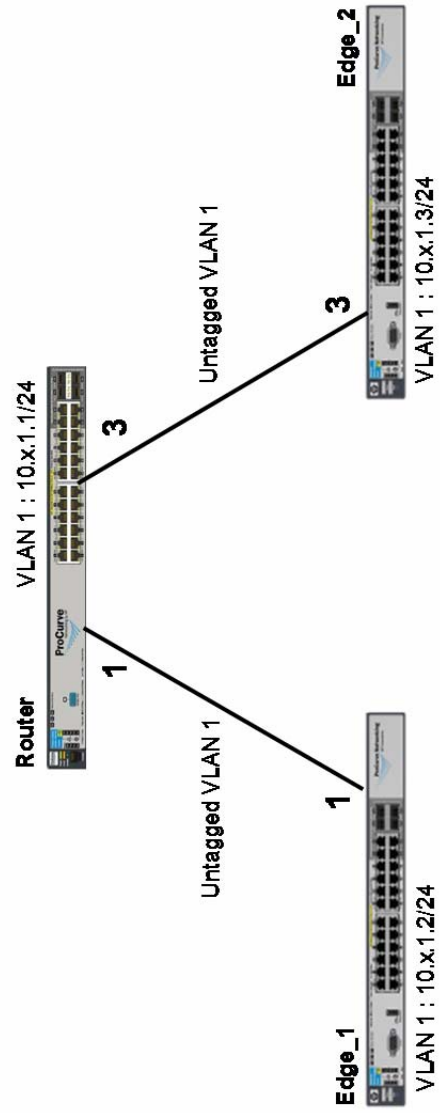


Figure 2-1: Final Topology from Lab Activity 1

Task 1: Connect to the switch and verify lab startup configuration

1. Each team member, select either Edge_1 or Edge_2 and establish a console/serial connection to the switch. (See *Appendix B – Accessing and Using the Remote Lab* for help with connecting to the switch.) If working alone, only configure one switch.
2. Click **OK**. Press **Enter** until the switch prompt is displayed.
3. Verify that the switch has the correct Lab 2 startup configuration by comparing the running-configs with the Lab 2 startup-configs in Appendix A.

```
Switch# show running-config
```

If the running-config of any switch does not match the startup-config for the lab, please inform the instructor.

Task 2 (optional): Back up your switch configuration to a USB drive

Important Note: This task can only be performed on switches with USB ports. To verify whether or not your switch has this functionality, issue the command **show usb**. (Backups to a server via TFTP will be performed in later labs).

If your switch does not have a USB port, review the steps of Task 2 and proceed to Task 3.

When updating to a newer version (or reverting back to an older version) of software, always back up the switch configuration before proceeding. This is especially true when replacing the software with a major version release (version 14.xx to 15.xx, for example) because changes may be automatically made to the configuration to support new features.

1. Verify that the running-config and startup-config are the same. If necessary, save the running-config before proceeding.

```
Switch# show running-config status  
Switch# write memory
```

2. Use the **copy** command to store your startup configuration on the USB drive attached to your switch's AUX port.

```
Switch# copy startup-config usb <switch_name>.lab2.cfg
```

3. The switch should display the CLI prompt without error messages. If an error message does appear, review the last command and make changes as necessary. If the error persists, please inform the instructor before proceeding.
4. Use the **dir** command to confirm that the configuration file has been copied to the USB drive. Use the **show time** command to verify that the date and timestamp match the current system time.

Task 3: Manage switch software on your HP switch

Many HP switches support the storage of two software images in different flash areas known as “primary” and “secondary.” In this task, you will update the secondary flash with the software stored in the primary flash location.

Note: A best-practices approach to managing software upgrades is to initially update one flash location, leaving the other as a “roll back” should an unexpected problem occur with the new software version. After a few weeks (or longer), once the new software has been thoroughly evaluated, copy the new software to the other flash location. This provides a convenient local software backup.

1. Determine the current active version of software.

```
Switch(config)# show version
```

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*): _____

2. Now examine the current contents of the flash memory on your switch. The contents should be similar to the output shown in Figure 2-2. In this example, both flash areas contain the RA.15.05.0006 software versions. You will replace the secondary image with the primary image.

```
Switch(config)# show flash
```

You should see output similar to the following:

Image	Size(Bytes)	Date	Version
Primary Image	: 8829329	08/09/11	RA.15.05.0006
Secondary Image	: 8829329	08/09/11	RA.15.05.0006

Boot ROM Version : RA.15.10
Default Boot : Primary

Record the software versions on your switch below

Primary _____

Secondary _____

Note

The secondary flash on your switch may be the same software version as the one in the primary flash. You should still perform the steps to “update” the secondary to better understand the process of managing software on HP switches.

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

If you were troubleshooting a current switch-related issue, which information would likely have more immediate value, **show version** or **show flash**? Why?

3. Use the following command to replace the software in the secondary flash area with the software image in the primary flash:

```
Switch(config)# copy flash flash secondary
```

The update process takes about 2-3 minutes to complete. The CLI prompt will not change while the software updates. When the software is installed, the switch will display the CLI prompt.

4. Confirm that the software has been correctly installed by issuing the **show flash** command. (If the versions are unchanged, there is no way to view the actual update/change.)
5. Restart the switch using this updated/replaced secondary software by entering the following command.

```
Switch(config)# boot system flash secondary
```
6. Type **y** to confirm that you want to restart the switch.
7. After the switch reboots and you log in to the CLI, type **show flash** and **show version** to determine which version of the software is currently running.

What is the default flash area?

When you restarted your switch, the image in the secondary flash area became the default startup image for your switch. The switch will use this image whenever it is restarted, unless you change the default. You can do this by:

- Rebooting the switch with the command **boot system flash primary**
- Using the **boot set-default flash primary** command to set the primary image to be the default (and reboot the switch later)

Task 4: Save the active configuration to a "base" configuration in your switch flash memory

Many HP switches enable you to define three different startup configuration files. When a switch supports this feature, you can configure the switch to use one configuration file whenever the switch is restarted and use the other files as backups of earlier configuration states. This can be useful when you are testing features that you have not previously used and want to be able to return quickly to a known state. You can also associate a different file with each software image stored in flash, enabling you to use different configurations for different software images.

In this task, you will save your current startup configuration to a backup configuration in flash memory and then restart the switch using the saved configuration.

1. View the current configuration files on your switch.

```
Switch(config)# show config files
```

The CLI output should be similar to Figure 2-2. The default configuration, named "config1" is active and is associated with the primary and secondary flash.

```
Edge_1(config)# show config files
Configuration files:
  id | act pri sec | name
-----|-----|-----|-----
  1  | *  *  *  | config1
  2  |      |      |
  3  |      |      |
Edge_1(config)# █
```

Figure 2-2: Default configuration file

2. Copy the configuration to "baseConfig" using the command **copy config <src_config> config <dst_config>**.

```
Switch(config)# copy config config1 config baseConfig
```


- Enter the following command to view the contents of this file and verify that it matches the current configuration:

```
Switch(config)# show config baseConfig
```

- View the current configuration files. The CLI output should be similar to that shown in Figure 2-3.

```
Switch(config)# show config files
```

```
Edge_1(config)# show config files
Configuration files:
  id | act pri sec | name
-----
  1  | *  *  *  | config1
  2  |          | baseConfig
  3  |          |
Edge_1(config)#
```

Figure 2-3: Configuration files

- The baseConfig 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 "baseConfig" file.

```
Switch(config)# startup-default config baseConfig
```

```
Switch(config)# show config files
```

```
Configuration files:
  id | act pri sec | name
-----
  1  | *          | config1
  2  |          * | baseConfig
  3  |          |
```

Figure 2-4: Configuration files after changing default file

- The "baseConfig" file is now the default configuration file for primary and secondary flash. To begin using this configuration, issue the **boot** command.

```
Switch(config)# boot system
```

After the system is restarted, baseConfig will become active. If you make any configuration changes, they will be stored to baseConfig (not config1).

- Verify that baseConfig is now the "active" configuration file.

```
Switch(config)# show config files
```

Note that the location of the asterisk in the "act" column is now associated with baseConfig.

8. Change the hostname of the switch, where x is 1 or 2 for your particular Edge switch, and save the change. Compare the contents of the two configuration files.

```
Switch(config)# hostname Edge_x_new
Switch(config)# write memory
Switch(config)# show config config1
Switch(config)# show config
```

Task 5: Associate your saved configuration with the primary flash area

A configuration file can be associated with either flash image. This ensures that the switch will use a specific configuration whenever it is started with a specific software image. This is commonly done when the primary and secondary software images are different versions. Associating a known working configuration with an older version of software provides a system recovery point if problems arise with the newer software.

Use the following steps to associate the "baseConfig" with the primary flash on your switch.

1. You can associate a configuration file with either flash area. Use the startup-default command to associate the "baseConfig" file with the primary flash.

```
Switch(config)# startup-default primary config baseConfig
```

2. Enter:

```
Switch(config)# show config files
```

How is this output different than the output in Task 4, Step 7?

What command would enable the switch to begin using the "baseConfig" configuration?

Do not reboot your switch at this time.

Task 6: Examine event logs

1. Use the **show logging** command to view the Event Log for your edge switch.
2. Use each of the following four commands to view only the events of a specific type. Record at least one event of each type (if available) below.

Warning: Switch(config)# show logging -w

Major: Switch(config)# show logging -m

Info: Switch(config)# show logging -i

Warning: _____

Major: _____

Info: _____

3. Enter **show logging -a** to view all events, including those from previous boot cycles. Scroll through the output and notice that the events include several reboots.
4. Enter **show logging -r** to view event in reverse time order, noting the most recent events.
5. Enter **show logging port** to view all events that contain the text string "port".



Tip!

The **show logging usb** command is an example of how you can use search strings to filter log events. To match text with spaces, include quotes around the text, for example: **show logging "port 1"**.

Task 7: Remove the baseConfig

Remove the baseConfig configuration that you created in an earlier task.

1. Reboot your switch, using the original startup-config file.

```
Switch(config)# boot system flash primary config <id 1 filename>
```
2. Enter **show config files** to verify that the configuration in **id 1** is active. Also notice that the hostname of the switch is now Edge_x (and not Edge_x_new).
3. Remove the baseConfig configuration from the switch.

```
Switch(config)# erase config baseConfig  
Switch(config)# show config files
```

Command Reference

Description	Command
Examine contents of flash memory	<code>show flash</code>
Copy files to and from flash including configuration files. Options include copying to and from TFTP server or USB drive.	<code>copy</code>
Restart the system and run diagnostics. Options include selection of flash image used for restart	<code>boot system</code>
Restart the system without running diagnostics.	<code>reload</code>
Examine information about installed software versions.	<code>show version</code>
Set the default flash image to be used when switch is restarted.	<code>boot set-default</code>
Display a list of the files and subdirectories in a directory on a USB device.	<code>dir [<pathname>]</code>
Show current date and time	<code>show time</code>
Examine the names of the alternate configuration files defined on the system.	<code>show config files</code>
Set the configuration file that will be used when the system is restarted. Options include ability to associate files with software images.	<code>startup-default config</code>
Examine event logs.	<code>show logging</code>

Configuring User VLANs and IP Services

Lab Activity 3

Objectives

Both of your edge switches must support end users. Your router must support a server and enable hosts in all VLANs to communicate with the server and with each other. 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 completion of this lab, you will be able to:

- Assign tagged and untagged ports for a VLAN
- Configure edge and router switches to support VLANs
- Configure access to IP services
- Explore remote management interfaces

As in earlier exercises, begin by configuring Edge_1 or Edge_2. If you are working in a team of two or more, your team will then collaborate on the configuration of the router. The table below shows the VLAN assignments used throughout the rest of this course.

Table 3-1: User VLANs

VLAN ID	User Group	Switches
1	Infrastructure devices and network administrators	All
2	Server	Router
10	Marketing	Router, Edge_1
20	Sales	Router, Edge_1
30	Manufacturing	Router, Edge_2
40	Human Resources	Router, Edge_2

At the end of this activity, your lab topology will be similar to Figure 3-1.

Note

You will not have a client PC in every VLAN for every task. Instead, you will assign the client port to the appropriate VLANs as tasks require.

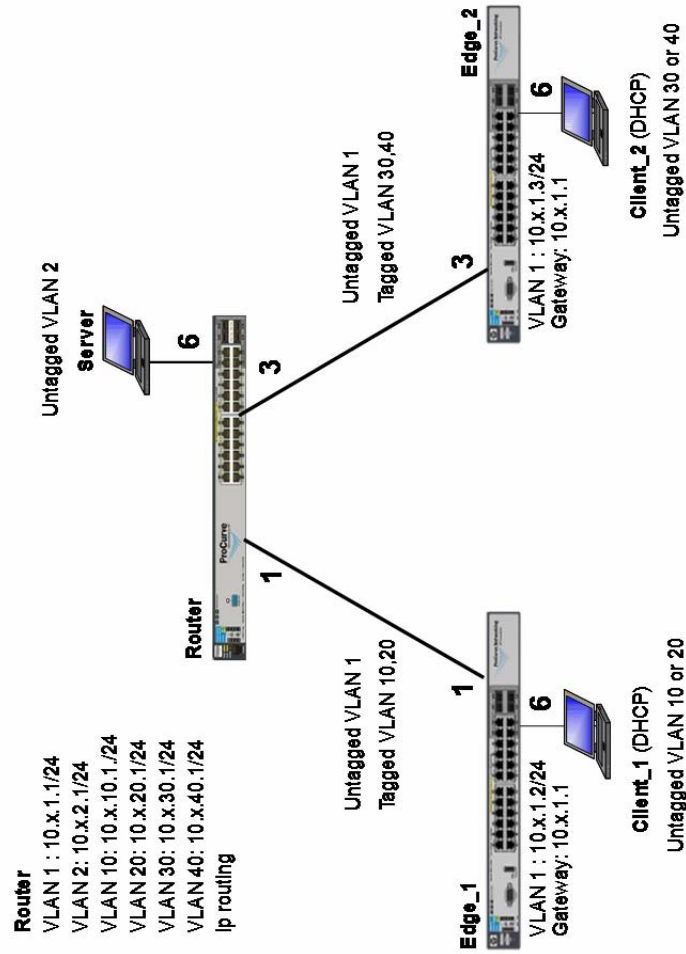


Figure 3-1: Final topology for Lab Activity 3

Task 1: Connect to the switch and verify lab startup configuration

1. Each team member, select either Edge_1 or Edge_2 and establish a console/serial connection to the switch. (See *Appendix B – Accessing and Using the Remote Lab* for help with connecting to the switch.)
2. Click **OK**. Press **Enter** until the switch prompt is displayed.
3. Verify that the switch has the correct Lab X startup configuration by comparing the running-configs with the Lab X startup-configs in Appendix A.
Switch# show running-config
4. Select a team member to verify the router configuration.
5. If the running-config of any switch does not match the startup-config for the lab, please inform the instructor.

Task 2: Configure support for the appropriate user VLANs on Edge_1 and Edge_2

1. Define each of the VLANs that must be supported on your switch. Use Table 3-1 for reference.
2. Assign switch-to-switch ports as tagged members of the VLANs as shown in Table 3-1.
Switch(vlan-id)# tagged <port>
3. Assign the untagged ports that will support end-user clients, as shown in Table 3-1.
Switch(vlan-id)# untagged <port>
4. Use the **show vlans** command to verify your VLAN configuration and compare it with Table 3-1 to ensure it is correct.
Switch(vlan-id)# show vlans <vlan-id>

Table 3-1: VLAN assignments for Edge_1 and Edge_2

Switch	VLANs	Connection	Port	VLAN assignment
Edge_1	10,20	Connects to Router	1	Tagged
Edge_2	30, 40	Connects to Router	3	Tagged
Edge_1	10	Client_1	6	Untagged
Edge_2	30	Client_2	6	Untagged

5. Save your configuration using the **write memory** command

Task 3: Configure Router to support the VLANs

The distribution-layer switch (Router) will act as the local router for your group and consequently requires a much different configuration than your edge switches. For best results, collaborate with your partner on this task.

1. Type the VLAN configuration context for each VLAN shown in Table 3-2.

```
Router(config)# vlan <vlan_id>
```

Table 3-2: Switch-to-switch VLAN assignments for Router

Switch	VLANs	Connection	Ports Used	VLAN assignment
Router	10,20	Connects to Edge_1	1	Tagged
Router	30,40	Connects to Edge_2	3	Tagged
Router	2	Connects to Server	6	Untagged

2. For **VLAN 2 only**, configure a port on the router as an **untagged member** of the VLAN, as shown in Table 3-2.

```
Router(vlan-2)# untagged 6
```

3. Configure the switch-to-switch connections, which are listed in Table 3-2, as **tagged members** of the specified user VLANs.

```
Router(vlan-id)# tagged <port>
```

4. Verify that the ports are tagged properly. Both downlink ports to Edge_1 and Edge_2 should also remain as untagged members of VLAN 1.

```
Router(vlan-id)# show vlans ports 1,3 detail
```

5. For all VLANs, assign an IP address to the VLAN interface (Table 3-3 below). This will enable your Router to act as the default gateway for hosts in each VLAN.

```
Router(vlan-id)# ip address 10.x.<vlan_id>.1/24
```

Table 3-3: VLAN IP Addresses

VLANs	IP address/prefix length
2	10.x.2.1/24
10	10.x.10.1/24
20	10.x.20.1/24
30	10.x.30.1/24
40	10.x.40.1/24

6. For **VLANs 10, 20, 30, and 40**, configure an IP helper address, using the address of your server, 10.x.2.100. This will enable the router to forward DHCP

requests from all VLANs to the server. (The DHCP server has already been configured on the server.)

```
Router(vlan-id)# ip helper-address 10.x.2.100
```



Tip!

You can use the **up arrow** on the keyboard to repeat earlier commands. For instance, after moving to the VLAN 20 context, you could use the up arrow to repeat commands entered in the VLAN 10 context. Be careful to change VLAN ID!

- Use the **show ip helper-address** command to verify your configuration.

- Return to the global configuration context.

```
Router(vlan-id)# exit
```

- Enable IP routing. This will enable the router to act as default gateway for all devices and to forward traffic among the five VLANs defined on the switch.

```
Router(config)# ip routing
```

- Use the **show ip** command to verify your IP configuration. The output should be similar to Figure 3-1, which shows IP addressing for a Group 1 Router.

```
Internet <IP> Service
IP Routing : Enabled

Default TTL      : 64
Arp Age         : 20
Domain Suffix   :
DNS server      :

ULAN             | IP Config | IP Address | Subnet Mask | Proxy ARP
-----+-----+-----+-----+-----+
DEFAULT_ULAN    | Manual    | 10.1.1.1  | 255.255.255.0 | No No
ULAN2           | Manual    | 10.1.2.1  | 255.255.255.0 | No No
ULAN10          | Manual    | 10.1.10.1 | 255.255.255.0 | No No
ULAN20          | Manual    | 10.1.20.1 | 255.255.255.0 | No No
ULAN30          | Manual    | 10.1.30.1 | 255.255.255.0 | No No
ULAN40          | Manual    | 10.1.40.1 | 255.255.255.0 | No No
```

Figure 3-1: show output for Router in Group 1

Task 4: Configure edge switches for remote management

On Router, Edge_1 and Edge_2, VLAN 1 has been designated as the management VLAN. In order to remotely manage Edge_1 and Edge_2, they require a default gateway.

- Using the CLI of your edge switch, define a default gateway, using the VLAN 1 interface on your router.

```
Switch(config)# ip default-gateway 10.x.1.1
```

Task 5: Verify connectivity between all client computers

1. Enable port 6 on the router, Edge_1 and Edge_2, verifying that each port is "up". Do not proceed until this port has changed to an "up" state.

```
Switch(config)# interface 6 enable
Switch(config)# show interface 6
```
2. From the router CLI, ping the Server IP address to verify connectivity. Do not proceed until the ping is successful.

```
Router(config)# ping 10.x.2.100
```
3. Each team member, select either Client_1 or Client_2 and establish an RDP connection to the VMware client. (See *Appendix B – Accessing and Using the Remote Lab* for help with connecting to the switch.)
 - a. Type in the username and password (**admin** and **hp**) and click OK.
4. From your client PC, open a command prompt window (Start > Run... > cmd > OK).
5. Type **ipconfig /release** followed by **ipconfig /renew**.
6. Type **ipconfig /all** to confirm that your PC has received an IP address in the correct range through DHCP. Table 3-4 below shows the address configured in the DHCP scope on your Server for each VLAN.

Table 3-4: DHCP scopes and DNS settings for clients

VLANS	IP address range	Default gateway	DNS server	Domain
10	10.x.10.100-110	10.x.10.1	10.x.2.100	hptrng0x.hp.com
20	10.x.20.100-110	10.x.20.1	10.x.2.100	hptrng0x.hp.com
30	10.x.30.100-110	10.x.30.1	10.x.2.100	hptrng0x.hp.com
40	10.x.40.100-110	10.x.40.1	10.x.2.100	hptrng0x.hp.com

7. From the CMD prompt of your client PC, ping the server and the client's default gateway.
8. If both clients can successfully ping the server, try to ping each other. This ping should be successful. If not, do not proceed until it is.

Task 6 (optional): Configure and test clients in VLANs 20 and 40

If time permits, when you finish validating the clients in VLAN 10 and 30, configure and test clients in VLANs 20 and 40. (Consider performing this task after first completing the optional tasks that follow.)

1. Reassign your client port on Edge_1 or Edge_2 to VLAN 20 or 40, respectively. Refer to Task 1 and Table 3-2 for the specific commands and parameters.
2. Once again, type **ipconfig /release** followed by **ipconfig /renew**.
3. Confirm that the client receives IP address in its respective VLAN.

4. **If the PC has not received an IP address**, confirm network connectivity by checking the Network connection icon in the taskbar. Right-click the Network connection icon and click **Repair**.

If the PC does not have connectivity, return to the Edge switch console and confirm that the port connected to the PC is assigned to the correct VLAN as an untagged port.

If the PC does have connectivity, take the following troubleshooting steps:

- a) Confirm that the ports connecting the edge switch to the router are assigned to the correct VLANs as tagged members.
- b) Confirm that the client's VLAN is configured on the edge switch and the router.
- c) On the router, confirm that the IP helper address is configured for the client's VLAN.

Task 7 (optional): Configure SNTP, DNS, and syslog on an edge switch

Many HP switches can be configured to access IP services such as SNTP, DNS, and remote system logging (syslog). In the next two tasks, you will configure and confirm SNTP, DNS, and syslog on your edge switch.

Note

Completion of these steps is not required for future labs.

2. Configure system logging, using the server located at 10.x.2.100.
`Switch(config)# logging 10.x.2.100`
3. Configure your switch to synchronize with the SNTP server located at 10.x.2.100.
`Switch(config)# sntp server priority 1 10.x.2.100`
`Switch(config)# sntp unicast`
`Switch(config)# timesync sntp`
4. Adjust the time setting on your switch to match your local timezone.
`Switch(config)# time timezone [-]<n>`

Note

The value entered after `timezone` should reflect the difference in minutes between the switch's **timezone** and Greenwich Mean Time. To set the time for Los Angeles, California, the command would be **time timezone -480**. The time offset for Paris, France, would be **time timezone 60**.

5. Use the **show logging** command to verify that your switch has synchronized with the SNTP server.
6. Configure your switch to use the DNS server at 10.x.2.100.

```
Switch(config)# ip dns server-address priority 1 10.x.2.100
```
7. Configure your domain name, which should be example0X.hp.com, where "x" equals your group number.

```
Switch(config)# ip dns domain-name hptrng0x.hp.com
```

Task 8 (optional): Confirm your DNS and syslog configuration

1. Confirm your DNS configuration by pinging the router by hostname.

```
Switch(config)# ping Router
```
2. If the pings fails, take the following steps to troubleshoot:
 - b. At the CLI of your switch, use **show running-configuration** to confirm that you have configured the correct DNS address, 10.x.2.100.
 - c. On your server (username: administrator, password: hp), confirm that your DNS server includes a host entry for your router.
 - 1) Click **Start > Administrative Tools > DNS**.
 - 2) Expand **SERVER-0x** in the DNS tree.
 - 3) Expand **Forward Lookup Zones**
 - 4) Click **hptrng0x.hp.com**.
 - 5) Confirm that the **hptrng0x.hp.com** Records pane includes an entry for your router. If no entry is present, consult your facilitator.
3. To confirm your syslog configuration, check your server to see the status of the TFTPd32n server, which should be running on the Desktop or Task Bar. The TFTPd32n interface is shown in Figure 3-3.

Task 9 (optional): Back up your switch configuration to a TFTP server

1. Save your running configuration to the startup configuration on your edge switch.

```
Switch(config)# write memory
```
2. Confirm that the TFTP server is running on your Windows server. If it is not running, double-click the **TFTPd32n** icon on your desktop (or from your Start menu).
3. Use the **copy** command to store your startup configuration on the TFTP server on Server.

```
Switch(config)# copy startup-config tftp 10.x.2.100  
<switch_name>.L3.cfg
```

4. Check the TFTP server to confirm that the configuration is backed up.
 - a. On your PC, click **Show Dir** on your TFTPd32n application.
 - b. The PC will display a window showing files in its default TFTP folder. Check to confirm that the configuration file you uploaded in Step 3 is listed.

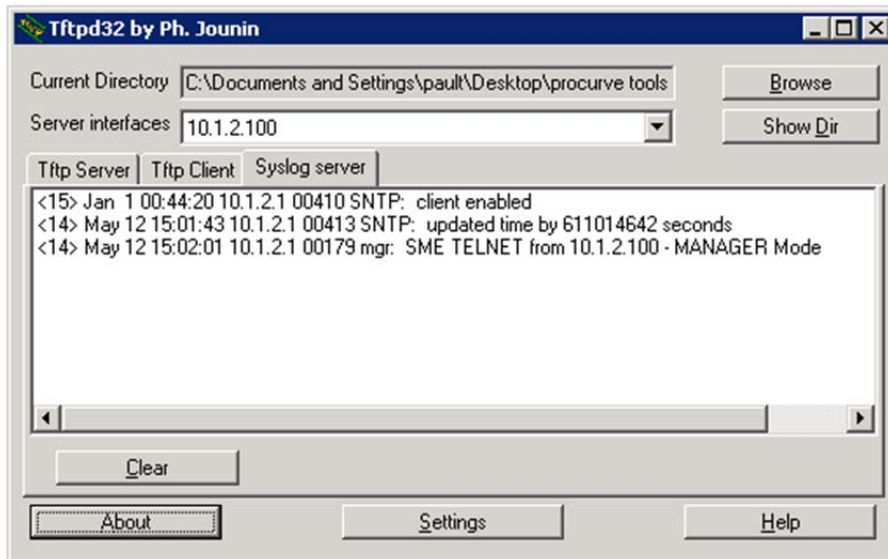


Figure 3-3: TFTPd32n

5. Click **Syslog server** and confirm that the entries include items from your switch. If the SNTP settings changed the time on your switch by more than three seconds, a message about the synchronization will appear in the log. If no entries appear, use the Telnet client on your PC to access the switch CLI. The syslog should report this access. If no entry appears, confirm that you have configured your switch to use the server at 10.x.2.100.

Note

If your TFTP server is not running or is not available from the Desktop, consult your facilitator.

Command reference

Description	Command
Assign port to a VLAN as a tagged member.	vlan <vlan_id> tag <port>
Assign port to a VLAN as an untagged member.	vlan <vlan_id> untag <port>
Enable DHCP relay.	ip helper-address <ip-address>
Enable IP routing.	ip routing
Define default gateway for switch.	ip default-gateway <ip-address>
Define a syslog server.	logging <ip-address>
Display multiple switch configuration and hardware parameters.	show tech
Define an SNTP server.	sntp server priority <x> <ip-address>
Specify that the switch synchronize time in unicast mode, meaning it will query a server identified by IP address and not broadcast for time information.	sntp unicast
Select SNTP as time synchronization protocol.	timesync sntp
Define the timezone the switch will use for time reporting.	time timezone <+/-n>
Configure the DNS (Domain Name System) default domain suffix and the name server IP address for translation of hostnames to IP addresses.	ip dns domain-name <domain>
Configure the DNS (Domain Name System) default domain suffix and the name server	ip dns server-address priority <1-2> <ip-address>

Configuring Link Aggregation

Lab Activity 4

Objectives

In this activity, you will meet the demand for high-speed access to intranet and Internet resources by increasing bandwidth for the connections between Router, Edge_1, and Edge_2.

After completion of this lab, you will be able to:

- Configure aggregated links using LACP (Link Aggregation Control Protocol) on HP switches
- Verify and troubleshoot client connectivity
- Examine how loads are shared between links.

At the end of this activity, your lab topology will be similar to Figure 4-1.

Note about accessing and using the remote lab

For detailed steps for accessing the remote lab, connecting to the console/serial port of the switches and opening an RDP session to the VMware clients, please refer to Appendix B: Accessing and Using the Remote Lab.

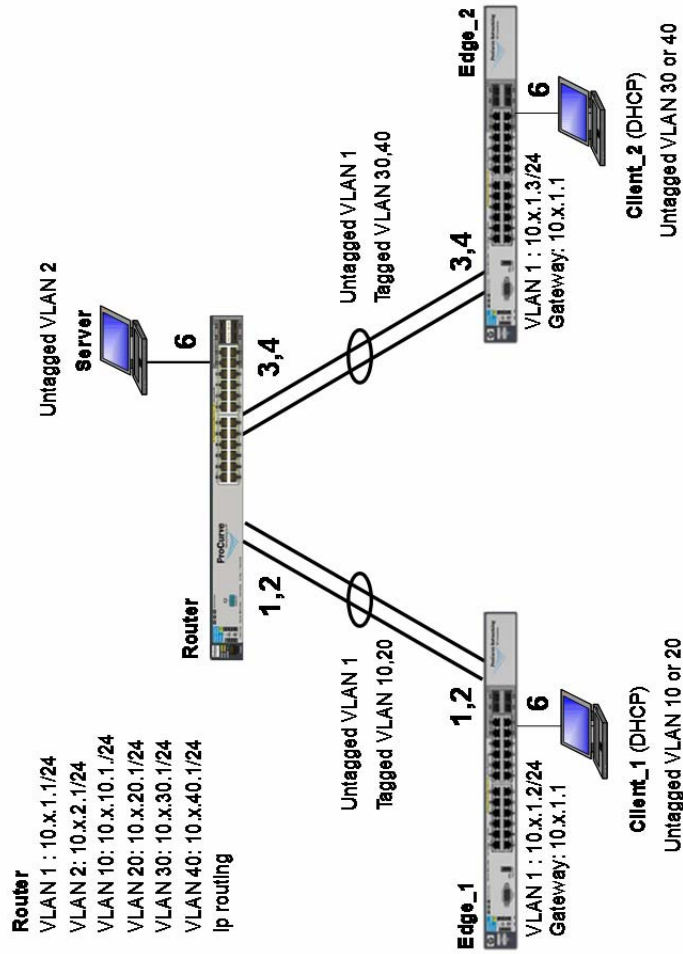


Figure 4-1: Final topology for Lab Activity 4

Task 1: Connect to the switch and verify lab startup configuration

1. Each team member, select either Edge_1 or Edge_2 and establish a console/serial connection to the switch. (See *Appendix B – Accessing and Using the Remote Lab* for help with connecting to the switch.)
2. Verify that the switch has the correct Lab 4 startup configuration by comparing the running-configs with the Lab 4 startup-configs in Appendix A.

```
Switch# show running-config
```

If the running-config of any switch does not match the startup-config for the lab, please inform the instructor.

3. Select a team member to verify the router configuration.

Task 2: Define two ports as members of a static LACP aggregated link between an edge switch and the router

In this task, you will configure a two-port static LACP trunk between one of your edge switches and the router. Your partner will configure a two-port trunk between the other edge switch and the router. You will start by configuring the trunk on the edge switch, then coordinate with your partner to perform configuration steps on the router.

Note

This task requires both members of your lab group to configure the router to complete the trunk configuration. Coordinate with your partner to ensure that you do not access the CLI simultaneously and inadvertently overwrite each other's configuration.

4. From the CLI of Edge_1 or Edge_2, define two ports as members of a static LACP trunk. Use the ports and trunk ids specified in Table 4-1.

```
Switch(config)# trunk <port_id,port_id> trk<id> lacp
```

Table 4-1: Trunk ports on edge switch

Switch	Ports used	Trunk id
Edge_1	1,2	trk1
Edge_2	3,4	trk2

5. Enable the second port of the trunk group on your edge switch (port 2 or 4).

```
Switch(config)# interface <port id> enable
```

Note

Generally, additional links within a trunk group should not be enabled before both sides of the trunk are completely configured. Doing so can cause loops and lost packets. However, because the second port on the router is currently disabled, you can safely enable the second port on the edge switch.

6. Type **write memory** to save your configuration.
7. Coordinating with your partner, use the Edge_1 or Edge_2 Telnet client to access the CLI of the router.

```
Switch(config)# telnet 10.x.1.1
```
8. Define two ports as members of a static LACP trunk. Use the ports and trunk ids specified in Table 4-2 Use the command syntax in Step 1.

Table 4-2: Trunk ports on the router

Connected to...	Ports used	Trunk id
Edge_1	1,2	trk1
Edge_2	3,4	trk2

9. Enable the second port of the trunk group on Router (port 2 or 4).
10. Type **write memory** to save your configuration.
11. Type **logout** to return to the CLI of your edge switch.

Task 3: Verify trunk configuration on the edge switch

The **show trunk**, **show interface** and **show lldp** commands provide tools for evaluating the trunk configuration.

1. Verify that both ports are included in the trunk configuration and that the LACP protocol is used. If not, make the appropriate changes to the trunk.

```
Switch# show trunk
```
2. Type **show interface brief <port_id>, <port_id>** to review the status of the ports in your trunk.

What are the names of the ports in the trunk group?

Note

Although the ports are part of the trunk group, port statistics are still viewed and physical port configuration (i.e., speed, duplex, enable/disable) are still configured on the individual ports. For example, interface trk1 itself cannot be enabled or disabled.

3. Type **show lldp info remote**. How does this command help you to evaluate the status of your trunk?

4. Ping the VLAN 1 interface on your router. The ping should succeed. If not, verify that the ports in the trunk group are "up" (**show interface brief**) and the trunk is an untagged member of VLAN 1 (**show vlan 1**). Do not proceed until the ping is successful.

Task 4: Test connectivity between your PC clients and the router

1. Open an RDP session to your PC client (Client_1 or Client_2) connected to your edge switch.
2. Release and renew the DHCP IP address (from the CMD prompt, type **ipconfig /release** followed by **ipconfig /renew**).

Your DHCP request should fail. Why?

What steps are required to enable connectivity?

3. On your edge switch, type **show vlans ports trk1 detail**.

In which VLAN is the trunk a member?

4. Configure all VLAN memberships for the trunk ports on your Edge_1 and Edge_2 switch, using Table 4-3 as a guide.

```
Switch(config)# vlan <vlan_id> tagged trk1
```

Table 4-3: VLAN assignment for Edge trunks

Edge switch	Trunk name	Tagged VLAN
Edge_1	Trk1	10,20
Edge_2	Trk2	30,40

- Return to your client desktop and once again try to release and renew your DHCP address.

What further configuration is required for the DHCP request to succeed?

- Telnet to Router and configure VLAN tagging for the trunk. Use the syntax from Step 3. Table 4-4 shows the necessary tagged VLAN assignments.

Table 4-4: VLAN assignments for Router trunks

Connected to...	Trunk name	Tagged VLAN
Edge_1	Trk1	10,20
Edge_2	Trk2	30,40

- From your client, once again release and renew DHCP. The DHCP request should succeed. **Do not proceed with this activity until the DHCP request is successful.**

If the DHCP request fails, verify that the trunk is a tagged member of the client VLAN and the PC client port on the edge switch is an untagged member of the same VLAN.

Also, confirm that port aggregation is configured on the other edge switch connected directly to the router in your group. From the CMD prompt of your client, ping the client connected to your partner's edge switch.

- Now configure the PC client port as an untagged member of the other user VLAN on your edge switch.
- From the CMD prompt of the client, release and renew the IP address. The DHCP request should be successful. If not, refer to the troubleshooting tips in Step 7. **Do not proceed with this activity until the DHCP request is successful.**

Task 5 (optional): Examine load-sharing

In this task, you will introduce traffic over the trunk and observe the port counters to see a demonstration of load sharing.

1. On a client connected to your edge switch, open the TfGen program by double-clicking its icon on the desktop.
2. Click **Option** to access the menu for traffic settings, as shown in Figure 4-2.

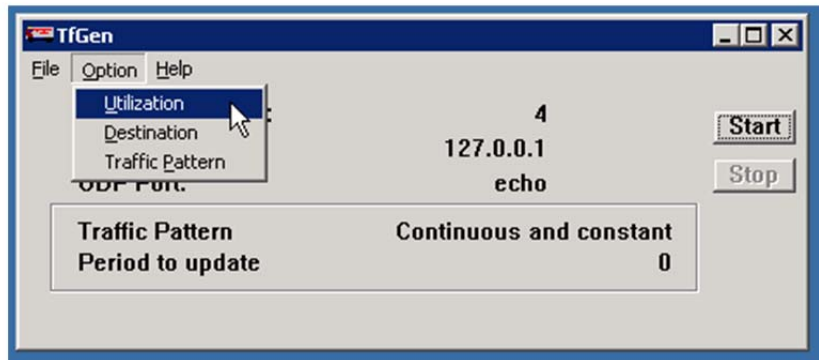


Figure 4-2: TfGen Option menu

3. Configure the application using the settings in Table 4-5.

Table 4-5 TfGen traffic settings

Field	Setting
Utilization rate	1000
Destination	10.x.2.100 (Server)
User-definable port	echo (default)
Traffic pattern	Continuous and constant

4. In the TfGen window, click **Start** to start the traffic flow.
5. At the CLI of your edge switch, type **show interface display** to view dynamic port statistics for your trunk ports. Scroll down to view the trunk ports.

What does this display indicate about how the ports are sharing the traffic load?

6. On the same client, open a second instance of the TfGen application. Configure the application using the settings in Table 4-6.

Table 4-6: TfGen traffic settings (second instance)

Field	Setting
Utilization rate	1000
Destination	10.x.1.1 (Router)
User-definable port	80
Traffic pattern	Continuous and constant

7. Return to the CLI of your edge switch and examine the port counter. How has the traffic pattern changed?

8. The trunk may not have assigned the traffic from the second conversation to the second link in the trunk. Continue testing by having your partner use TfGen to generate traffic between the two clients. If necessary, start additional sessions using the IP addresses of the other edge switch. What conclusions can you draw about load sharing on port trunks?

9. Close all instances of TfGen on all computers.

Command reference

Description	Command
Define static LACP trunk	trunk <port_id>,<port_id> trk<id> lacp
Examine trunk configuration	show trunk
Examine port configuration and status information	show interface brief <port_id>,<port_id>
Examine dynamic display of interface status	show interface display
Enable an interface	interface <port_id> enable

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Configuring Multiple Spanning Tree (MSTP)

Lab Activity 5

Objectives

While a single-instance STP solution provides redundancy in a network, it also makes poor use of the network resources. With redundant links configured between the switches, some ports will remain blocked and will carry no traffic unless other links fail. In this activity, you will configure and test Multiple Spanning Tree Protocol (MSTP) on your switches.

After completion of this lab, you will be able to:

- Configure MSTP
- Perform MSTP failover testing
- View MSTP configuration.

You will not make any changes to the lab topology shown in Figure 5-1.

Important Note

In this lab, the switch configurations have changed significantly from the earlier labs. However, the physical topology remains the same. The most significant change is the configuration of Edge_2, which is now a Layer 3 switch with a hostname of Router_2.

This lab topology represents a common customer configuration. The "dual core" topology provides additional redundancy, should one of the Layer 3 switches fail. Also, when configured with MSTP, the dual core also provides better traffic load distribution by separating client (VLAN) default gateways across two switches.

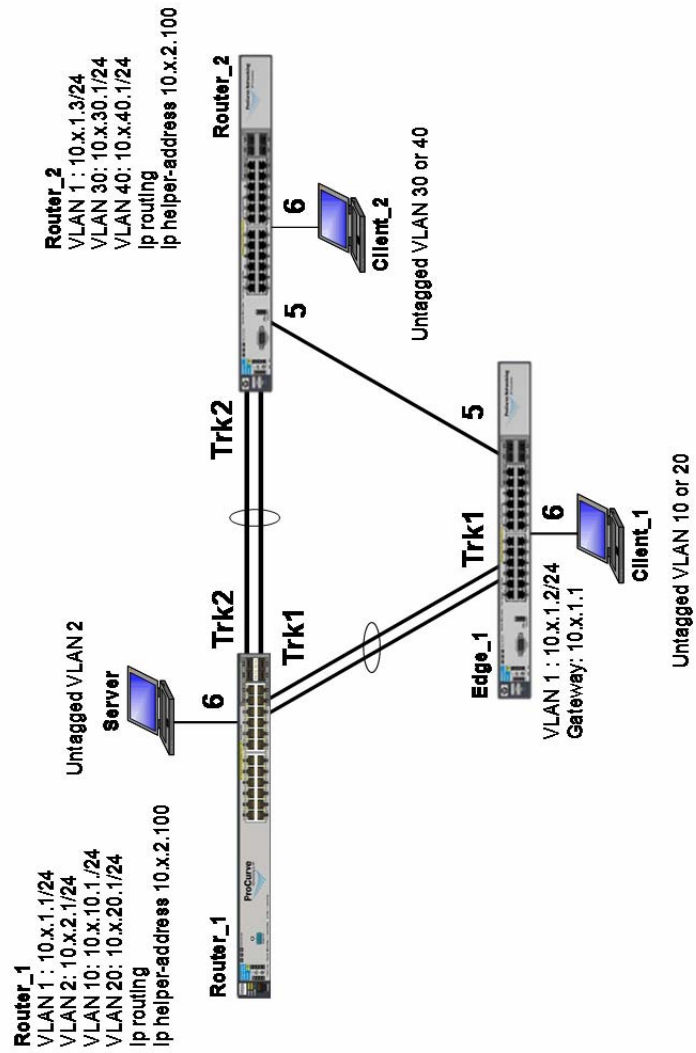


Figure 5-1: Final topology in Lab Activity 5

Task 1: Connect to each switch and verify lab startup configuration

1. Each team member, select either Edge_1 or Router_2 and establish a console/serial connection to the switch.
2. Verify that the switch has the correct Lab 5 startup configuration by comparing the running-configs with the Lab 5 startup-configs in Appendix A.

```
Switch# show running-config
```

3. Select a team member to verify the configuration on Router_1.

If the running-config of any switch does not match the startup-config for the lab, please inform the instructor.

Task 2: Verify new lab topology

1. Note and verify the changes below by viewing the running-configs of all three switches.
 - Router is now Router_1
 - Edge_2 is now Router_2
 - The default gateway on Router_2 has been removed
 - IP routing has been enabled on Router_2
 - Router_1 is the default gateway for VLANs 1, 2, 10 and 20 only
 - Router_2 is the default gateway for VLANs 30 and 40
 - IP addresses for VLANs 2, 10, 20, 30 and 40 are configured on Router_2
 - All switch-to-switch links have been tagged for VLANs 10, 20, 30 and 40
 - The trunk between Router_1 and Router_2 has been tagged for VLAN 2
 - All switch-to-switch links remain untagged for VLAN 1

Task 3: Configure the primary and backup root bridges for the IST

1. Set the bridge priority for the default MSTP instance, the IST (Internal Spanning Tree).

```
Router_1(config)# spanning-tree priority 1
```

```
Router_2(config)# spanning-tree priority 2
```

Task 4: Configure the MSTP regional configuration

In this task, you will configure two MSTP instances and associate them with the VLANs configured on your switches. After all switches are configured with the same

MSTP parameters, all three switches will be part of the same MSTP region and begin to load-distribute across multiple links.

Router_1 will be the root bridge for the MSTI 1. Router_2 will be the root for MSTI 2. In both cases, each router will act as the backup root for the other in the event of a switch failure

1. Configure MST region parameters on all three of your switches.

```
Switch(config)# spanning-tree config-name HP
Switch(config)# spanning-tree config-revision 1
```

Note

Take care when configuring the config-name. It is a case-sensitive parameter and must be the same on all three switches. As a general "best practices" policy, avoid mixing upper and lowercase characters. Keep it simple.

2. Associate each of the four user VLANs with MST instances on all three of your switches. (The Server VLAN 2 will remain in the IST with VLAN 1 because it is not part of the redundant path between the switches.)

```
Switch(config)# spanning-tree instance 1 vlan 10 20
Switch(config)# spanning-tree instance 2 vlan 30 40
```

3. Configure Bridge Priority for Router_1 and Router_2 in both instances, using the values shown in Table 5-1. (You already configured their priorities for the IST in the previous task.)

```
Switch(config)# spanning-tree instance <instance_id> priority
<priority>
```

Table 5-1 Bridge priority in MST instances

Switch	instance_id	priority
Router_1	1	1
	2	2
Router_2	1	2
	2	1

4. Save your configuration.

membership in both VLANs and the edge port is untagged for the correct user VLAN.

- b. If the VLAN port assignments are correct, try to ping Server from the CLI of Router_1.
- c. If the DHCP renewal still fails, ask the instructor for assistance.
- d. After successfully receiving an IP address, confirm that your host can ping its default gateway and the default gateway of the host it is trying to ping.

Do not continue to the next task until all ping tests are successful. Ask the instructor for additional assistance, if required.

Task 7: Verify load distribution on Edge_1

The traffic from Edge_1 should now be successfully distributed across the redundant links. VLANs 1, 10 and 20 should be forwarding on the trunk (TRK1) to Router_1, and VLANs 30 and 40 should be forwarding on port 5 connected to Router_2. You will now verify this.

1. Type the following command at the CLI for Edge_1 to determine which ports are forwarding and which are blocking (port state) in each instance.

```
Switch# show spanning-tree instance <instance_id>
```

Compare your findings to the expected outcome shown in Table 5-3 below. If your outcomes are different from the expected outcomes in the table, review your configurations or ask the instructor for assistance.

Table 5-3 MSTP port states for Edge_1

	Port	State
Instance 1	trk1	Forwarding
	5	Blocking
Instance 2	trk1	Blocking
	5	Forwarding

Note

Any active edge (client) port will be in a forwarding state.

Task 8: Test MSTP failover in instances 1 and 2

1. Connect clients to ports in VLAN 10 or 20 (Edge_1) and VLAN 30 or 40 (Router_2).
2. At the CMD prompt of each client, start a continuous ping targeting your partner's client PC.

```
c:\> ping -t <xx.xx.xx.xx>
```
3. At the CLI of Edge_1, disable ports 1 and 2 (the trunked ports) that are currently forwarding traffic between Edge_1 and Router_1, which is the root port in instance 1. The ping should fail.

How many iterations are required before the successful ping resumes?

4. Use **show spanning-tree instance** to determine how the forwarding path has changed.

What changes do you observe?

Task 9 (optional): Test MSTP failover of the redundant link

If there is time remaining in the lab, disable the redundant link and verify failover.

1. Enable ports 1 and 2 that were disabled in Task 8, step 3.
2. From Edge_1, now disable port 5, which is currently forwarding traffic between Edge_1 and Router_2, which is the root port in instance 2. The ping should temporarily fail while the spanning tree reconverges.
3. Use **show spanning-tree instance** to determine how the forwarding path has changed.
4. Close the CMD prompt window on your client PC to stop the continuous ping.

Command Reference

Description	Command
Set MST configuration name.	<code>spanning-tree config-name <value></code>
Set MST configuration revision value.	<code>spanning-tree config-revision <value></code>
Assign VLANs to MST instance.	<code>spanning-tree instance <instance_id> vlan <vlan_id vlan_id></code>
Set Bridge priority for an MST instance.	<code>spanning-tree instance <instance_id> priority <priority></code>
Set the path cost for a port in an MST instance.	<code>spanning-tree instance <instance_id> <port_ID> path-cost <path_cost></code>
Examine details of MST configuration.	<code>show spanning-tree mst-config</code>
Examine forwarding path and other details for an MST instance.	<code>show spanning-tree instance <instance_id></code>

Configuring IP Routing

Lab Activity 6

Objectives

In this activity, you will connect Router_1 to the Core campus (Classroom Core), providing connectivity to the other campuses (groups). In addition, Router_1 and Router_2 will be separated by VLAN 100 so that not all of the user VLANs will be directly connected to each router. Static routes will be configured on Router_1 and Router_2 so that hosts in the user VLANs (10, 20, 30 and 40) can access the server, other classroom groups, and a simulated Internet address in the Classroom Core.

After completing this lab, you will be able to:

- Configure static routes
- Enable connectivity to a core switch
- Test and troubleshoot connectivity
- Enable and test RIP

Important Note

In this and all following labs, the switch configurations have changed significantly from the MSTP labs. These changes are clarified in Task 2.

No further configuration changes are required on Edge_1 for this lab.

At the end of this activity, your lab topology will be similar to Figure 6-1.

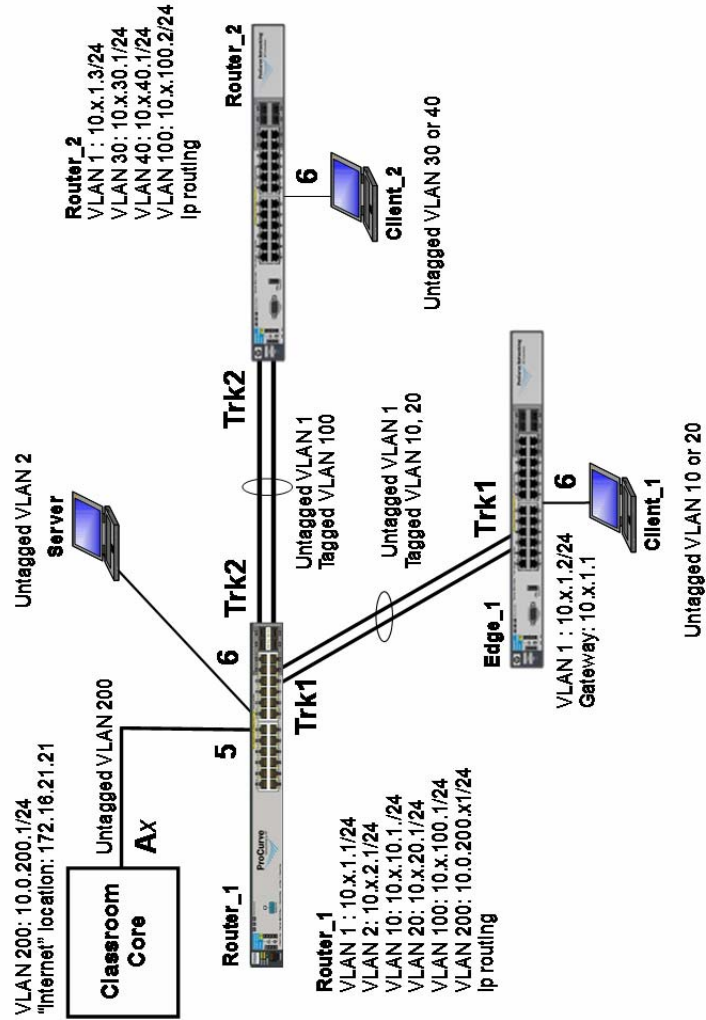


Figure 6-1: Final topology for Lab Activity 6.1

Task 1: Connect to each switch and verify lab startup configuration

1. Each team member, select either Router_1 or Router_2 and establish a console/serial connection to the switch.
2. Verify that the switch has the correct Lab 6 startup configuration by comparing the running-configs with the Lab 6 startup-configs in Appendix A.

```
Switch# show running-config
```

3. Select a team member to verify the configuration on Edge_1.

If the running-config of any switch does not match the startup-config for the lab, please inform the instructor.

Task 2: Verify the changes to the switch configurations

1. Note the changes from the final Lab 5 configurations:
 - The configuration that defined the redundant link between Edge_1 and Router_2 has been removed.
 - Interface 5 on Router_2 and Edge_1 has been disabled
 - VLANs 30 and 40 have been removed from Router_1 and Edge_1
 - VLAN 2, 10 and 20 have been removed from Router_2
2. Also, note that remote networks (VLANs 30 and 40 for Router_1 and VLANs 2, 10 and 20 for Router_2) do not appear in the routing table of the respective switches.

```
Router_x# show ip route
```

Task 3: Configure VLANs and IP addresses to support the new topology

Note: If you are working with a partner, the steps of this task may be configured simultaneously on Router_1 and Router_2.

In the new topology, the trunk (trk2) between Router_1 and Router_2 will be a tagged member of VLAN 100 while remaining an untagged member of VLAN 1.

Router_1 will be the default gateway for hosts in VLAN 2, 10 and 20. Router_2 will be the default gateway for hosts in VLANs 30 and 40. All switch-to-switch links will remain in VLAN 1.

Router_1 configuration

1. Add VLAN 100 to the switch configuration.

```
Router_1(config)# vlan 100
```

2. Add trk2 to VLAN 100 as a tagged link.

```
Router_1(vlan-100)# tagged trk2
```

3. Configure the VLAN 100 interface with an IP address of 10.x.100.1/24.

```
Router_1(vlan-100)# ip address 10.x.100.1/24
```

- Verify that trk2 is an untagged member of VLAN 1 and a tagged member of VLAN 100. Make changes as necessary.

```
Router_1(config)# show vlans ports trk2 detail
```

- Verify that IP routing has been enabled and the IP addresses in VLANs 1, 2, 10, 20 and 100 have been configured correctly (Table 6-1).

```
Router_1(config)# show ip
```

Table 6-1: IP addresses for Router_2

VLANs	IP address
1	10.x.1.1/24
2	10.x.2.1/24
10	10.x.10.1/24
20	10.x.20.1/24
100	10.x.100.1/24

- Verify that IP helper addresses have been configured for VLANs 10 and 20. If necessary, configure the helper addresses (10.x.2.100).

```
Router_1(vlan-id)# show ip helper-address
```

- Save your configuration changes by entering **write memory**.

Router_2 configuration

- Add VLAN 100 to the switch configuration.

```
Router_2(config)# vlan 100
```

- Add trk2 to VLAN 100 as a tagged link.

```
Router_2(vlan-100)# tagged trk2
```

- Configure the VLAN 100 interface with an IP address of 10.x.100.2/24.

```
Router_2(vlan-100)# ip address 10.x.100.2/24
```

- Verify that trk2 is an untagged member of VLAN 1 and a tagged member of VLAN 100.

```
Router_2(config)# show vlans ports trk2 detail
```

- Verify that IP routing has been enabled and the IP addresses in VLANs 1, 30, 40 and 100 have been configured correctly (Table 6-2). Note that the IP address for VLAN 100 is 10.x.100.2...not 10.x.100.1.

```
Router_2(config)# show ip
```

Table 6-2: IP addresses for Router_2

VLANs	IP address
1	10.x.1.3/24
30	10.x.30.1/24
40	10.x.40.1/24
100	10.x.100.2/24

6. Verify that IP helper addresses have been configured for VLANs 30 and 40. If necessary, configure the helper addresses (10.x.2.100).

```
Router_2(vlan-id)# show ip helper-address
```

```
Router_2(vlan-id)# ip helper-address 10.x.2.100
```

7. Save your configuration changes by entering **write memory**.

Task 4: Test connectivity

Note: If you are working with a partner, the steps of this task may be performed simultaneously on Router_1 and Router_2. However, you may find it useful to observe as your partner tests the other router.

Router_1 testing

1. From Router_1, ping the VLAN 100 address of Router_2. If your ping is not successful, follow these steps for troubleshooting:
 - a. Ensure that the links connecting the two switches are tagged members of VLAN 100.
 - b. Ensure that IP addresses are properly configured on the VLAN 100 interfaces of both switches.
 2. Open an RDP session to Client_1, connected to port 6 on Edge_1 (username: **admin** password: **hp**).
 3. From the CMD prompt of Client_1, release and renew the IP address (**ipconfig /release** and **ipconfig /renew**). The client should receive a 10.x.10.0/24 IP address. If not, troubleshoot and correct the problem.
 4. From the CMD prompt of Client_1, ping the VLAN 30 or 40 IP address on Router_2. The ping should not be successful. Why?
-
-

5. View the routing table of Router_1. Notice that only the directly connected networks are included in the routing table. (Only after the static routes are added to both routers will the remote networks be reachable.)

```
Router_1(config)# show ip routing
```

Router_2 testing

1. From Router_2, ping the VLAN 100 address of Router_1. If your ping is not successful, follow these steps for troubleshooting:
 - a. Ensure that the links connecting the two switches are tagged members of VLAN 100.
 - b. Ensure that IP addresses are properly configured on the VLAN 100 interfaces of both switches.
2. Open an RDP session to Client_2, connected to port 6 on Router_1 (username: **admin** password: **hp**).
3. From the CMD prompt of Client_2, release and renew the IP address (**ipconfig /release** and **ipconfig /renew**). The client should receive a 10.x.30.0/24 IP address. If not, ask the instructor for assistance.
4. From the CMD prompt of Client_2, ping the VLAN 2, 10 or 20 IP address on Router_1. The ping should not be successful. Why?

5. View the routing table of Router_2. View the router's routing table. Notice that only the directly connected networks are included in the routing table. (Only after the static routes are added to both routers will the remote networks be reachable.)

```
Router_2(config)# show ip routing
```

Task 5: Configure and analyze static routes

Note: Step 1 of this task must be configured on both routers before proceeding to the next steps (analysis).

Configure static routes on Router_1 and Router_2. The static routes will have a 16-bit mask that matches all hosts at your location (10.x.0.0). Routers prefer routes with the most specific bit match. The static route will be used only when a more specific match (e.g., directly connected networks with a 24-bit mask) does not exist in its routing table.

Router_1

```
Router_1(config)# ip route 10.x.0.0/16 10.x.100.2
```

Router_2

```
Router_2(config)# ip route 10.x.0.0/16 10.x.100.1
```

6. Save your configuration changes by entering **write memory**.

7. Examine the IP route tables of Router_1 or Router_2. Locate the new static route entry.
 8. From your Client PC, ping a user VLAN (10, 20, 30 or 40) IP address configured on the other router and also ping Server. These pings should be successful.
 9. View the routing table of your router. Which routing table entry matches the remote network(s) you just pinged?
-

Task 6: Enable connectivity to the Classroom Core

Note: This task should be done together with your partner. One partner should observe and help analyze as the other types in the appropriate commands and configuration.

Router_1 will connect to a switch in the facility's core network. In this task, you will enable connectivity between Router_1 and this network.

1. Add VLAN 200 to Router_1.
2. Add port 5 on Router_1 to VLAN 200 as an untagged member.
3. Configure VLAN 200 with an IP address of 10.0.200.x1/24, where x is your group number. For example, if you are in group number 1, you would use the IP address 10.0.200.11. (Note the different IP addressing syntax for this IP address.)
4. Enable port 5 on Router_1.
5. Use **show lldp info remote 5** to determine the hostname and IP address of the Classroom Core switch. Record information about this switch below:

Classroom Core switch name: _____

IP address: _____

Task 7: Test connectivity to the Classroom Core

Note: This task should be done together with your partner. There will be configuration and testing tasks on both routers but the steps must be followed in the correct order.

1. From Router_1, ping the Classroom Core switch. This ping should be successful. If not, verify the link status and VLAN 200 VLAN membership. Do not continue until your ping of the Classroom Core switch is successful.

2. Below, review the static routes configured on the Classroom Core and circle (mark) the entry that it uses to forward traffic to your location.

```
...
ip route 10.1.0.0/16 10.0.200.11
ip route 10.2.0.0/16 10.0.200.21
ip route 10.3.0.0/16 10.0.200.31
ip route 10.4.0.0/16 10.0.200.41
ip route 10.5.0.0/16 10.0.200.51
ip route 10.6.0.0/16 10.0.200.61
ip route 10.7.0.0/16 10.0.200.71
ip route 10.8.0.0/16 10.0.200.81
...
```

3. The Classroom Core switch is configured with a simulated Internet location of 172.16.21.21. From Router_1, ping this interface. The ping will fail. Why?

4. View the routing table on Router_1. Notice that there is no route to the 172.16.21.0/24 network.
5. On Router_1, configure a default route and retest connectivity. The ping should be successful. If not, ask the instructor to verify the Classroom Core configuration.

```
Router_1(config)# ip route 0.0.0.0/0 10.0.200.1
Router_1(config)# ping 172.16.21.21
```

6. From Client_1 connected to Edge_1, ping the Internet location. The ping should be successful.
7. From Client_2 connected to Router_2, ping the Internet location. The ping will not be successful. Why?

8. Configure a default route on Router_2 and again try to ping the Internet location. The ping should now be successful.

```
Router_2(config)# ip route 0.0.0.0/0 10.x.100.1
```

9. The static route configured earlier on Router_2 is no longer necessary? Why?

10. Remove the 10.x.0.0/16 static route from Router_2.

```
Router_2(config)# no ip route 10.x.0.0/16 10.x.100.1
```

11. From Client_2 connected to Router_2, ping the Internet location. This ping should be successful because of the default route entry in the routing table.

```
Router_2(config)# show ip routing
```

Task 8: Remove the default route and enable RIP routing on Router_1

In this task, the default route on Router_1 will be deleted. In place of the default route, routes to the remote sites (other groups) and the Internet (172.16.21.21) will be learned automatically using a dynamic routing protocol. Routing Information Protocol (RIP) will be enabled on Router_1 and configured on the VLAN 200 interface. Router_2 will continue to use its statically configured default route to reach the remote sites (no changes are required on Router_2).

Router_1

1. Remove the default route.

```
Router_1(config)# no ip route 0.0.0.0/0 10.0.200.1
```

2. Enable RIP globally.

```
Router_1(config)# router rip
```

```
Router_1(rip)# exit
```

3. Enable RIP in VLAN 200.

```
Router_1(vlan-200)# ip rip
```

4. View the IP RIP configuration and peer information.

```
Router_1(vlan-200)# show ip rip
```

How many RIP peers on VLAN 200 are shown? Record your results in the spaces below. (The number of peers will vary depending on the number of groups who have completed Steps 1-3. However, there should be at least one peer connection with the Classroom Core.)

5. Peers: _____ View the IP routing table.

```
Router_1(vlan-200)# show ip route
```

How many gateways and networks are shown? Record your results in the spaces below. (Numbers will vary depending on the progress of other groups.)

Gateways: _____

Networks: _____

Task 9: Test IP RIP routing on Router_1

1. From either Client, ping the VLAN 100 interface on another group's Router_2 (10.x.100.2) as they become available.
2. From either Client, ping the Internet location 172.16.21.21. The ping should be successful. If not, ask the instructor for assistance.
3. View the routing table on Router_1 and verify that network 172.16.0.0/16 does not appear in the routing table. This network is being "restricted" from RIP updates and not being advertised by the Classroom Core.

Why is it possible to ping 172.16.21.21 even though it does not appear as an entry in the routing table?

4. View the routing table on Router_1 again and verify that the default route is the first entry.

What "Type" of route is the default route? _____

The Classroom Core is redistributing static routes into RIP updates. By redistributing this centrally defined route, the default route does not need to be manually configured on every RIP-enabled router.

Command Reference

Description	Command
Delete VLAN from switch.	no vlan <vlan_id>
Configure static route.	[no] ip route <address_range>/<mask> <next_hop>
Display the IP routing table. The output may be restricted to a specific destination or type of route.	show ip route [IP-ADDR] [static connected rip ospf]
Enable/disable/configure Routing Internet Protocol (RIP) on the device, or enter RIP Configuration Context.	router rip
Enable/disable/configure Routing Internet Protocol (RIP) on the VLAN interface.	ip rip
Show RIP operational and configuration information.	show ip rip

Providing Mobility for SMBs

Lab Activity 7

Objectives

You will now add a standalone AP to the network and configure it to support a wireless LAN (WLAN). You will secure the WLAN with Wi-Fi Protected Access (WPA) in Preshared Key (PSK) mode. After you complete a quick setup, authorized users will be able to connect to your network from any location at the site.

After completing this lab, you will be able to:

- Install an HP E-MSM AP and access its web browser interface
- Convert the AP to autonomous (standalone) mode
- Complete the initial configuration of the AP
- Create a Virtual Service Community (VSC) that supports WPA-PSK and bridges wireless traffic into the correct virtual LAN (VLAN)
- Test wireless connectivity

As shown in Figure 7-1, the topology for this lab builds on the topology that you created in Lab 6.

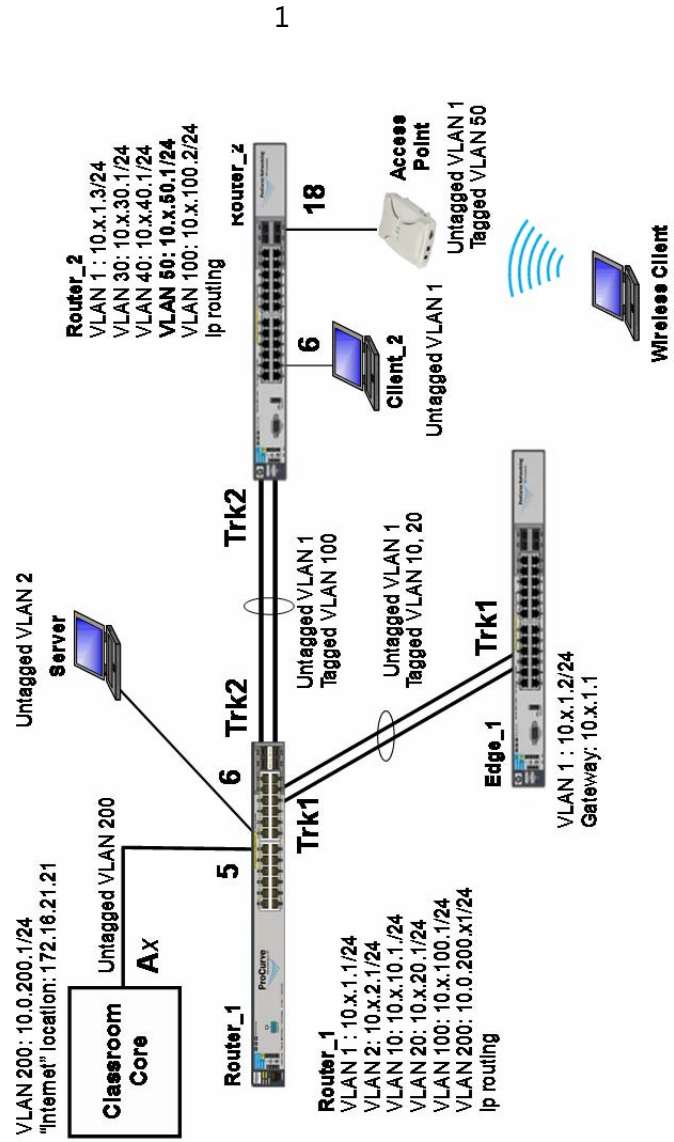


Figure 7-1: Final lab topology

Task 1: Connect to each switch and verify lab startup configuration

1. Each team member, select either Router_1 or Router_2 and establish a console/serial connection to the switch.
2. Verify that the switch has the correct Lab 7 startup configuration by comparing the running-configs with the Lab 7 startup-configs in Appendix A.

```
Switch# show running-config
```

3. Select a team member to verify the configuration on Edge_1.

If the running-config of any switch does not match the startup-config for the lab, please inform the instructor.

Task 2: Verify the changes to the Router_2 configuration

You will map the WLAN traffic to VLAN 50. The AP will connect to Router_2, which will be the default router for wireless users in this VLAN.

1. Note the changes from the final Lab 6 configurations. The only changes are on Router_2:
 - The “wireless” VLAN 50 has been added to Router_2
 - VLAN 50 has an IP address of 10.x.50.1/24 and a helper address of 10.x.2.10
 - Port 18 has been added as a tagged member of VLAN 50, the port to which the AP is directly connected (port 18 is also an untagged member of VLAN 1)
 - Port 18 has been enabled

Task 3: Install the AP and access its Web browser interface

In this lab, you will access the AP initially through its default IP address of 192.168.1.1. From your Client_2 PC, you will configure the AP through its web interface. You must change the client’s IP address to an IP address on the same network (192.168.1.0/24). Both the AP and Client_2 are in VLAN 1 for the initial configuration.

AP configuration

1. Verify that port 18 is enabled and delivering PoE power.

```
Router_2# show interface brief
```

```
Router_2# show power brief
```

2. If necessary enable port 18 and/or PoE on port 18.

```
Router_2(config)# interface 18 enable
```

```
Router_2(config)# interface 18 power-over-ethernet
```

Client configuration

3. Open an RDP session to the Client_2 (username: **admin** password: **hp**).
4. Access the client's TCP/IP configuration for the "Lab Network" interface (from the Windows **Start** menu, select **Control Panel > Network and Sharing Center > Change adapter settings > "Lab Network" > Properties > Internet Protocol Version 4**) and configure the following settings:
 - IP address = 192.168.1.2
 - Mask = 255.255.255.0
 - Default gateway = 192.168.1.1
5. Assign port 6 on Router_2 as an untagged member of VLAN 1 (the same VLAN as the AP connected to port 18).


```
Router_2(config)# vlan 1 untagged 6
```
6. From the CMD prompt of Client_2, ping the AP (192.168.1.1). Do not proceed until the ping is successful.
7. Using Internet Explorer on Client_2, open a session with the AP's web browser interface (192.168.1.1) and log in:
 - Username = admin
 - Password = admin

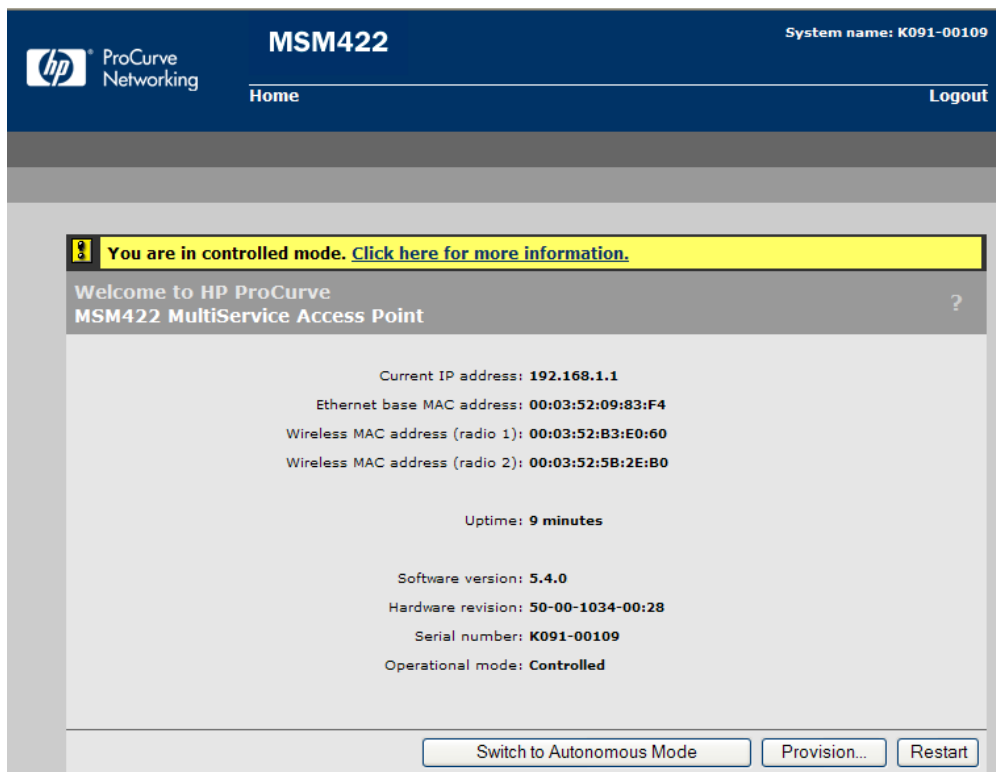


Figure 7-2: E-MSM AP Initial Welcome Window

8. Click **Switch to Autonomous Mode**.
9. Confirm that you want to make the change.
10. Wait for the AP to reboot. Then navigate to the AP's web browser interface and log in again.
11. You will be guided through the initial configurations steps:

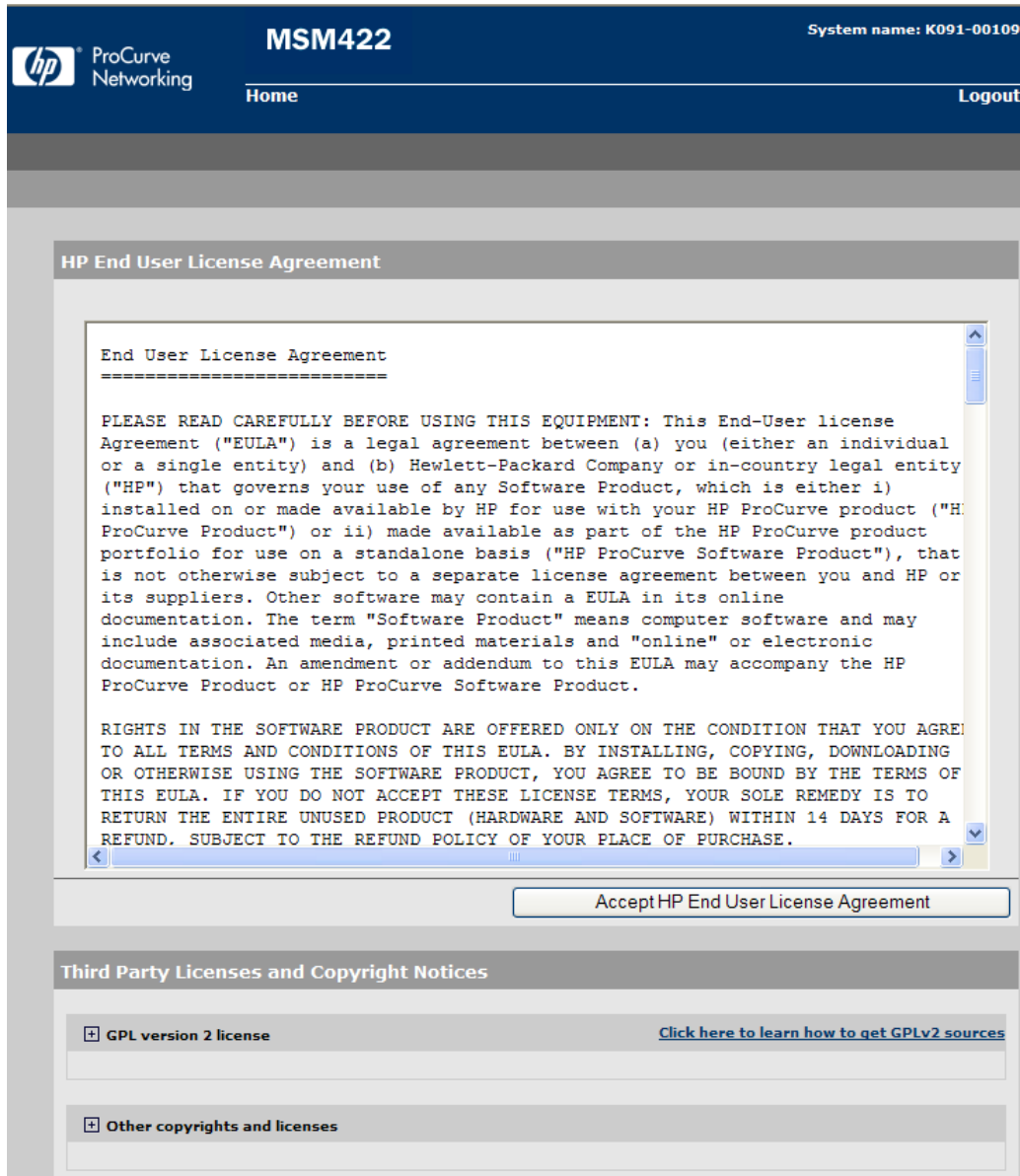


Figure 7-3: E-MSM AP HP End User License Agreement

- a. Accept the license agreement.

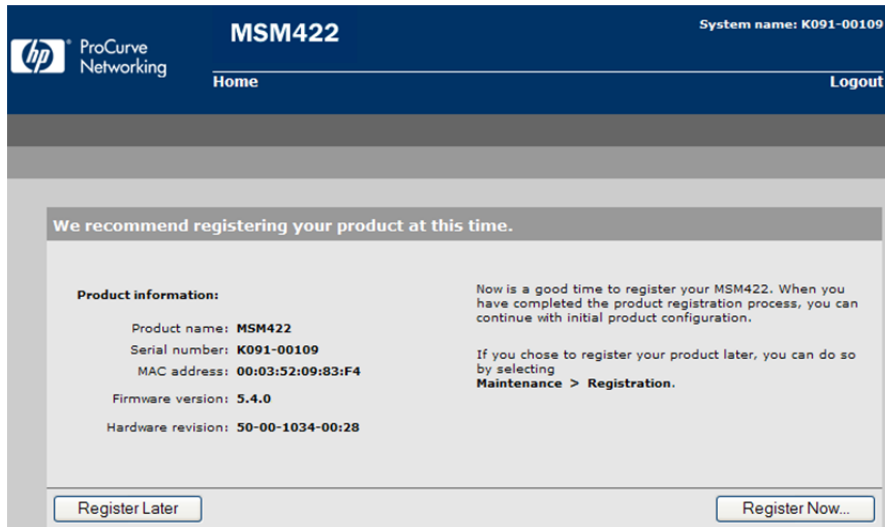


Figure 7-4: HP E-MSM registration

- b. Select **Register Later**.

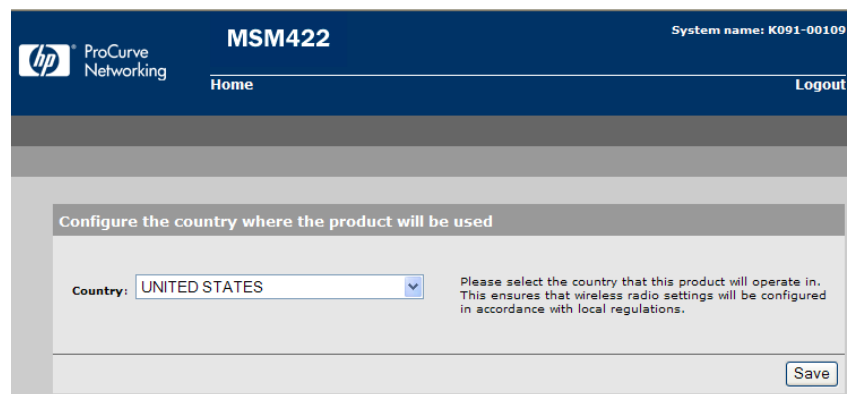


Figure 7-5: HP E-MSM country code

- c. Select **United States** for the country if you are in the United States. Otherwise, ask your instructor which country to select. The country selected determines frequencies based on local regulations. Click **Save**.
- d. Change the management credentials:
- ◆ Username = admin
 - ◆ Current password = admin
 - ◆ New password = password
 - ◆ Confirm password = password

hp ProCurve Networking **MSM422** System name: K091-00109
Home Logout

We recommend changing the default administrator password at this time.

Username:

Current password:

New password:

Confirm new password:

Access to the MSM422 management tool can be restricted by an administrator password. It is highly recommended that you change your unit password, especially if it is exposed to external networks.

For optimum security, your password should be at least six characters long. The password is case-sensitive.

Cancel Save

Figure 7-6: HP E-MSM changing password

Task 4: Configure wireless services

You will now configure the wireless services.

1. Create the VLAN for wireless users:
 - a. Click **Network > Network profiles**.

hp ProCurve Networking **MSM422** System name: K091-00109
Home Logout

VSC Wireless Network Security Authentication Management Status Tools Maintenance

Ports Network profiles Bandwidth control Discovery protocols DNS IP routes IP QoS 802.1X Supplicant

Network profiles ?

Name	VLAN	Location
No network profiles are defined.		

Add New Profile...

Figure 7-7: HP E-MSM Network > Network profiles window

- b. Click **Add new profile**.
 - c. For **Name**, type **WirelessUsers**.
 - d. Select the **VLAN** check box.
 - e. For **VLAN**, type **50**.

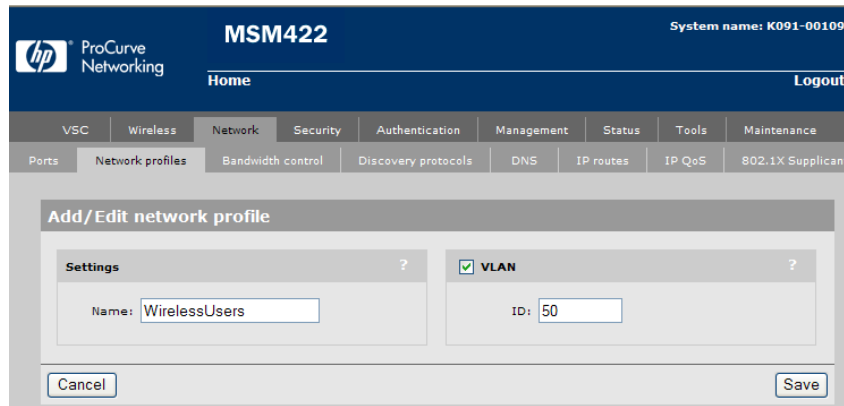


Figure 7-8: HP E-MSM Network > Network profiles > Add/Edit network profile window

- f. Click **Save**.
- g. Next assign the profile as a VLAN on a port. Click the **Ports** tab.

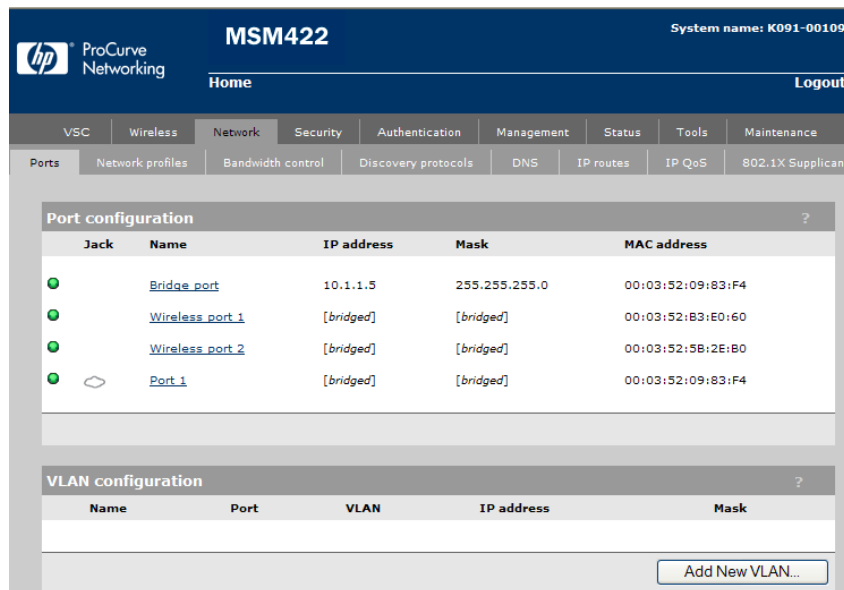


Figure 7-9: HP E-MSM Network > Ports window

- h. Click **Add New VLAN**.
- i. Leave the **Port** set to **Port 1**.
- j. Select the **50 (WirelessUsers)** profile.
- k. Make sure that **None** is selected for IP address.

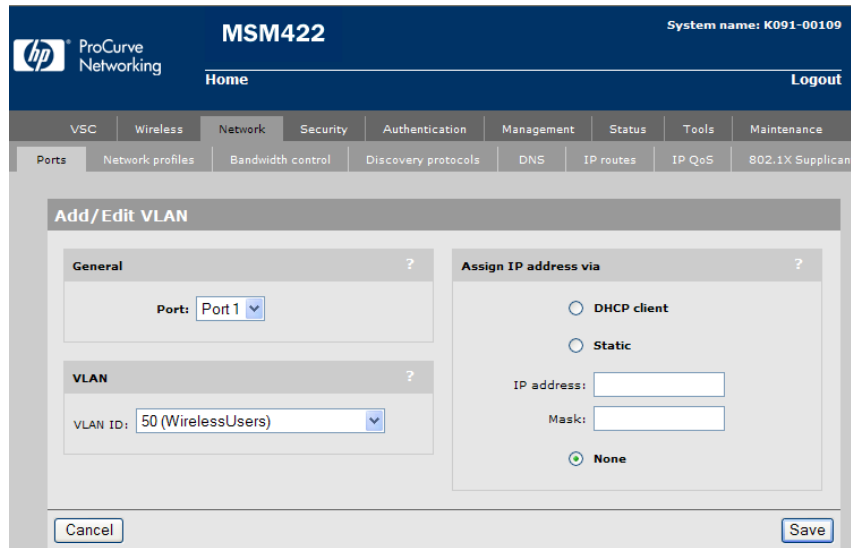


Figure 7-1: HP E-MSM Network > Ports > Add/Edit VLAN window

- I. Click **Save**.
2. Create the Virtual Service Community (VSC), which specifies the wireless LAN (WLAN) settings and services. In this lab, you will configure Wi-Fi Protected Access-Pre-shared Key (WPA-PSK).
 - a. Click **VSC** in the navigation bar.

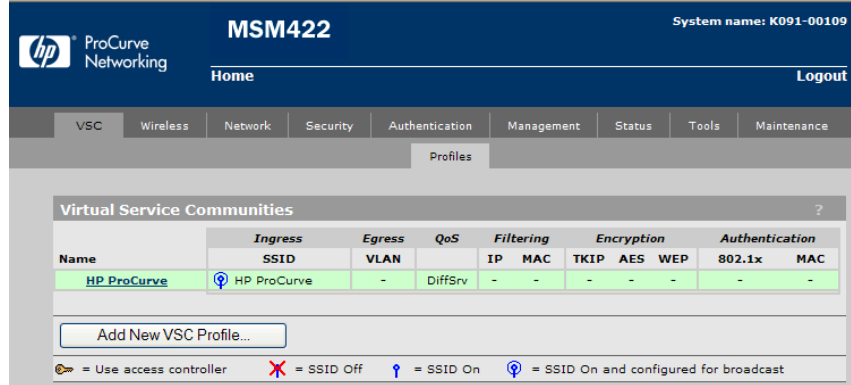


Figure 7-112: HP E-MSM VSC window

- b. A default VSC already exists. You will edit that one. Click its name.
- c. In the **General** section, for **Name**, type **HP-SMB**.
- d. In the **Virtual AP** section, for **Name (SSID)**, type **x-HP-SMB**. (Replace x with your group number.)

- e. For **Wireless protection**, select **WPA**. Then configure these settings:
 - ◆ For **Mode**, select **WPA (TKIP)**.
 - ◆ For **Key source**, select **Preshared Key**.
 - ◆ For **Key** and **Confirm key**, type **password**.

In a real-world environment, you might select WPA2 for the mode. Here, you are selecting WPA to ensure that your client can connect.

- e. In the **Egress VLAN** section, select the VLAN that you created in the previous step.

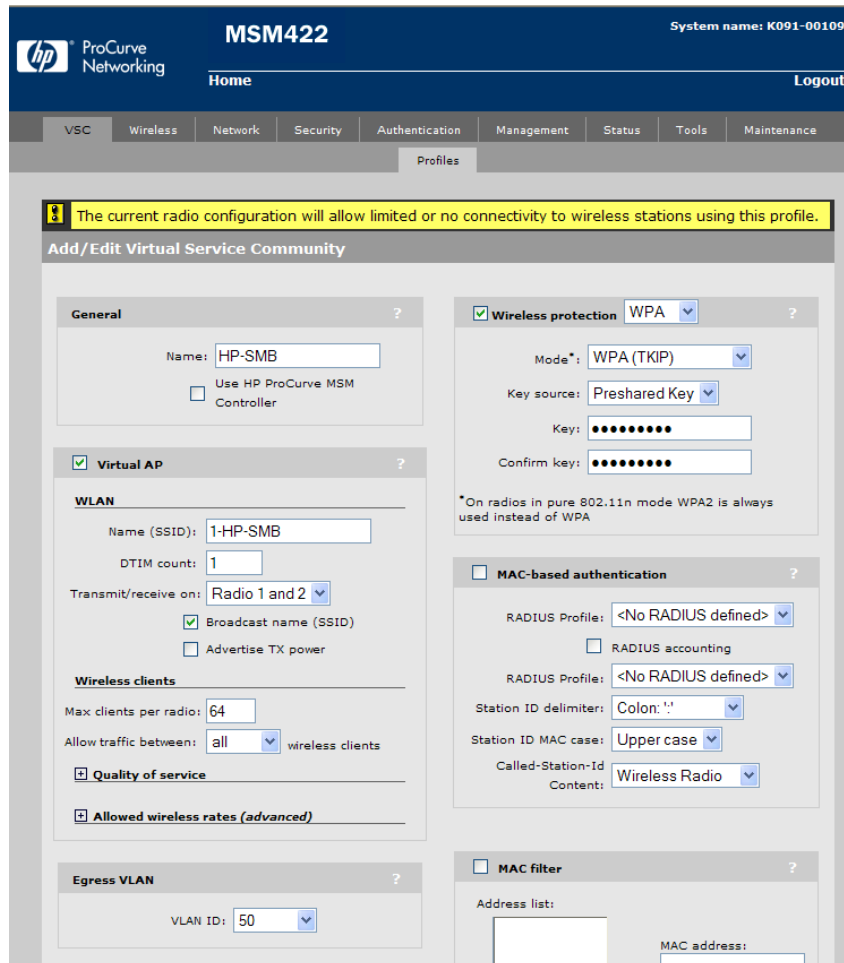


Figure 7-12: HP E-MSM VSC > Profiles > Add/Edit Virtual Service Community window

- f. Scroll down to the **Wireless Security Filters** section and, if necessary, remove the check mark from the checkbox for the entire section.
- g. Leave other settings at their defaults.
- h. Click **Save**.

Task 5: Configure the AP radios

You will now configure the AP radios. E-MSM APs support several modes for radio operation. In this course, the only mode that you want to use is **Access Point only**, which enables the radio to support wireless clients.

You can also configure the 802.11 operation mode. For this lab, you will configure one radio to support 802.11n/b/g. You will disable the other radio to reduce the number of active antennas.

1. Click **Wireless > Radios**.
2. Configure these settings:
 - **Radio 1**—Check box selected
 - ◆ **Operating mode** = Access point only
 - ◆ **Wireless mode** = 802.11n/b/g
 - ◆ **Channel** = Automatic

Note

In a real-world environment, you should usually analyze interference on different channels at different times, and select the best channel. However, for this lab, you can leave the channel at the automatic setting, which configures the radio to select the channel with the least interference when the radio is enabled. Due to the constrictions of a lab environment, your network will experience some interference.

- **Radio 2** (check box clear)

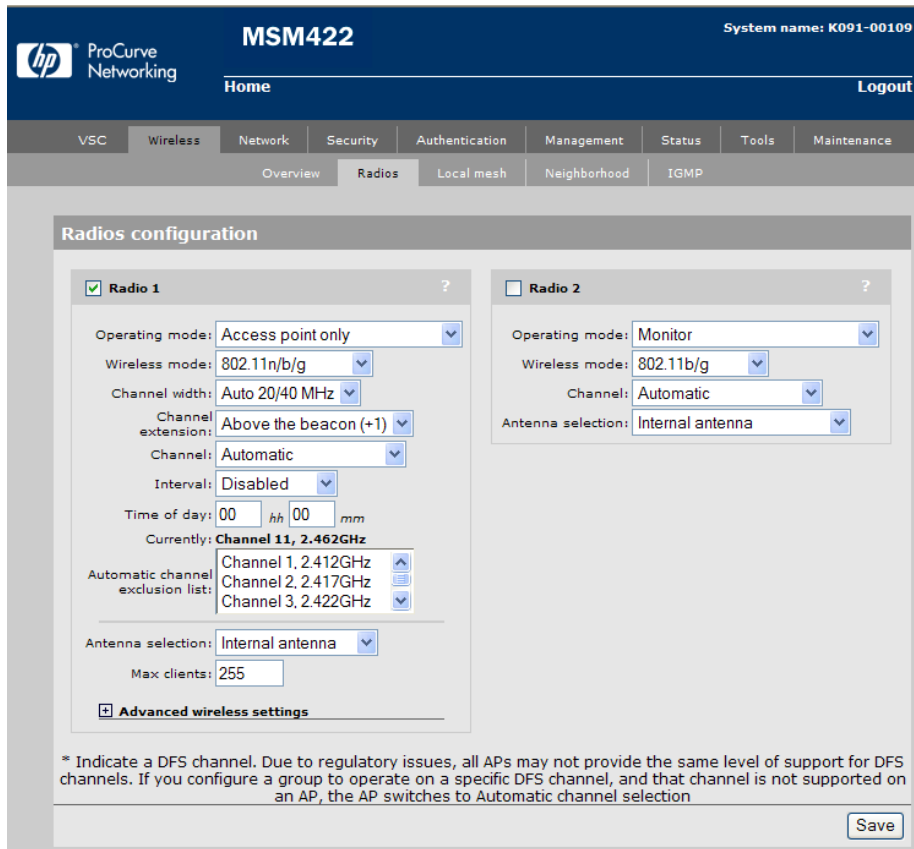


Figure 7-13: E-MSM Wireless > Radios window

3. In a lab environment with many groups establishing wireless networks, it is generally a good idea to turn down the transmit power.
 - a. Expand **Advanced wireless settings**.
 - b. Clear the **Maximum available output power** check box.
 - c. In the % field, type **30**. The **dBm** field automatically changes.

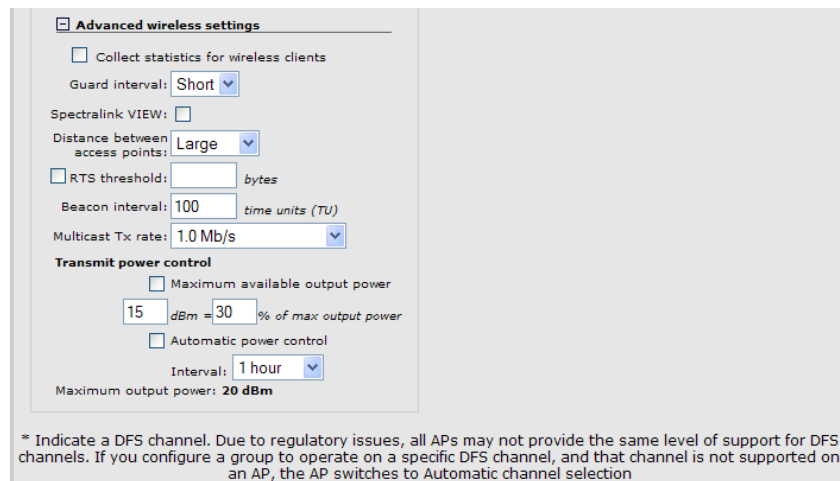


Figure 7-143: E-MSM Wireless > Radios window > Advanced wireless settings section

4. Click **Save**.

Task 6: Configure the management IP address of the AP

You will now configure the management IP address for the AP. The AP will be managed in VLAN 1 (network 10.x.1.0/24).

1. Assign the AP its permanent IP address:
 - a. Click **Network > Ports**.
 - b. Click **Bridge port**.
 - c. Select **Static** and click **Configure**.
 - d. Specify the IP address:
 - ◆ **IP address** = 10.x.1.5
 - ◆ **Address mask** = 255.255.255.0
 - ◆ **Default gateway** = 10.x.1.1

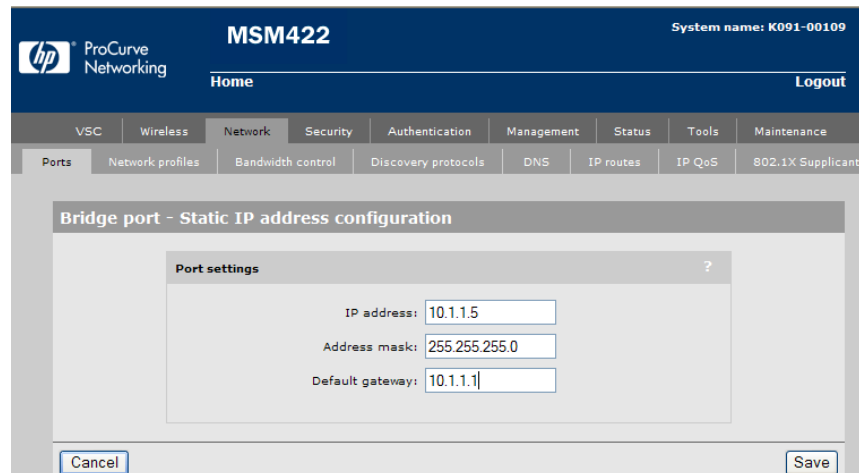


Figure 7-15: HP E-MSM Network > Ports > Bridge port – Static IP address configuration window

- d. Click **Save**. (You will lose management access to the AP.)
2. Change the IP address of the Client_2 Ethernet interface back to DHCP (refer to Task 3, Step 4 for details) and close the RDP session.

Task 7: Test wireless connectivity

You will now verify that your client can connect to the wireless network and reach the Classroom Core.

Wireless Client configuration

1. Open an RDP session to Wireless_Client (username: **admin** password: **hp**).
2. Initiate the connection to your wireless network by clicking the wireless network icon in the system tray. Click your SSID and select **Connect**.

When you are prompted to enter a security key, type **password**.

3. The client should connect to the AP and receive an IP address.
4. Open a command prompt and ping the Classroom Core (10.0.200.1).

The ping should be successful. If not, ask the instructor for assistance.

Command Reference

Description	Command
Show port PoE configuration and status information.	show power brief
Set Power Over Ethernet(PoE) configuration parameters.	interface <port id> power-over-ethernet

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Getting Started with HP PCM+

Lab Activity 8

Objectives

As a small business expands, network administrators find it more difficult to keep up with management tasks. In this lab, you will install and use HP PCM+, which is a Simple Network Management Protocol (SNMP) solution, and begin to explore the tools that it provides.

After completing this lab, you will be able to:

- Install a single-server PCM+ solution
- Verify that devices are discovered and add managed subnets when necessary
- Use PCM+ to view the status of devices and topology maps
- Access managed devices using PCM+

As shown in Figure 8-1, the topology for this lab is the same as the topology for Lab 7.

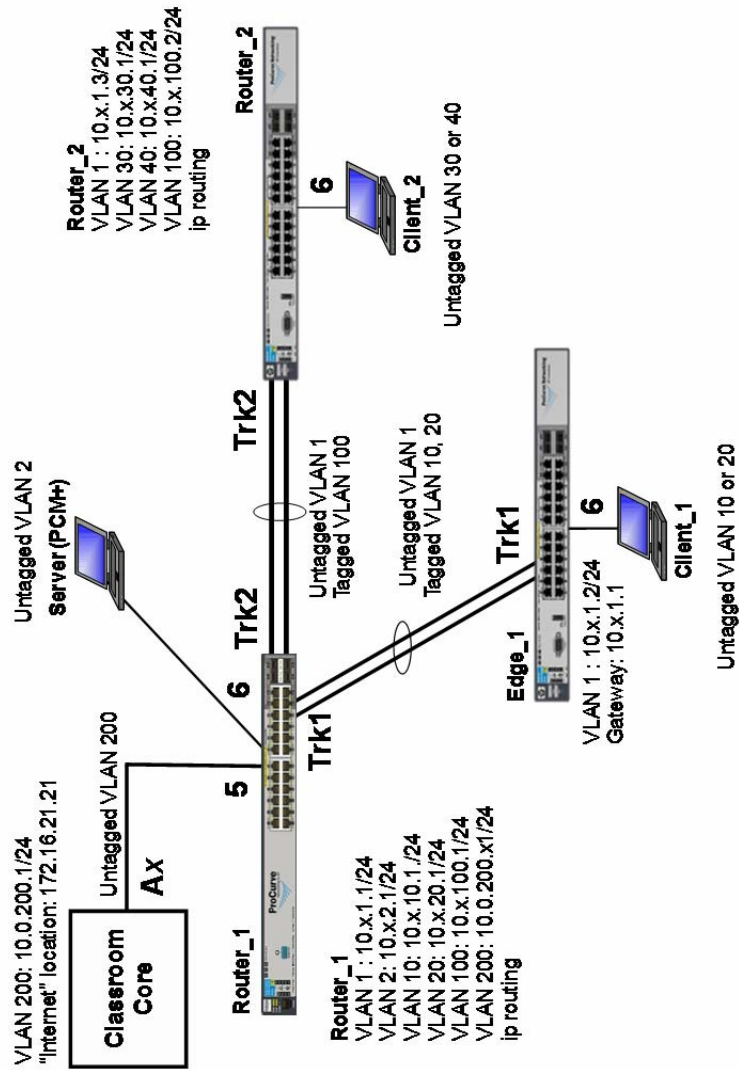


Figure 8-1: Final lab topology

Task 1: Connect to each switch and verify lab startup configuration

1. Each team member, select either Router_1 or Router_2 and establish a console/serial connection to the switch.
2. Verify that the switch has the correct Lab 8 startup configuration by comparing the running-configs with the Lab 8 startup-configs in Appendix A.

```
Switch# show running-config
```

3. Select a team member to verify the configuration on Edge_1.

If the running-config of any switch does not match the startup-config for the lab, please inform the instructor.

Task 2: Install PCM+ on the Server

Install PCM+ on your server only. In this lab, you will run the server and the local agent and client, which install automatically with the server.

Note

In the lab environment, you are installing PCM+ on the same server that offers many other services. In a production environment, it is recommended that you dedicate a server to PCM+. If you have a secure management VLAN, make sure that this server and the agents have an IP address on that VLAN.

Server:

1. Open an RDP session to the Server (username: **administrator** password: **hp**).
2. Your C:\Kit folder contains a PCM folder with the installation file (C.03.10.zip). Unzip the file and run the install.exe file.

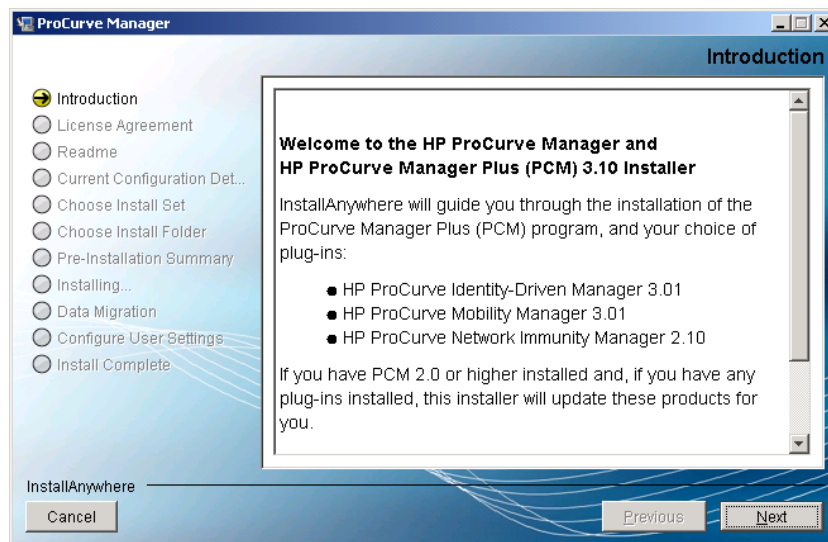


Figure 8-2: PCM+ Installer > Introduction window

3. After the installation launches, click **Next** in the **Introduction** window.

4. Accept the license and continue to click **Next** until you reach the **Choose Install Set** window.
5. This window includes a check box to select PCM+ as well as other plug-ins. For this lab, only select the check box displayed in Figure 8-3 (ProCurve Manager 3.10).

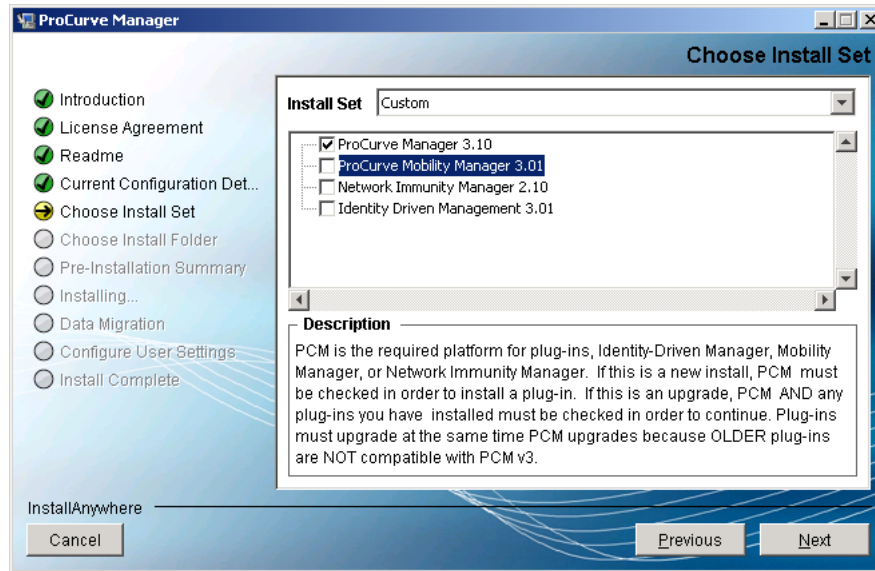


Figure 8-3: PCM+ Installer > Choose Install Set window

6. Click **Next**.
7. In the installation directory window, click **Next**.
8. In the **Pre-installation Summary** window, click **Install**. When the warning is displayed, telling you not to interrupt the installation program, click **Continue**.
9. When asked if you want to "Integrate PCM with Network Immunity Manager 2.10 2.10", do not check the box. Click **Next**.
10. You should see a window with the agent configuration settings about which you learned in the lesson. Because you only want to use the local agent, you should clear the **Allow new agents to connect** check box. Later, if you wanted to install a remote agent, you could add it from the PCM+ user interface.
11. Click **Next**.
12. When prompted to set the password, in both fields, type **password**. Click **Next**.
13. For **Start from device**, type **10.x.1.1**. This is the seed device you learned about in the lesson.
14. Select the **Automatically register as a trap receiver** check box (already checked as the default setting). This will configure the switch to use PCM+ as an SNMP trap receiver.

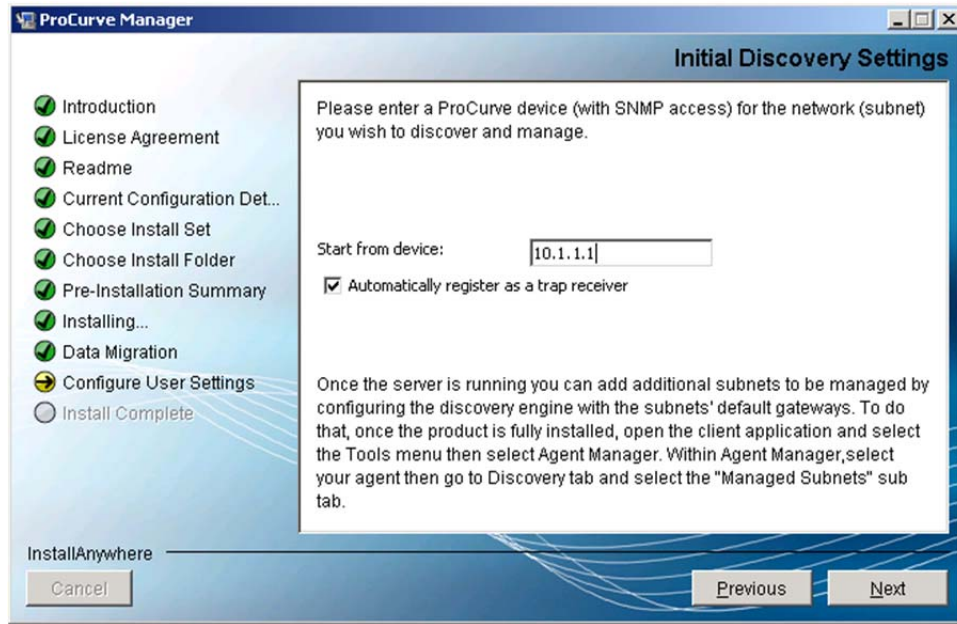


Figure 8-4: PCM+ Installer > Initial Discovery Settings window

15. Click **Next**.
16. You will use the default SNMPV2 settings. Click **Next**.

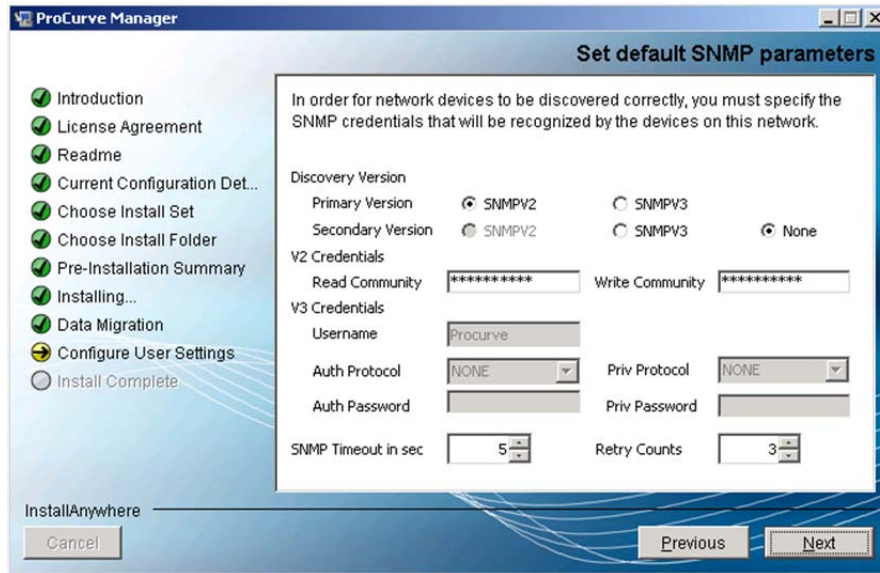


Figure 8-5: PCM+ Installer > Set default SNMP parameters

17. Click **Next**.
18. You must configure the settings that PCM+ uses to access the CLI of devices and automatically implement configuration changes. SSH is the more secure protocol, which you should use in a production environment. For this lab, however, you will use Telnet (the default settings). Since the switches do not have usernames or passwords configured, there are no changes required. Click **Next**.

19. Leave the HTTP proxy settings at their defaults and click **Next**.
20. You do not need automatic updates for the lab, so disable this feature. Click **Disable automatic updates** and click **Next**.
21. You can check your settings in the **Installation Complete** window. Then click **Next** and then **Done**.


Task 3: Log in and verify device discovery

You will now use the local PCM+ client to log in to the user interface and begin to explore it.

Server:

1. On the Server, the PCM+ client is automatically installed. You can access it from the server's **Start** menu.
2. The first time that you launch the client, you must enter the server's IP address. Type **10.x.2.100** and click **Connect**.
3. When prompted to log in, enter **Administrator** as the username and then enter the password you configured: **password**.
4. Expand folders in the Navigation Tree. Where do you find your devices? (All of the devices might not be discovered yet.)

5. In this lab, all of your network infrastructure devices have management IP addresses in the same subnet. But if you had devices in another subnet, you would need to add that subnet as a managed subnet. Practice the procedure.

First click the Agent Manager icon in the global toolbar: .

6. The local agent is displayed in the left pane. Click **Discovery > Managed Subnet**.

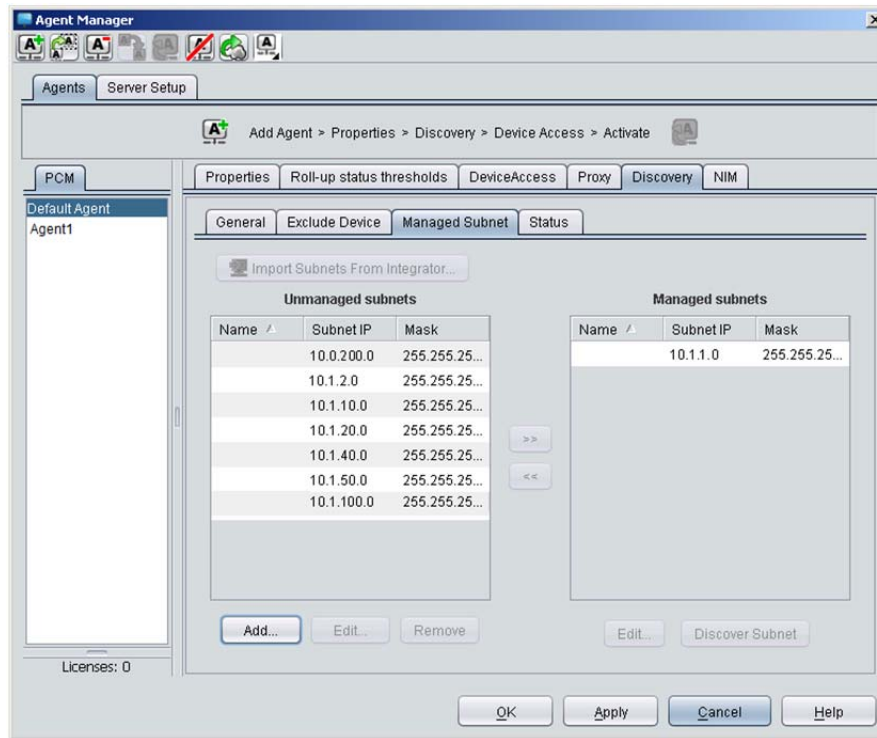


Figure 8-6: PCM+—Agent Manager > Discovery > Managed Subnet window

7. As you see, the detected subnets are listed in the **Unmanaged subnets** list. You can select any of these subnets (or multiple subnets) and click the arrow button to move it to the **Managed subnets** list.
8. Click the **Status** tab.
9. You can see which discovery methods are currently running.
10. Click **OK**.

Note

If you want to discover any of your devices manually, select **Tools > Manual Discovery Wizard**. Follow the prompts; you should specify the device's IP address in VLAN 1.

Task 4: Explore PCM+

On Server:

1. When you select a device in the Navigation tree, the right pane displays information about it. You can view different information or complete different tasks by selecting a new tab.

Explore the tabs in the right pane to find the following information (indicate where you find the information):

Which ports are active on Router_1? (You can view a device's system name by clicking the **Dashboard** tab.)

Of which VLANs are Router_2's ports members?

Which software version is Edge_1 running?

What events have occurred on Edge_2?

2. In the Navigation Tree, expand **Network Management Home > Agent Groups > Default Agent Group**. Click **Network Map**.
3. In the **Link View** drop-down menu, select several different options. What do you see?

4. Right-click the name of one of your devices in the Navigation Tree. Select **Device Access > Telnet to device**. You can configure the device from here. However, PCM+ provides tools that automate and ease configuration. Move to the next task to practice using one.

Task 5 (optional): Explore management options

If you have time, you can explore some of the tools that are available in PCM+. You can access most device management options by either:

- Selecting a device in the Navigation Tree, right-clicking, and selecting an option
- Selecting a device in the Navigation Tree and clicking a button in the toolbar in the right pane; different buttons are available depending on the selected tab


You can apply actions to multiple devices by selecting a folder in the Navigation Tree, clicking the Devices List tab in the right pane, selecting multiple devices in the list (press [Ctrl]), and selecting a button in the toolbar.

The sections below guide you through using one useful tool: the VLAN Manager.

Add a VLAN

For this task, add a new VLAN and extend it throughout the network.

On Server:

1. In the Navigation Tree, select the **Devices** folder that contains your devices.
2. Click the **Devices List** tab.
3. Press [Ctrl] and select all of your switches in the list.
4. Right-click and select **VLAN Manager Toolbar > Create VLAN** or click  and select **Create VLAN**.

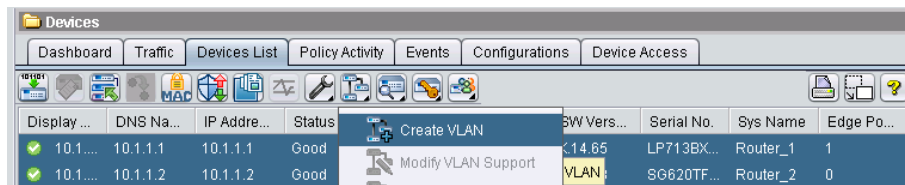


Figure 8-7: PCM+ > Devices List > VLAN Manager Toolbar > Create VLAN

5. In the VLAN wizard welcome window, click **Next**.
6. Type 60 for the **VLAN ID**.

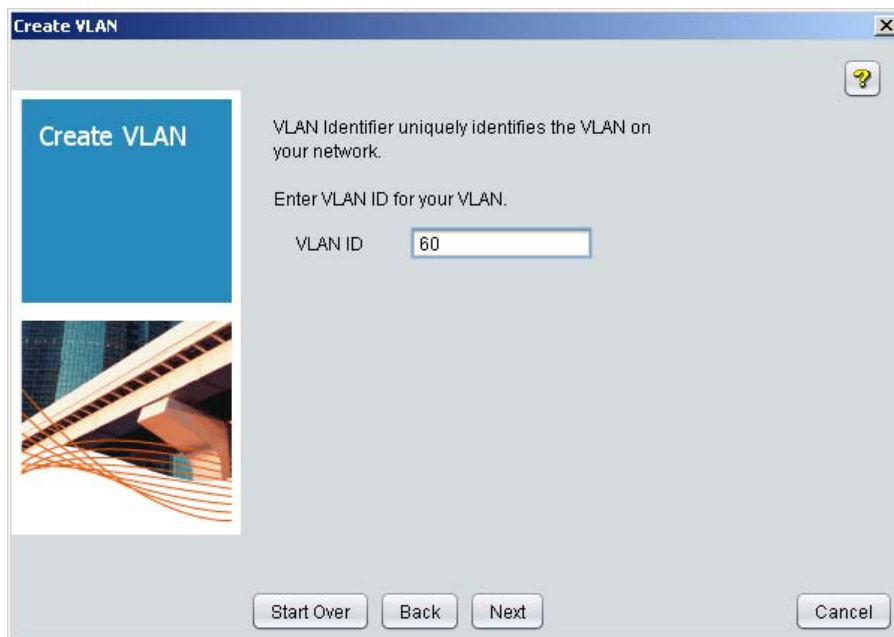


Figure 8-8: PCM+ > Create VLAN

7. Click **Next**.

8. You will see a page in which you can configure the VLAN settings on the first switch. For Router_1, select **Manual** from the **IP config** list. Configure an IP address:
 - **IP Address = 10.x.60.1**
 - **Subnet Mask = 255.255.255.0**
9. Select the **Tagged** column for the switch-to-switch ports (note that you can see the active ports).

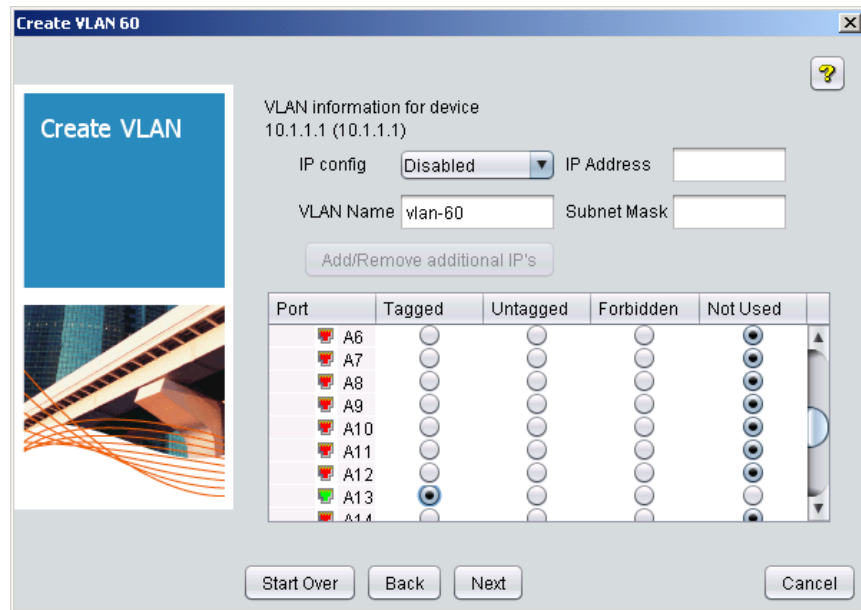


Figure 8-9: PCM+ > Create VLAN 60

10. Click **Next**.
11. Configure the settings for the next switch.

Assign Router 2 an IP address in VLAN 60: 10.1.60.3/24. Do not assign the other switches an IP address in this VLAN.

On each switch, select **Tagged** for each switch-to-switch port. On Edge_1 also select one available port and select **Untagged**. Continue clicking **Next** until you have finished configuring all switches.
12. When you reach the summary window, review the settings.
13. Click **Next**.

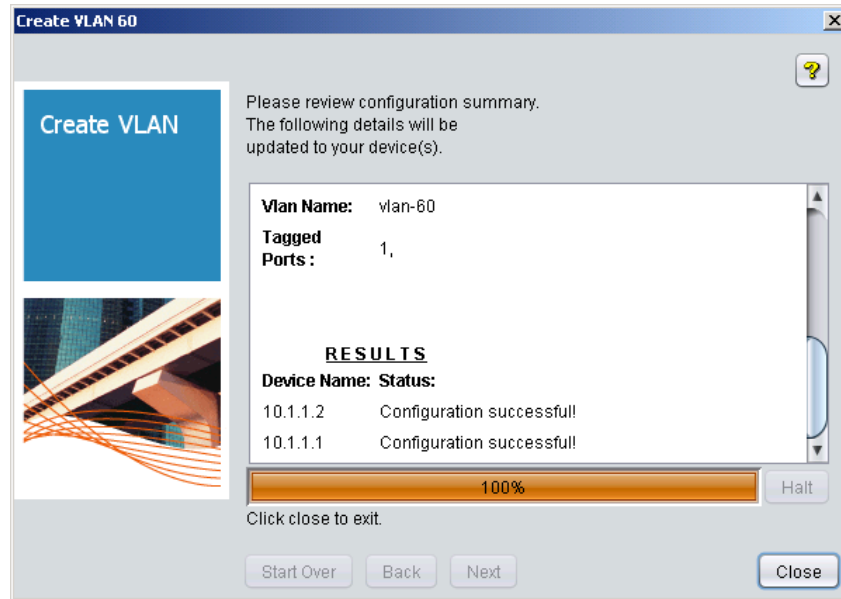



Figure 8-10: PCM+ > Create VLAN 60 (Success)

14. After the configurations have been successfully applied, click **Close**.
If PCM+ cannot apply the settings, check the SNMP settings on each switch to ensure that they were entered correctly.
15. You also need to add a helper IP address for this VLAN on Router_1. This task provides a good opportunity for you to learn how to use the CLI Wizard. You should be in the **Device List** tab. Select Router_1.
16. Click the Device Configuration button  and select **CLI**.
17. Type this command in the window:
`vlan 60 ip helper-address 10.x.2.100`
18. Select the two check boxes to commit the command to the switch's memory and to display the configuration.

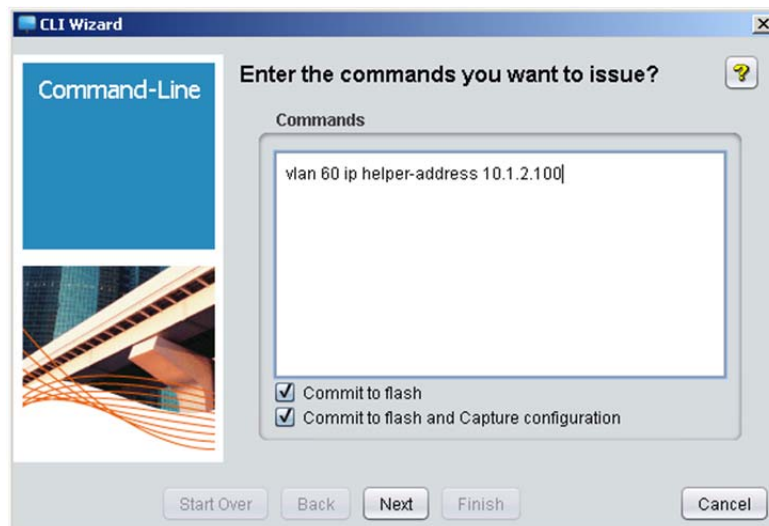


Figure 8-11: PCM+ > CLI Wizard

19. Click **Next**.
20. Choose to commit the commands now.
21. Click **Next**.

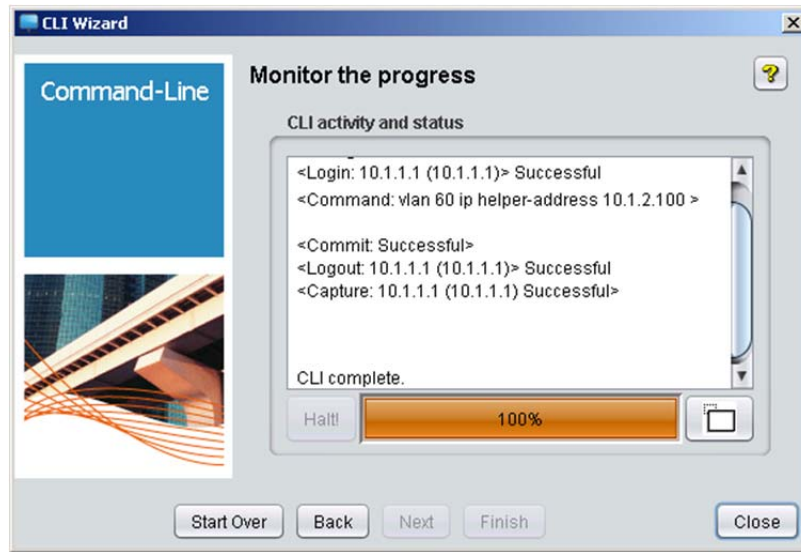


Figure 8-12: PCM+ > CLI Wizard (Success)

22. After you see that the commands have been committed successfully, click **Close**.

Command reference

Description	Command
N/A	

Startup Configs for Each Lab Activity

Appendix A

Lab 1 (startup configs)

Router/Edge_1

```
hostname "HP-E2620-24-PPoEP"  
interface 1  
    disable  
exit  
interface 2  
    disable  
exit  
interface 3  
    disable  
exit  
interface 4  
    disable  
exit  
interface 5  
    disable  
exit  
interface 6  
    disable  
exit  
vlan 1  
    name "DEFAULT_VLAN"  
    untagged 1-24  
    ip address dhcp-bootp  
    exit  
snmp-server community "public" unrestricted
```

Edge_2

```
hostname "HP-E2620-24-PPoEP"  
interface 1  
    disable  
exit  
interface 2  
    disable  
exit  
interface 3  
    disable  
exit  
interface 4  
    disable  
exit  
interface 5  
    disable  
exit
```

```
interface 6
  disable
exit
interface 18
  disable
exit
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-24
  ip address dhcp-bootp
  exit
snmp-server community "public" unrestricted
```


Lab 2 (startup configs)

Note: These startup configs are the same as the final configs of Lab 1.

Router

```
hostname "Router"
interface 1
  name "Edge_1"
exit
interface 2
  disable
exit
interface 3
  name "Edge_2"
exit
interface 4
  disable
exit
interface 5
  disable
exit
interface 6
  disable
exit
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-24
  ip address 10.x.1.1 255.255.255.0
  exit
snmp-server community "public" unrestricted
```

Edge_1

```
hostname "Edge_1"
interface 1
  name "Router"
exit
interface 2
  disable
exit
interface 3
  disable
exit
interface 4
  disable
exit
interface 5
  disable
exit
interface 6
  disable
exit
vlan 1
```

```
name "DEFAULT_VLAN"  
untagged 1-24  
ip address 10.x.1.2 255.255.255.0  
exit  
snmp-server community "public" unrestricted
```

Edge_2

```
hostname "Edge_2"  
interface 1  
  disable  
exit  
interface 2  
  disable  
exit  
interface 3  
  name "Router"  
exit  
interface 4  
  disable  
exit  
interface 5  
  disable  
exit  
interface 6  
  disable  
exit  
interface 18  
  disable  
exit  
vlan 1  
  name "DEFAULT_VLAN"  
  untagged 1-24  
  ip address 10.x.1.3 255.255.255.0  
  exit  
snmp-server community "public" unrestricted
```

Lab 3 (startup configs)

No configuration changes were required. Refer to the *Lab 2 (startup configs)* for the Lab 3 startup configs.

Lab 4 (startup configs)

Note: These startup configs are the same as the final configs of Lab 3.

Router

```
hostname "Router"
interface 1
  name "Edge_1"
exit
interface 2
  disable
exit
interface 3
  name "Edge_2"
exit
interface 4
  disable
exit
interface 5
  disable
exit
ip routing
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-5,7-24
  ip address 10.x.1.1 255.255.255.0
  no untagged 6
  exit
vlan 10
  name "VLAN10"
  ip helper-address 10.x.2.100
  ip address 10.x.10.1 255.255.255.0
  tagged 1
  exit
vlan 20
  name "VLAN20"
  ip helper-address 10.x.2.100
  ip address 10.x.20.1 255.255.255.0
  tagged 1
  exit
vlan 30
  name "VLAN30"
  ip helper-address 10.x.2.100
  ip address 10.x.30.1 255.255.255.0
  tagged 3
  exit
vlan 40
  name "VLAN40"
  ip helper-address 10.x.2.100
  ip address 10.x.40.1 255.255.255.0
  tagged 3
  exit
vlan 2
```

```
    name "VLAN2"
    untagged 6
    ip address 10.x.2.1 255.255.255.0
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
```

Edge_1

```
hostname "Edge_1"
interface 1
    name "Router"
    exit
interface 2
    disable
    exit
interface 3
    disable
    exit
interface 4
    disable
    exit
interface 5
    disable
    exit
ip default-gateway 10.x.1.1
vlan 1
    name "DEFAULT_VLAN"
    untagged 1-5,7-24
    ip address 10.x.1.2 255.255.255.0
    no untagged 6
    exit
vlan 10
    name "VLAN10"
    untagged 6
    tagged 1
    no ip address
    exit
vlan 20
    name "VLAN20"
    tagged 1
    no ip address
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
```

Edge_2

```
hostname "Edge_2"
interface 1
  disable
exit
interface 2
  disable
exit
interface 3
  name "Router"
exit
interface 4
  disable
exit
interface 5
  disable
exit
interface 18
  disable
exit
ip default-gateway 10.x.1.1
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-5,7-24
  ip address 10.x.1.3 255.255.255.0
  no untagged 6
  exit
vlan 30
  name "VLAN30"
  untagged 6
  tagged 3
  no ip address
  exit
vlan 40
  name "VLAN40"
  tagged 3
  no ip address
  exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
```

Lab 4 (final configs)

Note: The startup configs for Lab 5 have been modified from the final configs of Lab 4. The Lab 4 final configs are shown here for reference and troubleshooting.

Router

```
hostname "Router"
interface 1
    name "Edge_1"
exit
interface 3
    name "Edge_2"
exit
interface 5
    disable
exit
trunk 1-2 Trk1 LACP
trunk 3-4 Trk2 LACP
ip routing
vlan 1
    name "DEFAULT_VLAN"
    untagged 5,7-24,Trk1-Trk2
    ip address 10.x.1.1 255.255.255.0
    no untagged 6
    exit
vlan 10
    name "VLAN10"
    ip helper-address 10.x.2.100
    ip address 10.x.10.1 255.255.255.0
    tagged Trk1
    exit
vlan 20
    name "VLAN20"
    ip helper-address 10.x.2.100
    ip address 10.x.20.1 255.255.255.0
    tagged Trk1
    exit
vlan 30
    name "VLAN30"
    ip helper-address 10.x.2.100
    ip address 10.x.30.1 255.255.255.0
    tagged Trk2
    exit
vlan 40
    name "VLAN40"
    ip helper-address 10.x.2.100
    ip address 10.x.40.1 255.255.255.0
    tagged Trk2
    exit
vlan 2
    name "VLAN2"
    untagged 6
    ip address 10.x.2.1 255.255.255.0
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
```

```
snmp-server community "public" unrestricted
spanning-tree Trk1 priority 4
spanning-tree Trk2 priority 4
```

Edge_1

```
hostname "Edge_1"
interface 1
    name "Router"
exit
interface 3
    disable
exit
interface 4
    disable
exit
interface 5
    disable
exit
trunk 1-2 Trk1 LACP
ip default-gateway 10.x.1.1
vlan 1
    name "DEFAULT_VLAN"
    untagged 3-5,7-24,Trk1
    ip address 10.x.1.2 255.255.255.0
    no untagged 6
    exit
vlan 10
    name "VLAN10"
    untagged 6
    tagged Trk1
    no ip address
    exit
vlan 20
    name "VLAN20"
    tagged Trk1
    no ip address
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree Trk1 priority 4
```

Edge_2

```
hostname "Edge_2"
interface 1
    disable
exit
interface 2
    disable
```



```
exit
interface 3
  name "Router"
exit
interface 5
  disable
exit
interface 18
  disable
exit
trunk 3-4 Trk2 LACP
ip default-gateway 10.x.1.1
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-2,5,7-24,Trk2
  ip address 10.x.1.3 255.255.255.0
  no untagged 6
  exit
vlan 30
  name "VLAN30"
  untagged 6
  tagged Trk2
  no ip address
  exit
vlan 40
  name "VLAN40"
  tagged Trk2
  no ip address
  exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree Trk2 priority 4
```

Lab 5 (startup configs)

Router_1

```
hostname "Router_1"
interface 1
    name "Edge_1"
exit
interface 3
    name "Edge_2"
exit
interface 5
    disable
exit
trunk 1-2 Trk1 LACP
trunk 3-4 Trk2 LACP
ip routing
vlan 1
    name "DEFAULT_VLAN"
    untagged 5,7-24,Trk1-Trk2
    ip address 10.x.1.1 255.255.255.0
    no untagged 6
    exit
vlan 10
    name "VLAN10"
    ip helper-address 10.x.2.100
    ip address 10.x.10.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 20
    name "VLAN20"
    ip helper-address 10.x.2.100
    ip address 10.x.20.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 30
    name "VLAN30"
    ip helper-address 10.x.2.100
    ip address 10.x.30.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 40
    name "VLAN40"
    ip helper-address 10.x.2.100
    ip address 10.x.40.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 2
    name "VLAN2"
    untagged 6
    ip address 10.x.2.1 255.255.255.0
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
```

```
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree Trk1 priority 4
spanning-tree Trk2 priority 4
```

Router_2

```
hostname "Router_2"
interface 1
  disable
exit
interface 2
  disable
exit
interface 3
  name "Router"
exit
interface 5
  disable
exit
interface 18
  disable
exit
trunk 3-4 Trk2 LACP
ip routing
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-2,5,7-24,Trk2
  ip address 10.x.1.3 255.255.255.0
  no untagged 6
  exit
vlan 30
  name "VLAN30"
  ip helper-address 10.x.2.100
  ip address-address 10.x.30.1 255.255.255.0
  untagged 6
  tagged 5,Trk2
  no ip address
  exit
vlan 40
  name "VLAN40"
  ip helper-address 10.x.2.100
  ip address-address 10.x.40.1 255.255.255.0
  tagged 5,Trk2
  no ip address
  exit
vlan 10
  name "VLAN10"
  ip address 10.x.10.2 255.255.255.0
  tagged 5,Trk2
  exit
vlan 20
  name "VLAN20"
  ip address 10.x.20.2 255.255.255.0
```

```
    tagged 5,Trk2
    exit
vlan 2
    name "VLAN2"
    ip address 10.x.2.2 255.255.255.0
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree Trk2 priority 4
```

Edge_1

```
hostname "Edge_1"
interface 1
    name "Router"
    exit
interface 3
    disable
    exit
interface 4
    disable
    exit
interface 5
    disable
    exit
trunk 1-2 Trk1 LACP
ip default-gateway 10.x.1.1
vlan 1
    name "DEFAULT_VLAN"
    untagged 3-5,7-24,Trk1
    ip address 10.x.1.2 255.255.255.0
    no untagged 6
    exit
vlan 10
    name "VLAN10"
    untagged 6
    tagged 5,Trk1
    no ip address
    exit
vlan 20
    name "VLAN20"
    tagged 5,Trk1
    no ip address
    exit
vlan 30
    name "VLAN30"
    ip address 10.x.30.2 255.255.255.0
    tagged 5,Trk1
    exit
vlan 40
    name "VLAN40"
```

```
ip address 10.x.40.2 255.255.255.0
tagged 5,Trk1
exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree Trk1 priority 4
```

Lab 5 (final configs)

Note: The startup configs for Lab 6 have been modified from the final configs of Lab 5. The Lab 5 final configs are shown here for reference and troubleshooting.

Router_1

```
hostname "Router_1"
interface 1
name "Edge_1"
exit
interface 3
name "Edge_2"
exit
interface 5
disable
exit
trunk 1-2 Trk1 LACP
trunk 3-4 Trk2 LACP
ip routing
vlan 1
name "DEFAULT_VLAN"
untagged 5,7-24,Trk1-Trk2
ip address 10.x.1.1 255.255.255.0
no untagged 6
exit
vlan 10
name "VLAN10"
ip helper-address 10.x.2.100
ip address 10.x.10.1 255.255.255.0
tagged Trk1-Trk2
exit
vlan 20
name "VLAN20"
ip helper-address 10.x.2.100
ip address 10.x.20.1 255.255.255.0
tagged Trk1-Trk2
exit
vlan 30
name "VLAN30"
ip helper-address 10.x.2.100
```

```
    ip address 10.x.30.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 40
    name "VLAN40"
    ip helper-address 10.x.2.100
    ip address 10.x.40.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 2
    name "VLAN2"
    untagged 6
    ip address 10.x.2.1 255.255.255.0
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk1 priority 4
spanning-tree Trk2 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 priority 1
spanning-tree instance 1 Trk1 priority 4
spanning-tree instance 1 Trk2 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 priority 2
spanning-tree instance 2 Trk1 priority 4
spanning-tree instance 2 Trk2 priority 4
spanning-tree priority 1
```

Router_2

```
hostname "Router_2"
interface 1
    disable
    exit
interface 2
    disable
    exit
interface 3
    name "Router"
    exit
interface 18
    disable
    exit
trunk 3-4 Trk2 LACP
ip routing
vlan 1
    name "DEFAULT_VLAN"
    untagged 1-2,5,7-24,Trk2
```

```
    ip address 10.x.1.3 255.255.255.0
    no untagged 6
    exit
vlan 30
    name "VLAN30"
    ip helper-address 10.x.2.100
    ip address 10.x.30.1 255.255.255.0
    untagged 6
    tagged 5,Trk2
    no ip address
    exit
vlan 40
    name "VLAN40"
    ip helper-address 10.x.2.100
    ip address 10.x.40.1 255.255.255.0
    tagged 5,Trk2
    no ip address
    exit
vlan 10
    name "VLAN10"
    ip address 10.x.10.2 255.255.255.0
    tagged 5,Trk2
    exit
vlan 20
    name "VLAN20"
    ip address 10.x.20.2 255.255.255.0
    tagged 5,Trk2
    exit
vlan 2
    name "VLAN2"
    ip address 10.x.2.2 255.255.255.0
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk2 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 priority 2
spanning-tree instance 1 Trk2 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 priority 1
spanning-tree instance 2 Trk2 priority 4
spanning-tree priority 2
```

Edge_1

```
hostname "Edge_1"
interface 1
    name "Router"
```

```
exit
interface 3
  disable
exit
interface 4
  disable
exit
trunk 1-2 Trk1 LACP
ip default-gateway 10.x.1.1
vlan 1
  name "DEFAULT_VLAN"
  untagged 3-5,7-24,Trk1
  ip address 10.x.1.2 255.255.255.0
  no untagged 6
  exit
vlan 10
  name "VLAN10"
  untagged 6
  tagged 5,Trk1
  no ip address
  exit
vlan 20
  name "VLAN20"
  tagged 5,Trk1
  no ip address
  exit
vlan 30
  name "VLAN30"
  ip address 10.x.30.2 255.255.255.0
  tagged 5,Trk1
  exit
vlan 40
  name "VLAN40"
  ip address 10.x.40.2 255.255.255.0
  tagged 5,Trk1
  exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk1 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 Trk1 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 Trk1 priority 4
```


Lab 6 (startup configs)

Router_1

```
hostname "Router_1"
interface 1
    name "Edge_1"
exit
interface 3
    name "Edge_2"
exit
interface 5
    disable
exit
trunk 1-2 Trk1 LACP
trunk 3-4 Trk2 LACP
ip routing
vlan 1
    name "DEFAULT_VLAN"
    untagged 5,7-24,Trk1-Trk2
    ip address 10.x.1.1 255.255.255.0
    no untagged 6
    exit
vlan 10
    name "VLAN10"
    ip helper-address 10.x.2.100
    ip address 10.x.10.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 20
    name "VLAN20"
    ip helper-address 10.x.2.100
    ip address 10.x.20.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 30
    name "VLAN30"
    ip helper-address 10.x.2.100
    ip address 10.x.30.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 40
    name "VLAN40"
    ip helper-address 10.x.2.100
    ip address 10.x.40.1 255.255.255.0
    tagged Trk1-Trk2
    exit
vlan 2
    name "VLAN2"
    untagged 6
    ip address 10.x.2.1 255.255.255.0
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
```

```
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk1 priority 4
spanning-tree Trk2 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 priority 1
spanning-tree instance 1 Trk1 priority 4
spanning-tree instance 1 Trk2 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 priority 2
spanning-tree instance 2 Trk1 priority 4
spanning-tree instance 2 Trk2 priority 4
spanning-tree priority 1
```

Router_2

```
hostname "Router_2"
interface 1
  disable
exit
interface 2
  disable
exit
interface 3
  name "Router"
exit
interface 5
  disable
exit
interface 18
  disable
exit
trunk 3-4 Trk2 LACP
ip routing
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-2,5,7-24,Trk2
  ip address 10.x.1.3 255.255.255.0
  no untagged 6
  exit
vlan 30
  name "VLAN30"
  ip helper-address 10.x.2.100
  ip address 10.x.30.1 255.255.255.0
  untagged 6
  tagged Trk2
  no ip address
  exit
vlan 40
  name "VLAN40"
  ip helper-address 10.x.2.100
```

```
    ip address 10.x.40.1 255.255.255.0
    tagged Trk2
    no ip address
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk2 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 priority 2
spanning-tree instance 1 Trk2 priority 4
spanning-tree instance 2 vlan 30 40
```

Edge_1

```
hostname "Edge_1"
interface 1
    name "Router"
exit
interface 3
    disable
exit
interface 4
    disable
exit
interface 5
    disable
exit
trunk 1-2 Trk1 LACP
ip default-gateway 10.x.1.1
vlan 1
    name "DEFAULT_VLAN"
    untagged 3-5,7-24,Trk1
    ip address 10.x.1.2 255.255.255.0
    no untagged 6
    exit
vlan 10
    name "VLAN10"
    untagged 6
    tagged Trk1
    no ip address
    exit
vlan 20
    name "VLAN20"
    tagged Trk1
    no ip address
    exit
logging 10.x.2.100
timesync sntp
```

```
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk1 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 Trk1 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 Trk1 priority 4
spanning-tree instance 2 priority 1
spanning-tree instance 2 Trk2 priority 4
spanning-tree priority 2
```

Lab 7 (startup configs)

Note: These startup configs are the same as the final configs of Lab 6.

Router_1

```
hostname "Router_1"
interface 1
  name "Edge_1"
exit
interface 3
  name "Edge_2"
exit
trunk 1-2 Trk1 LACP
trunk 3-4 Trk2 LACP
ip routing
vlan 1
  name "DEFAULT_VLAN"
  untagged 5,7-24,Trk1-Trk2
  ip address 10.x.1.1 255.255.255.0
  no untagged 6
  exit
vlan 10
  name "VLAN10"
  ip helper-address 10.x.2.100
  ip address 10.x.10.1 255.255.255.0
  tagged Trk1-Trk2
  exit
vlan 20
  name "VLAN20"
  ip helper-address 10.x.2.100
  ip address 10.x.20.1 255.255.255.0
  tagged Trk1-Trk2
  exit
vlan 2
  name "VLAN2"
  untagged 6
  ip address 10.x.2.1 255.255.255.0
  exit
vlan 100
  name "VLAN100"
  ip address 10.x.100.1 255.255.255.0
  tagged Trk2
  exit
vlan 200
  name "VLAN200"
  ip address 10.0.200.99 255.255.255.0
  exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
```

```
router rip
  redistribute connected
  exit
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk1 priority 4
spanning-tree Trk2 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 priority 1
spanning-tree instance 1 Trk1 priority 4
spanning-tree instance 1 Trk2 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 priority 2
spanning-tree instance 2 Trk1 priority 4
spanning-tree instance 2 Trk2 priority 4
spanning-tree priority 1
vlan 200
  ip rip 10.0.200.99
  exit
```

Router_2

```
hostname "Router_2"
interface 1
  disable
exit
interface 2
  disable
exit
interface 3
  name "Router"
exit
interface 18
  disable
exit
trunk 3-4 Trk2 LACP
ip routing
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-2,5,7-24,Trk2
  ip address 10.x.1.3 255.255.255.0
  no untagged 6
  exit
vlan 30
  name "VLAN30"
  untagged 6
  ip helper-address 10.x.2.100
  ip address 10.x.30.1 255.255.255.0
  tagged Trk2
  exit
vlan 40
  name "VLAN40"
  ip helper-address 10.x.2.100
  ip address 10.x.40.1 255.255.255.0
```

```
    tagged Trk2
    exit
vlan 100
    name "VLAN100"
    ip address 10.x.100.2 255.255.255.0
    tagged Trk2
    exit
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
ip route 0.0.0.0 0.0.0.0 10.x.100.1
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk2 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 priority 2
spanning-tree instance 1 Trk2 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 priority 1
spanning-tree instance 2 Trk2 priority 4
spanning-tree priority 2
```

Edge_1

No changes to the configuration in this Lab Activity.

Lab 8 (startup and final configs)

Note: These startup configs are the same as the final configs of Lab 7.

Router_1

No changes to the configuration in this Lab Activity.

Router_2

```
hostname "Router_2"
interface 1
  disable
exit
interface 2
  disable
exit
interface 3
  name "Router"
exit
trunk 3-4 Trk2 LACP
ip routing
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-2,5,7-24,Trk2
  ip address 10.x.1.3 255.255.255.0
  no untagged 6
  exit
vlan 30
  name "VLAN30"
  untagged 6
  ip helper-address 10.x.2.100
  ip address 10.x.30.1 255.255.255.0
  tagged Trk2
  exit
vlan 40
  name "VLAN40"
  ip helper-address 10.x.2.100
  ip address 10.x.40.1 255.255.255.0
  tagged Trk2
  exit
vlan 100
  name "VLAN100"
  ip address 10.x.100.2 255.255.255.0
  tagged Trk2
  exit
vlan 50
  name "VLAN50"
  ip helper-address 10.x.2.100
  ip address 10.x.50.1 255.255.255.0
  tagged 18
  exit
```



```
logging 10.x.2.100
timesync sntp
sntp unicast
sntp server priority 1 10.x.2.100
ip dns domain-name "hptrng0x.hp.com"
ip dns server-address priority 1 10.x.2.100
ip route 0.0.0.0 0.0.0.0 10.x.100.1
snmp-server community "public" unrestricted
spanning-tree
spanning-tree Trk2 priority 4
spanning-tree config-name "HP"
spanning-tree config-revision 1
spanning-tree instance 1 vlan 10 20
spanning-tree instance 1 priority 2
spanning-tree instance 1 Trk2 priority 4
spanning-tree instance 2 vlan 30 40
spanning-tree instance 2 priority 1
spanning-tree instance 2 Trk2 priority 4
spanning-tree priority 2
```

Edge_1

No changes to the configuration in this Lab Activity.

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