Southern Polytechnic State University

Electrical and Computer Engineering Technology Program

ECET 4820 Laboratory Exercise: Frame Relay Router Configuration

Objective:

Students will learn how to configure a Cisco 2600 router to interface with a frame relay switch so that it can route IP packets between local area networks via a frame relay cloud.

Background:

Frame relay is a packet switching scheme based on virtual circuits. The virtual circuits can be permanent or switched. Permanent virtual circuits (PVCs) are set up when the customer tells the service provider to do so and will be removed when the customer says to remove them. Switched virtual circuits (SVCs) are configured on-demand by the customer premise frame relay access device and the frame switch. The service provider and customer make arrangements for SVC capacity as part of their service level agreement so that the network is aware how many, and what capacity the SVCs can be.

Cisco 2621routers can be configured as a FRAD (frame relay access devices or frame relay assembler/disassembler) or as frame switches. In this exercise, three routers will serve as CPE and one as the network frame switch. Communication between the routers will be through serial links. The bit rate on the link, or access rate, is agreed to in advance by the ISP and customer and the frame switch provides clocking on the line (it acts as a DCE).

In this lab exercise, PVCs will be set up between the four CPE routers through the switch. Data-link connection identifier (DLCI) numbers are assigned to each point-to-point link between the CPE router and the switch router. In the switch router, the DLCIs are mapped properly to make the complete PVC connection. In order to permit multiple PVC connections from one CPE router interface, its physical interface is subdivided into sub-interfaces. Each sub-interface supports one PVC and is assigned one DLCI number and one IP address.

Referring to Figs. 1 and 2 and Tables 1 and 2, the connection between London's S 0/0.1 interface and the frame switch interface S0/1 is assigned DLCI 101. The London router sub-interface is assigned IP address 10.10.2.2. Inside the frame switch, DLCI 101 is mapped to DLCI 102, which is the connection from the frame switch S 0/0 interface and Washington's S 0/0.1 interface. Washington's interface is assigned IP address 10.10.2.1, which is on the same subnet as the London S 0/0.1 interface.

Note that the serial interfaces on the frame switch are not assigned IP addresses. IP addresses are unnecessary for operation as a frame switch. However, the CPE routers must have IP addresses in order to support the IP traffic routing once the frame relay framing is removed through de-encapsulation.
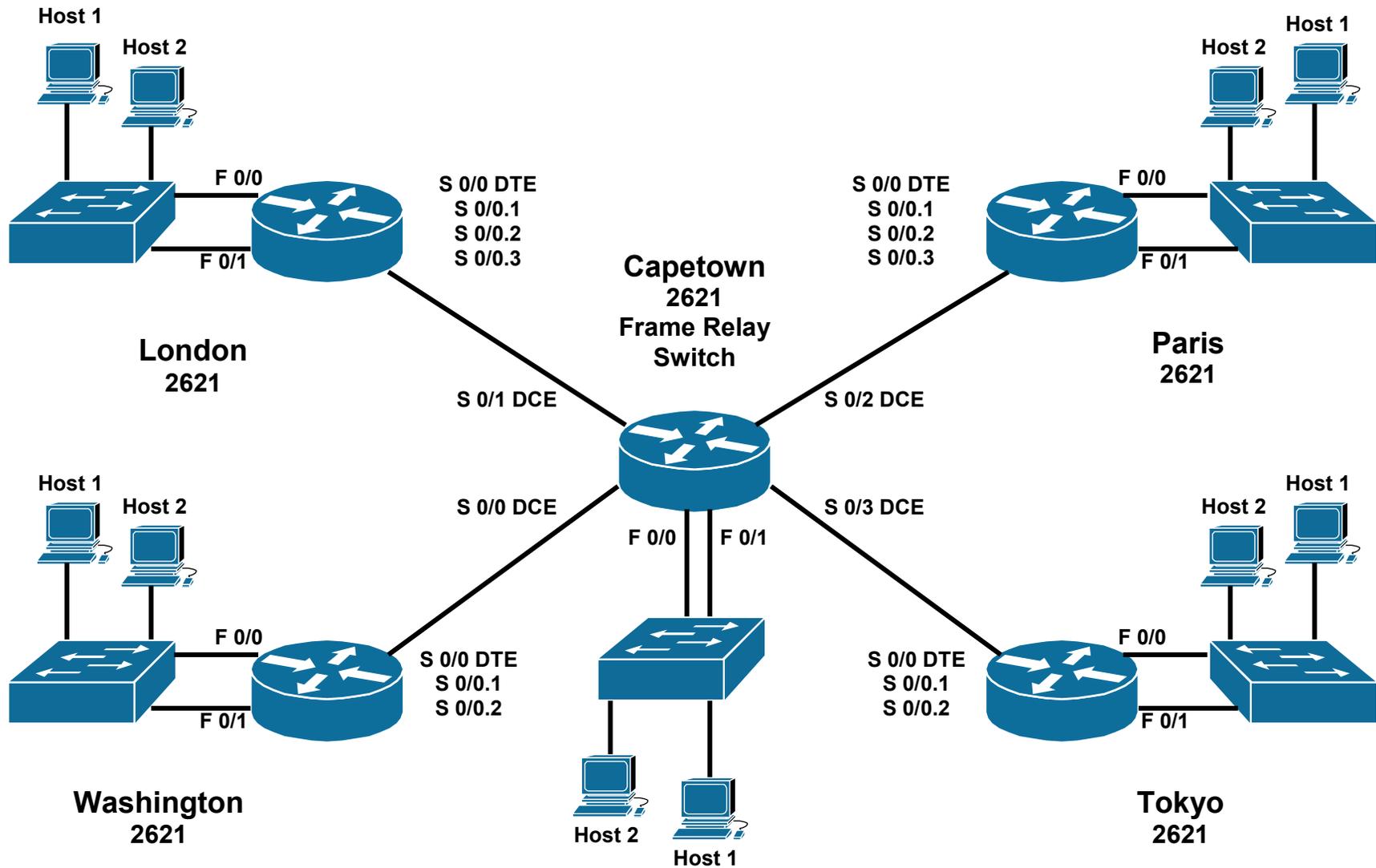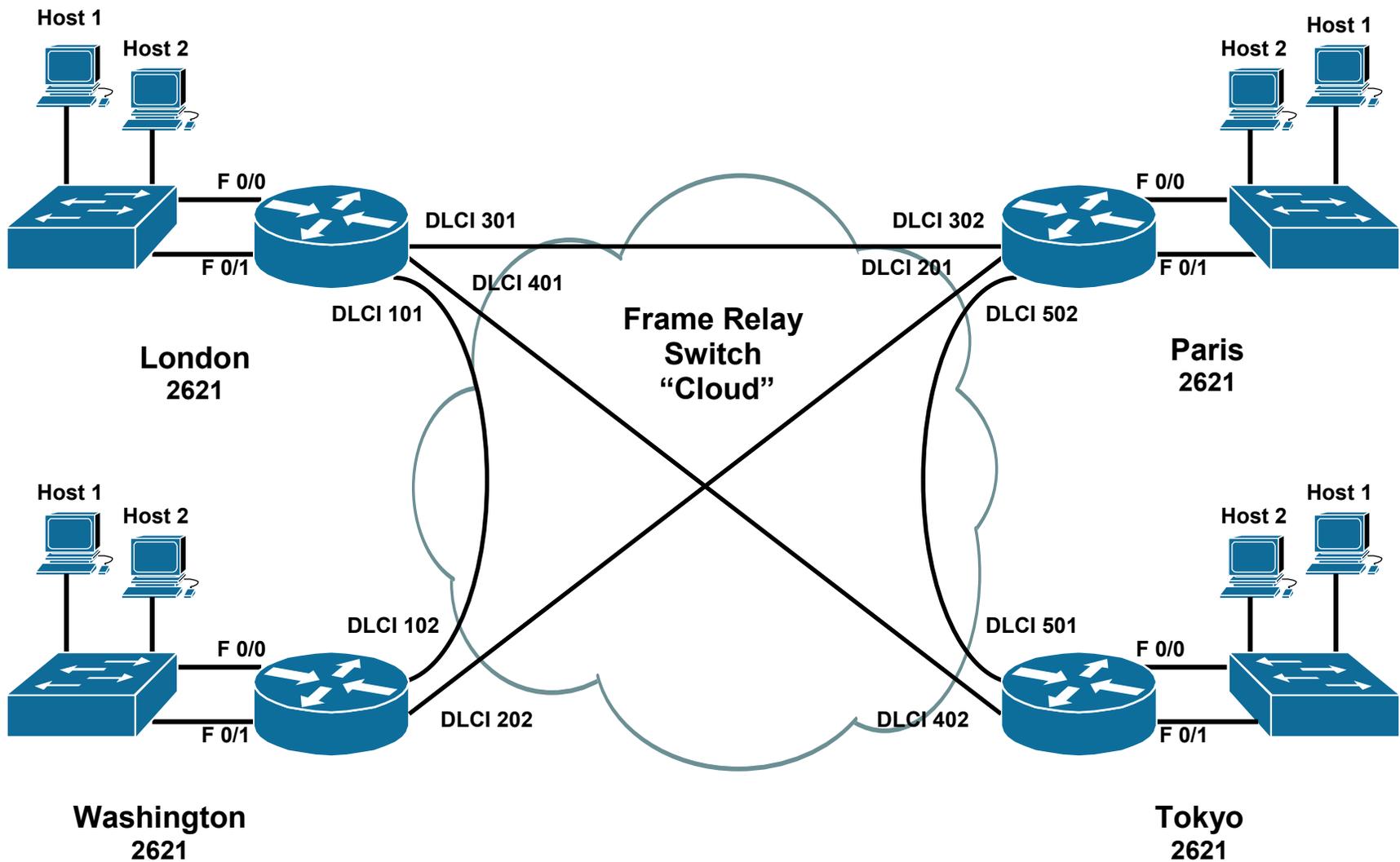
Fig. 1. Lab network configuration.

Fig. 2. Virtual circuit connections.

Table 1. 2600 Series Router IP Addresses.

Location	S 0/0.1	S 0/0.2	S 0/0.3		F 0/0	F 0/1	Host 1	Host 2
Washington	10.10.2.1 /24 DLCI 102	10.10.1.1 /24 DLCI 202			192.168.10.1 /24	192.168.11.1 /24	192.168.10.2 /24	192.168.11.2 /24
London	10.10.2.2 /24 DLCI 101	10.10.3.1 /24 DLCI 301	10.10.4.1 /24 DLCI 401		192.168.30.1 /24	192.168.31.1 /24	192.168.30.2 /24	192.168.31.2 /24
Tokyo	10.10.5.1 /24 DLCI 501	10.10.4.2 /24 DLCI 402			192.168.40.1 /24	192.168.41.1 /24	192.168.40.2 /24	192.168.41.2 /24
Paris	10.10.1.2 /24 DLCI 201	10.10.3.2 /24 DLCI 302	10.10.5.2 /24 DLCI 502		192.168.50.1 /24	192.168.51.1 /24	192.168.50.2 /24	192.168.51.2 /24

Table 2. Capetown (Frame Relay Switch) Router IP Addresses.

Location	S 0/0	S 0/1	S 0/2	S 0/3	F 0/0	F 0/1	Host 1	Host 2
Capetown					192.168.20.1 /24	192.168.21.1 /24	192.168.20.2 /24	192.168.21.2 /24

Procedure:

Logistics

1. You will work in teams during this exercise. Your instructor will assign you to a workstation and a router. Enter the name of your router below.

    Router Name: _____

Physical Configuration

2. The routers and workstations are to be connected together as shown in Figs. 1 and 2. This may already be done. If it is, verify the configuration.

Check the Frame Switch Router Configuration

3. You will log on to the frame switch router and check its configuration.

    a) Your instructor will connect a switch or hub to the frame switch's F 0/0 interface. Connect your workstation to this switch.

    b) Configure your workstation's IP address so that it is on the same subnet as the IP address assigned to the frame switch's F 0/0 interface. Use the router's address as your default gateway.

    c) Telnet to the router and log on.

    d) Display the router's running configuration and save a copy of it to view later if needed. You can use a screen shot.

    e) Answer the following about the frame switch router configuration.

    Is the router configured for IP routing? _____

    Which router interfaces have IP addresses? _____

    f) As a way of visualizing how the frame switch is configured, fill in the tables below. For the first table, locate the sections of the configuration file associated with each interface and list the access rate and DLCIs on that interface.

    In the second table, list the PVC mapping between interfaces. That is, list both serial interfaces and the DLCIs associated with each PVC. Note that PVCs are not numbered in the configuration file, but they are numbered 1, 2, 3, 4, and 5 in the table for convenience.

Serial Interface	Interface Access Rate	DLCIs on Interface

PVC	Interface	DLCI	Interface	DLCI
1				
2				
3				
4				
5				

g) Log off of the frame switch router.

Configuring Your CPE Router

4. You will connect your workstation to your CPE router and configure frame relay. Your router will have Ethernet interfaces configured, but the serial interfaces associated with the frame relay network will not be configured. Groups can use more than one workstation but must be careful when configuring the router at the same time so that one configuration command does not interfere with another.

   a) Connect your workstation to the switch associated with your router.

   b) Configure your workstation IP address to be on the same subnet as the router's F 0/0 interface. Use the F 0/0 interface's IP address as your default gateway.

   c) Enter privileged mode and check your router's configuration.

   d) Your router's S 0/0 interface will need to be set up *without* an IP address and *with* two or three subinterfaces, each having an IP address. Also, the interface must be DTE, so no clockrate will be set. Note that placing "no" in front of a configuration command will remove that configuration.

      i) Once in priviledged mode enter global configuration mode.

      ii) Enter S 0/0 configuration mode

      iii) If S 0/0 has an IP address configured, remove it. If it has a clock rate, remove it.

      iv) Add frame relay encapsulation to the interface by typing **enacpsulation frame-relay** while in the interface configuration mode.

   e) Now you will configure the subinterfaces for S 0/0.

      i) While in the S 0/0 interface configuration mode, create the subinterface S 0/0.1 by typing **interface S 0/0.1 point-to-point**. You should see the sub-interface router prompt.

      ii) Add the correct IP address and subnet mask to the subinterface from Table 1.

      iii) While still in the subinterface configuration mode, add the correct DLCI by typing **frame-relay interface-dlci XXX** where XXX is the DLCI number.

iv) Type **exit** to return to the interface S 0/0 configuration mode.

v) Configure the other subinterface the same way with the appropriate IP address and subnet mask.

f) RIP should already be configured on the CPE router. If it is not, configure it now.

i) Make sure to advertise the RIP updates on the IP networks connected to your router using the Network command. This procedure was illustrated in the previous lab exercise.

ii) While in the config-router configuration mode, specifiy RIP version 2 with the **version 2** command.

iii) Open Wireshark and examine a RIP update packet. Does it have the routing table IP network and subnet mask information?

g) Check your running configuration for accuracy.

Ask your instructor to check your configuration.

h) Save your running configuration to the startup configuration.

i) Reboot your router.

5. After each group is finished setting up their routers, you will check your configuration.

a) Telnet into your router and log on.

b) Verify that your routing tables show all the Ethernet networks in Fig. 1. Be sure to note whether you see the IP addresses assigned to the Ethernet interfaces on the frame-relay switch.

c) If you do not see them, troubleshoot your configuration and that of the other groups.

6. Now that the network is operational, you will test some frame relay show commands. The CPE routers and the frame relay switch exchange information using local management interface (LMI) commands. There are several varieties of LMI protocol and the Cisco version is the default. All of the routers will be using the Cisco protocol. Note that if you do not configure the correct LMI protocol for a particular interface, then there will be errors on the interface.

a) Use the **show interface** command to check the interfaces.

b) Use the **show frame-relay pvc** command to check PVC status. Look for any errors.

c) Use the **show frame-relay lmi** to check that the CPE router and frame switch are communicating properly with lmi commands.

i) Look at the timeout entry. How many timeouts have occurred? If there are too many, it is possible that the wrong LMI protocol is configured. Using the **debug frame-relay lmi** command will reveal any LMI incompatibilities. However, do not execute the debug command.

Exiting out of the Routers

7. Type **exit** at each prompt until you log yourself out and then close the hyperterminal or telnet window.

Conclusions:

Bring together the concepts illustrated in the lab and make conclusions as to what they mean, and what you learned.

References

[1] S. McQuerry, *Interconnecting Cisco Network Devices*, Indianapolis, IN, Cisco Press, 2000.
[2] K. Solie, *CCIE Practical Studies*, vol. 1, Indianapolis, IN, Cisco Press, 2002.