IE2004 - Computer Networks

Lab 3 – Ethernet Switch Functions

Address learning

Each switch maintains a MAC address table which associates MAC addresses of network devices with a port on the switch. When an Ethernet switch receives a frame with a source address of X, it checks whether address X is already in its MAC address table. If it is not there, the switch adds the entry associating the MAC address X with the port on which it was received.

Frame forwarding

An Ethernet switch forwards each frame it receives according to the following rules.
1. If it is a broadcast frame (Destination Ethernet address is ff:ff:ff:ff:ff:ff) then the frame is flooded on all ports except the port on which the frame was received.
2. If it is a unicast frame, then
   a. If the destination Ethernet address is found in the MAC address table of the switch, send the frame out on the corresponding port
   b. If not, flood the frame on on all ports except the port on which the frame was received.

In this lab, we will observe how switches perform address learning and forward frames according to the above rules, using Cisco Packet Tracer software.

1. Create a network consisting of 6 PCs and four Cisco 2900 series switches as shown in the following diagram. Make sure that you create the PCs and switches in the order PC0 to PC5 and Switch0 to Switch3. Use the Automatic connector ⚡ to connect PCs and switches as shown.
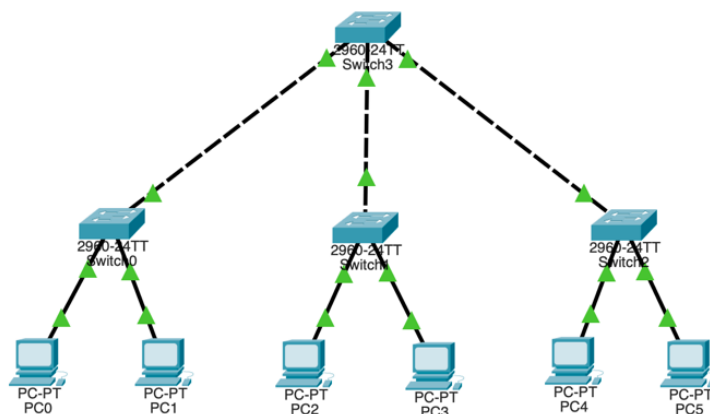
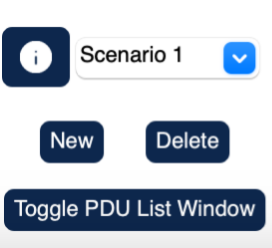| PC Name	IP address
PC0	192.168.xx.10
PC1	192.168.xx.11
PC2	192.168.xx.12
PC3	192.168.xx.13
PC4	192.168.xx.14
PC5	192.168.xx.15

Use 255.255.255.0 as netmask for all PCs.

2. Assign IP addresses to the FastEthernet0 network interface of each PC according to the table shown above, where xx is the last two digits of your registration number. If the first digit in xx is zero, replace it with 1 (i.e. 00 becomes 10, and 05 becomes 15). Record the IP address and MAC address of each PC in your lab report.

3. Now go into the Simulation mode and use the "Add simple PDU" button to create simple PDUs from PC0 to PC1, PC2, PC3, PC4 and PC5. You should see the five PDUs under "Scenario 0" as follows.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	In Progress	PC0	PC1	IC...		0.000	N	0
	In Progress	PC0	PC2	IC...		0.000	N	1
	In Progress	PC0	PC3	IC...		0.000	N	2
	In Progress	PC0	PC4	IC...		0.000	N	3
	In Progress	PC0	PC5	IC...		0.000	N	4

4. Now create another scenario by pressing the New button shown in the above figure and use the "Add simple PDU" button to create simple PDUs from PC0 to PC1, PC2, PC3, PC4 and PC5. You should see the five PDUs under "Scenario 1" as follows.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	In Progress	PC0	PC1	IC...		0.000	N	0
	In Progress	PC0	PC2	IC...		0.000	N	1
	In Progress	PC0	PC3	IC...		0.000	N	2
	In Progress	PC0	PC4	IC...		0.000	N	3
	In Progress	PC0	PC5	IC...		0.000	N	4

5. Now create another scenario by pressing the "New" button shown in the above figure and use the "Add complex PDU" button to create a complex simple PDU from PC0. Enter the following parameters in the PDU creation window:
    Destination IP address: 192.168.xx.255
    Source IP address: 192.168.xx.10
    Sequence: 0
    Time: 0
You should see the created PDU under "Scenario 2" as follows:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	In Progress	PC0	192.168....	IC...		0.000	N	0

6. You can configure the switches by selecting the switch, and then selecting the CLI tab.
   a. Press Enter until you see the switch prompt (e.g. `Switch>`).
   b. Enter the Privileged mode by typing the command `enable` at the prompt. You should see the Privileged mode prompt ending with "#" (e.g. `Switch#`).
   c. Clear the MAC address table of each switch by entering the command `clear mac-address-table`
   d. Verify that the MAC address table of each switch is empty by entering the command `show mac-address-table`
   and record the output of the command (for all three switches) in your lab report.

7. Now go to the simulation mode,
   a. Select "Scenario 0"
   b. Start the simulation using the Play button in the Simulation Panel.
   c. Observe that all the frames are flooded by all the switches because the destination MAC address is not in the MAC address table of the switch.
   d. After the completion of the simulation, "Last Status" of all 5 PDUs should show "Successful".
   e. The flow of frames in step 7 above will enable the switches to learn the MAC addresses of some or all of the PCs. In the CLI of each switch, enter the command `show mac-address-table`
   and record the mac addresses learned by each switch in your lab report.

8. While in simulation mode
   a. Select "Scenario 1"
   b. Start the simulation using the Play button in the Simulation Panel.
   c. Observe that the frames are not flooded this time because the destination MAC addresses are in the MAC address table of the switches.

9. While in simulation mode
   a. Select "Scenario 2"
   b. Click on the PDU shown next to PC0, and record the Source and Destination addresses in the Layer 2 Ethernet II Header in your lab report.
   c. Start the simulation using the Play button in the Simulation Panel.
   d. Observe that the frame is flooded by each switch because the Layer 2 destination address is the broadcast address.

10. Save the lab report document as a PDF file and submit it via the submission link given in Courseweb.