

Lab #7 : Data Link Layer (CSMA/CD)

Communication Networks
Prof. SAYAD Lamri

Academic Year : 2025/2026
Duration : 2 sessions

This lab will guide you through simulating Carrier Sense Multiple Access with Collision Detection (CSMA/CD) using Cisco Packet Tracer.

Objectives :

- Understand the functionality of CSMA/CD in a shared network.
- Observe how collisions occur and how devices handle them.
- Analyze network performance with and without collisions.

A. General questions about OSI MAC sublayer :

1. What are the main functions of the Media Access Control (MAC) sublayer?
2. Give examples of protocols of MAC sublayer ?
3. Describe the concept of CSMA/CD protocol ?
4. What is the difference between CSMA/CD and CSMA/CA protocols ?
5. Which one among them is used in Ethernet and in Wifi ?
6. Do you know how to design a network in packet tracer using :
 - a. Star topology
 - b. Bus topology

B. Lab: Simulating CSMA/CD with Packet Tracer

Materials: Cisco Packet Tracer software

Topology:

1. Open Packet Tracer.
2. Add the following devices:
 - Five PCs (PC0, PC1, PC2, PC3, PC4)
 - One Hub
 - Connect all PCs to the Hub using Ethernet cables.

Question : Identify the type of this network topology.

Your answer :

Configuration:

3. No configuration is required for the Hub as it operates at Layer 1.
4. Double-click on each PC and configure the following:

Hostname	IP address	Mask
PC0	10.10.10.1	255.0.0.0
PC1	10.10.10.2	255.0.0.0
PC2	10.10.10.3	255.0.0.0
PC3	10.10.10.4	255.0.0.0
PC4	10.10.10.5	255.0.0.0

5. Save your topology with a descriptive name (e.g., CSMA_CD_Lab_7.1).
6. Using command prompt, execute a ping from PC0 to PC4 and compute the transmission delay.
7. Using command prompt, execute a ping from PC1 to PC4 and compute the transmission delay.
8. Using command prompt, execute a ping from PC2 to PC4 and compute the transmission delay.
9. Using command prompt, execute a ping from PC3 to PC4 and compute the transmission delay.
10. The goal of steps 6 to 9 is to initialize the ARP table of PCs.

Lab #7 : Data Link Layer (CSMA/CD)

Simulation:

11. Switch to simulation mode.
12. Instruct all PCs to ping PC4 simultaneously. You can achieve this by:
 - Double-click on a PC and open a Command Prompt.
 - Typing **ping 10.10.10.5** and pressing Enter.
 - Repeat this step for all PCs at roughly the same time.
13. Play the simulation for few seconds. Observe the network activity and then stop the simulation.

Analysis:

14. Observe the Capture Window. Look for dropped packets and retransmissions.
15. Collisions will be indicated by a red fire next to the packet in the capture window.



16. Analyze the captured data to answer the following questions:
 - Did any collisions occur during the ping test?
 - How many packets were retransmitted due to collisions?
 - How did collisions affect the overall network performance (time taken for pings to complete)?
 - Observe and compute the delay needed for successful transmission of a packet.

Challenge:

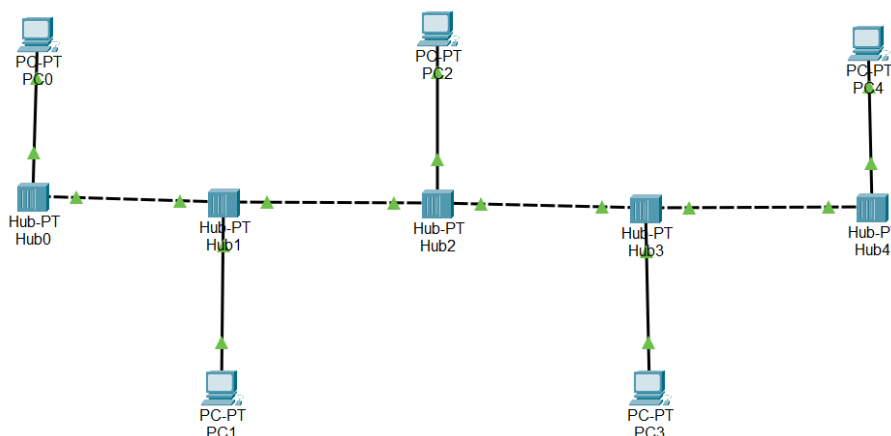
17. Replace the Hub with a Switch. Run the ping test again. How does network performance change with a switch?
18. Study the concept of CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) and discuss how it differs from CSMA/CD.

C. Lab: Simulating CSMA/CD with Packet Tracer (bus topology)

Materials: Cisco Packet Tracer software

Topology:

1. Open a new packet tracer window.
2. Add the following devices:
 - Five PCs (PC0, PC1, PC2, PC3, PC4)
 - Five Hubs (Hub0, Hub1, Hub2, Hub3, Hub4)
 - Connect between these devices according to the following figure.



Lab #7 : Data Link Layer (CSMA/CD)

Question : Identify the type of this network topology.

Your answer :

Configuration:

3. No configuration is required for the Hub as it operates at Layer 1.
4. Double-click on each PC and configure the following:

Hostname	IP address	Mask
PC0	10.10.10.1	255.0.0.0
PC1	10.10.10.2	255.0.0.0
PC2	10.10.10.3	255.0.0.0
PC3	10.10.10.4	255.0.0.0
PC4	10.10.10.5	255.0.0.0

5. Save your topology with a descriptive name (e.g., CSMA_CD_Lab_7.2).
6. Using a command prompt, execute a ping from PC0 to PC1 and compute the transmission delay.
7. Using a command prompt, execute a ping from PC3 to PC4 and compute the transmission delay.
8. The goal of the two steps 6 and 7 is to initialize the ARP table of PC0 and PC3.

Simulation:

9. Switch to the simulation mode.
10. Instruct PC0 to ping PC1 and PC3 to ping PC4 simultaneously. You can achieve this by:
 - Double-click on PC0 and open a Command Prompt.
 - Typing **ping 10.10.10.2** and pressing Enter.
 - Do the same thing to execute a ping from PC3 to PC4.
11. Play the simulation for few seconds. Observe the network activity and then stop the simulation.

Analysis:

12. Observe the Capture Window. Look for dropped packets and retransmissions.
13. Analyze the captured data to answer the following questions:
 - Did any collisions occur during the ping test?
 - How many packets were retransmitted due to collisions?
 - How did collisions affect the overall network performance (time taken for pings to complete)?
 - Observe and compute the delay needed for successful transmission of packet.

Challenge:

14. Repeat the same simulation by adding another data flow from PC2 to PC0 and indicate how it will affect the network performance.