Lab 6: Packet Tracer Collision Domains

OBJECTIVES

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In this lab you will:

- Simulate unicast and broadcast packets traveling on a network made with the following networking devices:
    - Hubs
    - Repeaters
    - Switches
- Experiment and observe collision domains in Packet Tracer

DISCUSSION

A collision domain is a physical network segment on a shared medium where packets can "collide" causing destruction of any data being sent on the network at that time. When packets "collide" the packets are lost (!) and must be retransmitted at a later time.

To detect collisions a NIC which is transmitting compares the data it is transmitting with the data it receives on the wire. If the NIC detects a difference between what is being sent and what it is receiving then a collision is occurring and the NIC sends out a jamming signal to notify all other devices that a collision has occurred on the network segment.

While too many collisions can cause problems on a network, they are a normal occurrence on Ethernet networks. Reducing the size of collision domains can improve network performance. Switches can be used to break up a collision domain into smaller domains. Hubs however will extend collision domains and increase the chance of excess collisions.

Experiment Steps:

<u>Build the network in Packet Tracer</u>

1. Startup Packet Tracer. Check the **Options tab** to confirm that <u>only</u> the following are checked:

    - ✓ Simple Mode
    - ✓ Animation
    - ✓ Sounds

2. Click and drag down a hub and four PCs.
   Each PC, server or printer is also known as a network **node**.

3. Connect the PCs as shown below.
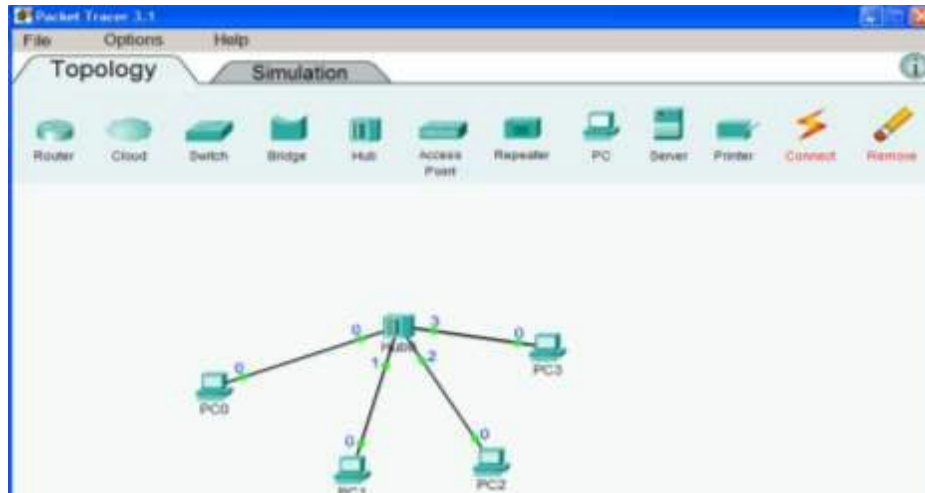
Configure the IP addresses in Packet Tracer

4. Configure the PCs with the following IP addresses and record the physical addresses for each PC.

	IP Address	MAC Address
PC 0	192.168.0.4	0007.EC91.CD58
PC 1	192.168.0.5	000C.CF8B.BCAD
PC 2	192.168.0.6	000D.BD2.A5BE
PC 3	192.168.0.7	0002.1686.73734

Collisions and Collision Domains in Packet Tracer

5. A **unicast** is when a packet is sent from one device and to a single node. Use Packet Tracer to send a packet from one node to another.

If two packets are sent at the same time on Ethernet a **collision** will occur because the hub does not buffer data. If you haven't already done so, make a collision occur. Once a collision occurs on Ethernet a **jamming signal** is sent out.

What do you think the jamming signal looks like on Packet Tracer?

Jamming signal looks like a fire

An easy way to find the collision domain using Packet Tracer is to make a collision and see which nodes receive the jamming signal. All the nodes which see the jamming signal are considered to be in the same **collision domain**.

Which devices in this network are in the same collision domain?

All of them are in the same collision domain

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The diagram below shows a single circle around all the devices that are in the same collision domain. In this case all of the devices are in the same collision domain!
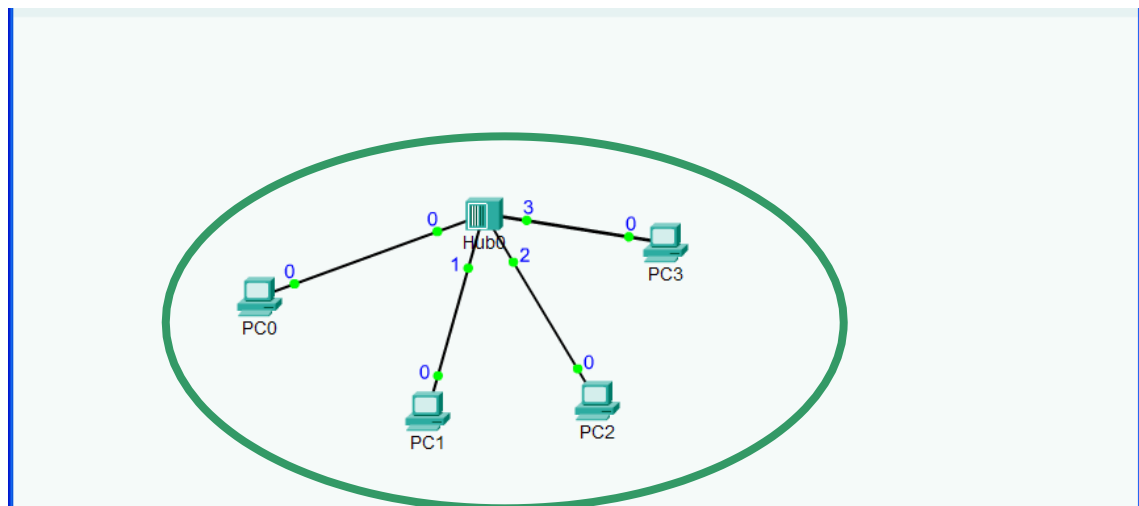
Observe the effect of a repeater on the collision domain

6. Install a repeater between the hub and PC3 as shown below:
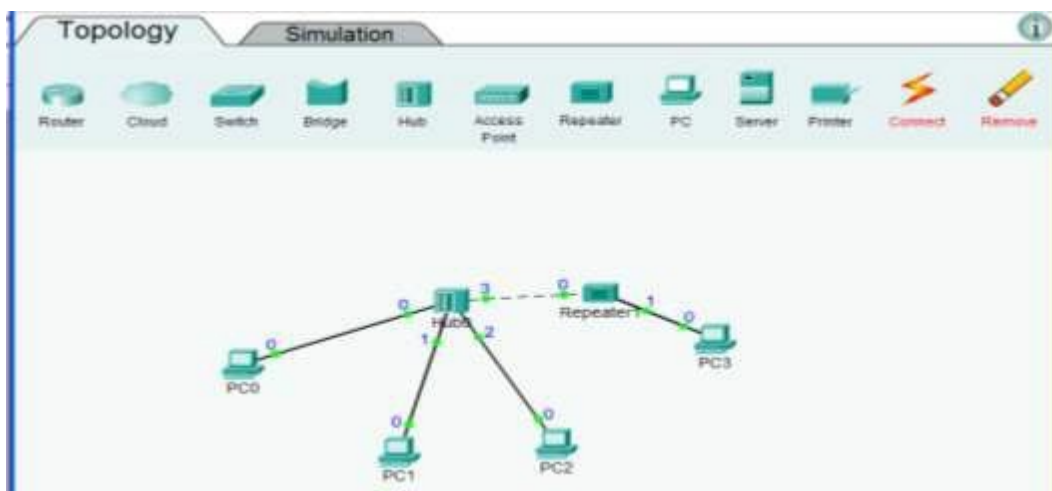
Go to simulation mode and send a packet from PC0 to PC2.

Do PC1 and PC3 see the packet sent from PC0?

Yes it the repeater does not mask the device all it does it repeat the signal that it receives so that both ends can send/receive the signal

Based on how you know a repeater works, explain why this happens.

The signal gets repeated so it still gets received and does not cut it from the collision domain

7. Make a collision happen between PC0 and PC2.

Is PC3 still in the same collision domain as the other PCs? Explain.

It is still in the collision domain

Draw a circle around each collision domain in the network diagram below.
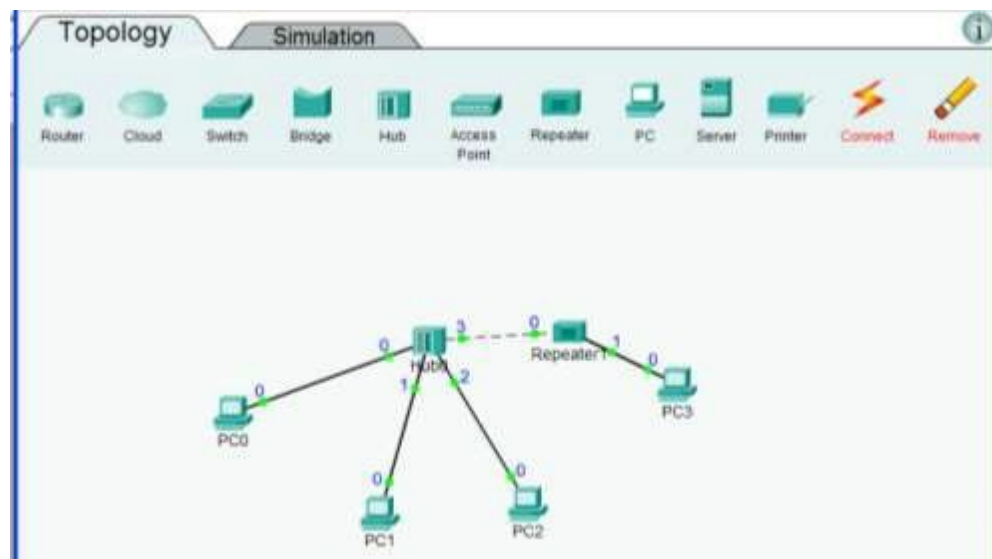
8. Create a MAC broadcast frame.

So far the packets in this lab have been **unicasts**, that is, they are sent from one device and addressed to one other device. Even though other devices may see the packet, it is not addressed to them so they will ignore the packet (unless they are running a packet sniffer).

A **broadcast** is a packet sent from one device to all other devices. Think of the way a radio station broadcasts to the entire listening area. A MAC broadcast packet is sent to all devices on the network segment. Every device on the segment will open up the packet and read the contents.

   a. Go to Options tab and leave Simple Mode (uncheck it) so you will be able to create a MAC broadcast.

   b. Create a packet (by dragging and placing the packet onto a PC),
      select Broadcast, => Create

What is the MAC address for a broadcast?   The mac of the broadcasting PC

Run the simulation and observe the broadcast. How is the simulation different from the previous ones? [Hint: Explain the terms unicast and broadcast]

All of the PCs on the network get the packets and unpack them to see what is inside Rather than figuring out if it was for them then deciding to open it or not

Observe the effect of a bridge on the collision domain

9. First go back to Simple Mode [Options tab].

10. Replace the repeater with a bridge and make a collision happen between PC0 and PC2. Bridges filter packets based on the destination MAC addresses. (To replace the repeater, first delete it, then drag in a bridge and connect it to the hub on one side and PC 3 on the other.)

PC3 is now in its own collision domain with the bridge.

Draw the new network by hand below and circle the two collision domains.

Note!
Collision domains cannot stop in the middle of a wire… so make sure yours do not. ☺

Why doesn't PC3 see traffic from PC0 to PC2? Explain.
Because the bridge can filter out what goes to PC3 if it isn't for that PC the PC never gets it

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Observe the effect of a switch on the collision domain

11. Replace the bridge with a <u>switch</u> and make a collision happen between PC0 and PC2. Like bridges, switches filter packets based on the destination MAC addresses.

Is PC3 in the same collision domain as the other PCs?
No because it filters the destination based on MAC addresses therefore the PC3 is no longer in the same collision domain as the others

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Explain based on how you know a switch works.

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The switch gets the ICMP package and finds out where the destination needs to be if the Ip/MAC doesn't match the destination it is looking for the package does not get delivered to a random destination. Similar to the post office.
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12. Create a MAC broadcast frame.
    a. Leave Simple Mode [Options tab] to allow you to create a MAC broadcast.
    b. Grab a packet and drop it on the desired PC, select Broadcast, => Create

Does the switch filter the MAC broadcast?

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No although It can filter through IP addresses MAC Broadcast cannot be filtered and will be pushed out to all devices
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Reflection

13. List the networking devices in this lab that operate at OSI layer 1:

repeater and Hub_____

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14. List the networking devices in this lab that operate at OSI layer 2:

The bridge and the switch_____

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15. List the devices in this lab that operate at OSI layer 7:

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Firewall? I'm not sure what would go here since nothing here should be transport layer

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16. Of the network devices you have seen in this lab, which ones can be used to reduce network traffic?

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A switch is smart enough to filter through most of the traffic and get where that specific packet needs to go rather than pushing it out to all of the devices in the network.

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17. Of the network devices you have seen in this lab, which ones reduce the size of collision domains?

The Switch and the Bridge
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18. Do switches filter Layer 2 broadcasts?

No that would be a MAC broadcast switches do a very good job at every other thing that we've done in this lab

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19. What are two differences between a bridge and a switch? (You may want to check the web to answer this question if you don't remember from class.)

A bridge connects two LAN networks however a switch can determine which device is which and where things need to go based on the IP addresses in each port.

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