Greetings NetSteppers. In this CCNA video cheat sheet we will be covering Ethernet: specifically, collision domains, MAC address and carrier sense multiple access with collision detection (CSMA/CD)

Ethernet functions at the OSI data link layer (layer 2) and has not only become the default technology for Local Area Networks (LANs) but also for Wide Area Networks (WANs).

Let's look at the forest slide. In the upper left hand corner we have a picture of a broadcast and collision domain. A broadcast domain is a set of network interfaces, that if a broadcast frame is sent, it is received by all other network interfaces on the same broadcast domain. A collision domain is a set of network interfaces, that if a frame was sent could result in a collision with a frame sent by another network interface on the same collision domain. A switch can create multiple collision domains but cannot create multiple broadcast domains, unless Virtual Local Area Networks (VLANs) are utilized. VLANs offer switches the ability to create broadcast domains.

In the upper right hand corner we have a picture of an Ethernet MAC address structure. Switches are expected to forward frames based on source and destination MAC addresses. Each frame received by the switch has a source and destination MAC address in the header. This is how switches learn where everyone is located. A PC sends a frame and the switch looks at the source and says “O, you’re on the port”. It now knows where you live.

In the lower middle we have a picture of a carrier sense multiple access with collision detection (CSMA/CD) network. If a network device wants to send data it has to wait and listen on the link to make sure the network is not being used. If the network is free it can send the data. CSMA/CD is utilized in half-duplex networks to avoid collisions and retransmits.

\*\*\*\*New Slide\*\*\*\*

Let's dig a little deeper and look at the tree slide. We have a picture of a broadcast and collision domain. What can each device do in these domains?

Hub

* Creates multiple collision domains – no
* Creates multiple broadcast domains - nada

Switch

* Creates multiple collision domains – you bet
* Creates multiple broadcast domains – sorry (not without VLANs)

Router

* Creates multiple collision domains – you bet
* Creates multiple broadcast domains – but of course

You will notice that only routers segregate the Ethernet LAN into separate broadcast domains. Ethernet switches will forward broadcast frames but routers do not. It would be safe to say that broadcasts from one domain will not be sent to another broadcast domain. To a hub every port is in the same collision domain. To a bridge, switch or router every port is a separate collision domain.

\*\*\*\*New Slide\*\*\*\*

The next tree level slide looks deeper into MAC addressing and switches. To forward or filter, that is the question. The switch’s main function is to decide if it is going to forward or filter a frame based on the destination MAC address. Each frame received by the switch has a source and destination MAC address in the header. This is how switches learn where everyone is located. A switch tracks MAC addresses of directly-connected devices. In addition, switches create an environment where the frame can reach the destination. This environment would have to be free of loops (endless circular paths). Spanning Tree Protocol (STP) is employed for that endeavor.

\*\*\*\*New Slide\*\*\*\*

The next tree level slide looks deeper into carrier sense multiple access with collision detection (CSMA/CD). Ethernet networking uses CSMA/CD, a protocol that helps devices share the bandwidth evenly without having two devices transmit at the same time on the network medium. CSMA/CD was created to overcome the problem of those collisions that occur when packets are transmitted simultaneously from different nodes. When a node transmits in a CSMA/CD network, all the other nodes on the network receive and examine that transmission. When a host wants to transmit over the network, it first checks for the existence of a signal on the wire. If all is clear (no other host is transmitting), the host will then proceed with its transmission. While transmitting host continually monitors the wire to make sure no other hosts begin transmitting. If the host detects another signal on the wire, it sends out an extended jam signal that causes all nodes on the segment to stop sending data. The nodes wait awhile before trying to transmit again. Backoff algorithms determine when the colliding stations can retransmit. If collisions keep occurring after 15 tries, the nodes attempting to transmit will then time out.

\*\*\*\*New Slide\*\*\*\*

I want to stop and have a reality check. On this slide we will talk about the difference between academia and the real world.

In academia you need to know the difference between a collision and broadcast domain.

In the real world of switches and routers, collision domains are not an issue. I guess it could be an issue IF one of the PC’s connected to a switch could only do half-duplex, THEN the switch would have to do half-duplex on the port and IF the same PC HAPPENED to be sending and receiving frames at the same time, THEN you could have a collision.

In academia you need to know what bits make a MAC address.

In the real world you need to know how devices (especially switches) use MAC addresses to forward traffic. This includes unicast and broadcast MAC address situations.

In academia you need to know how carrier sense multiple access with collision detection (CSMA/CD) operates.

In the real world most networks run Ethernet at full-duplex. You can transmit and receive whenever you like. For an example of when a network might fall into half-duplex and thusly CSMA/CD refer to sarcastic example from before.

\*\*\*\*New Slide\*\*\*\*

Let's dig a little deeper and look at the leaf slide. It is now time to see what you have learned and introduce some specific concepts with the NetStep Challenge.

What does a host on an Ethernet network do when it is creating a frame and it does not have the destination address?

\*\*\*\*New Slide\*\*\*\*

* sends out an ARP request with the destination IP address

ARP is used to convert an IP address to a physical address such as an MAC address.

Is this information needed to pass the test? I am not saying …….. I am just saying

\*\*\*\*New Slide\*\*\*\*

Staying at the leaf level, we have another NetStep Challenge.

Which two statements describe the operation of the CSMA/CD access method ?

\*\*\*\*New Slide\*\*\*\*

* In a CSMA/CD collision domain, stations must wait until the media is not in use before transmitting.
* After a collision, all stations run a random back off algorithm. When the back off delay period has expired. All stations have equal priority to transmit data.

CSMA/CD was created to overcome the problem of collisions that occur when packets are transmitted simultaneously from different nodes. When a node transmits in a CSMA/CD network, all the other nodes on the network receive and examine that transmission. When a host wants to transmit over the network, it first checks for the existence of a signal on the wire. If all is clear (no other host is transmitting), the host will then proceed with its transmission. While transmitting, the host continually monitors the wire to make sure no other hosts begin transmitting. If the host detects another signal on the wire, it sends out an extended jam signal that causes all nodes on the segment to stop sending data. The nodes wait a period of time before trying to transmit again. Backoff algorithms determine when the colliding stations can retransmit.

 Is this information needed to pass the test? I am not saying …….. I am just saying

\*\*\*\*New Slide\*\*\*\*

Staying at the leaf level, we have another NetStep Challenge.

A switch has 48 ports and 4 VLANs. How many collision and broadcast domains exist on the switch?

 \*\*\*\*New Slide\*\*\*\*

* 48 collision domains
* 4 broadcast domains

A switch uses a separate collision domain for each port, and each VLAN is a separate broadcast domain.

Is this information needed to pass the test? I am not saying …….. I am just saying

\*\*\*\*New Slide\*\*\*\*

Staying at the leaf level, we have our final NetStep Challenge.

How many collision domains are shown?

\*\*\*\*New Slide\*\*\*\*

* two

Hubs create single collision and broadcast domains.

Is this information needed to pass the test? I am not saying …….. I am just saying

\*\*\*\*New Slide\*\*\*\*

You now know enough about Ethernet to pass the CCNA ICND1 test. Always keep learning but take it step by step.