

CompTIA Network+ Exam N10-008

Lesson 3



Deploying Ethernet Switching

Objectives

- Deploy networking devices
- Explain network interfaces
- Deploy common Ethernet switching features

Lesson 3

Topic 3A

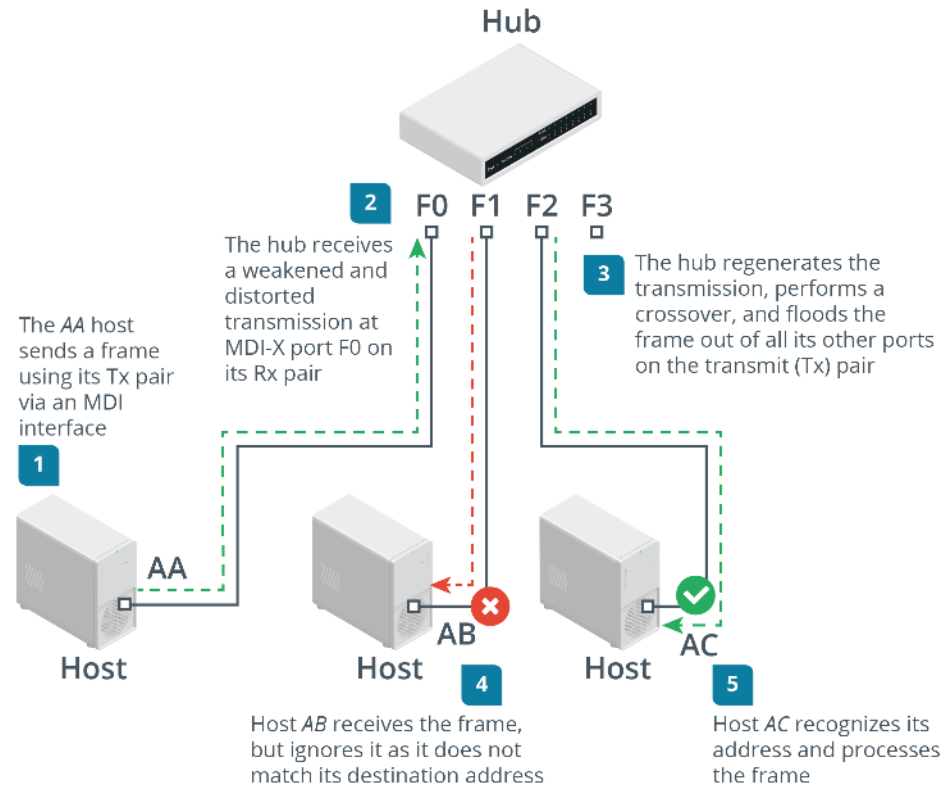
Deploy Networking Devices

Repeaters and Media Converters

- Repeater
 - Overcome distance limitations
 - Works at physical layer (layer 1)
 - Copper and fiber optic types
- Media converter
 - Transition between media types
 - Works at physical layer (layer 1)
 - Fiber to copper
 - Single mode to multimode



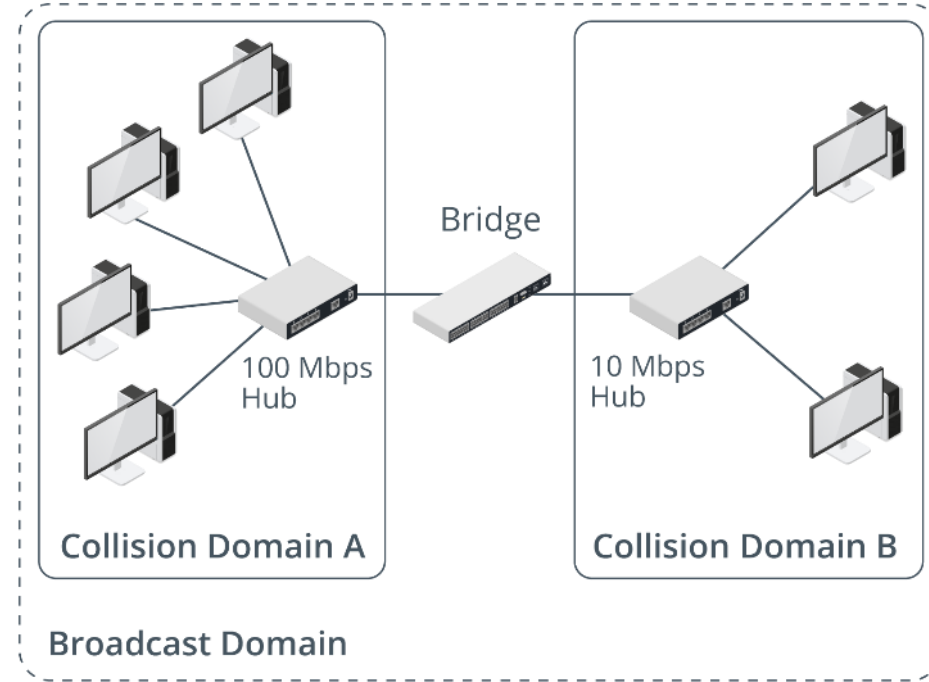
Hubs



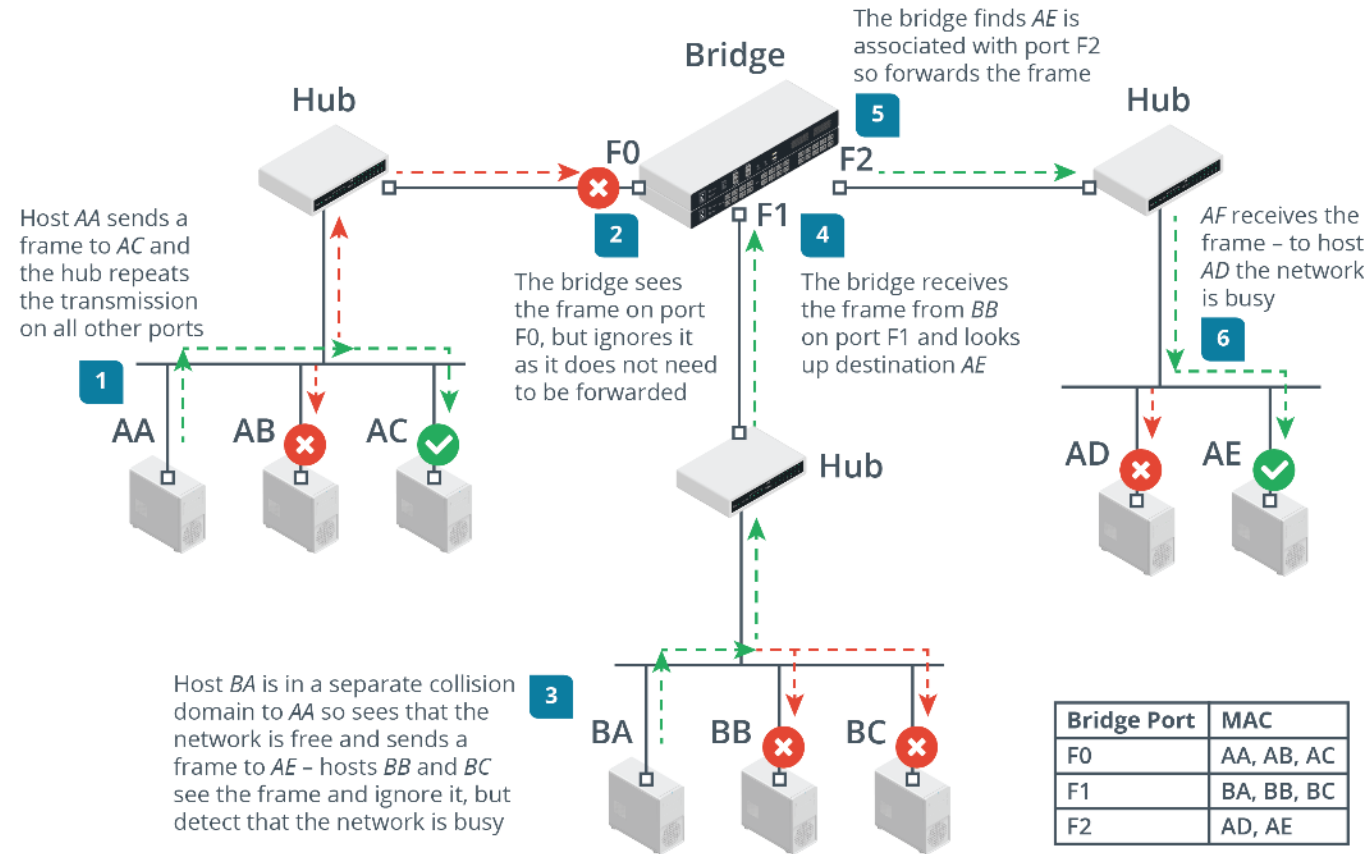
- Legacy intermediate system for Ethernet
- Multiport repeater working at physical layer
- All ports in the same collision domain
- Medium dependent interface (MDI)
 - End system to intermediate system
 - Transmit (Tx) --> Receive (Rx)
 - Hub ports are MDI-X (crossover)

Bridges (Slide 1 of 2)

- Works at data link layer (layer 2)
- Ports are in separate collision domains
- Ports are in same broadcast domain
- Bridge must track MAC addresses associated with each port



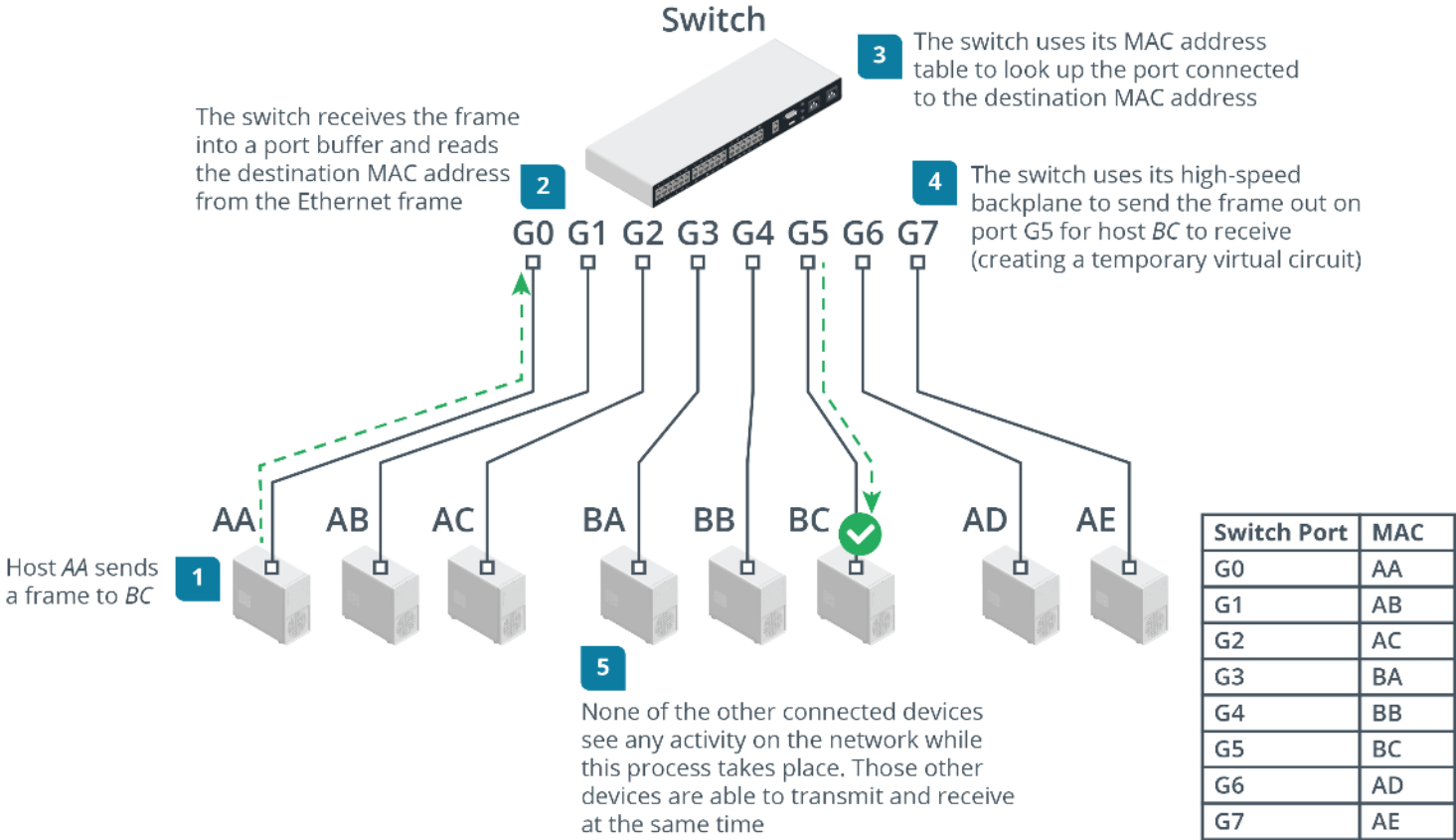
Bridges (Slide 2 of 2)



Layer 2 Switches (Slide 1 of 2)

- Replace hubs and bridges and eliminate performance drag from contention
- Each port is a separate collision domain
 - Microsegmentation
 - Allows full-duplex (depending on host NIC)
- All ports are in the same broadcast domain
 - Unless virtual LANs (VLANs) have been configured...

Layer 2 Switches (Slide 2 of 2)



Review Activity: Networking Devices

- Repeaters and Media Converters
- Hubs
- Bridges
- Layer 2 Switches

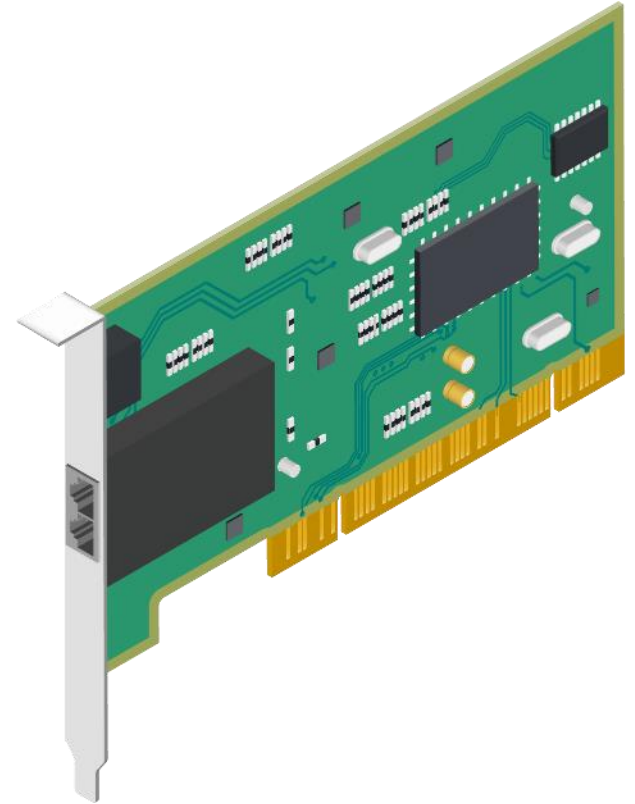
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Topic 3B

Explain Network Interfaces

Network Interface Cards

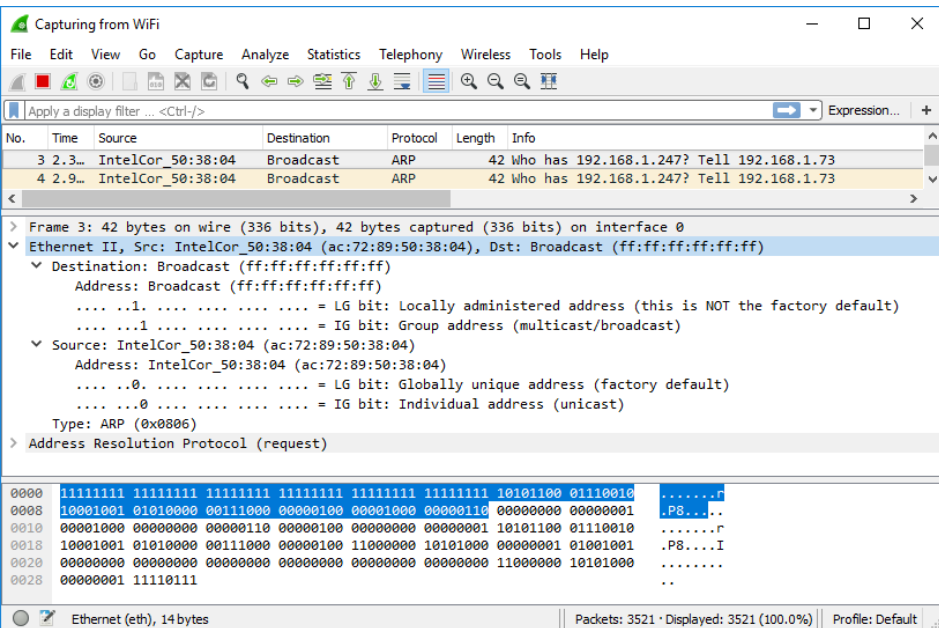
- Network interface card/controller (NIC) or network adapter
- Transceiver component works at physical layer
 - Copper or fiber optic
 - Ethernet standard (10/100/1000 or 10G/40G)
 - Multi-port
- Card logic and driver work at data link layer
 - Ethernet framing
 - Local/hardware/physical address
 - Media access control (MAC) address/Ethernet Address (EA)/extended unique identifier (EUI)



Ethernet Frame Format



Media Access Control Address Format



- 48 bit/6 byte ID expressed in hex notation
 - 00:60:8c:12:3a:bc
 - 00608c123abc
 - 0060.8c12.3abc
- Burned-in address
- Locally administered addresses
- Broadcast address
 - ff:ff:ff:ff:ff:ff

Frame Length and Maximum Transmission Unit

- Maximum transmission unit (MTU)
 - Normally up to 1500 byte payload
- EtherType
 - Indicate network layer protocol rather than size
 - 0x0800 or 2048 in decimal for IPv4
 - 0x86DD for IPv6
- Minimum length
 - 64 bytes to ensure CSMA/CD detects collisions
- Frame length (including headers)
 - 1518 bytes or jumbo frames

Packet Sniffers and Taps

- Protocol analyzer decodes (pares) frame and protocol headers and data
- Packet sniffer reads frames from the network
- Host-based capture
- Switched Port Analyzer (SPAN) / mirror port
- Test Access Point (TAP)
 - Passive versus active

tcpdump

- -i to specify interface
- -w / -r to write or read a file
- -vvv to increase verbosity
- Capture filters
 - Type (host, net, port)
 - Direction (src, dst)
 - Protocol (arp, icmp, ip, ip6, tcp, udp)
 - Boolean operators
 - And (&&), Or (||), Not (!)
 - Parentheses to group expressions

```
tcpdump -i eth0
```

```
tcpdump -i eth0  
"src host 10.1.0.100 and  
(dst port 53 or dst port 80)"
```

Wireshark

The image shows a Wireshark network traffic capture window titled "Capturing from Ethernet". The interface includes a menu bar (File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, Help) and a toolbar with various icons for packet capture and analysis. A display filter bar at the top shows "Apply a display filter ... <Ctrl-/>".

The main packet list displays several captured packets. Packet 4822 is selected, showing details for an IMAP login request. The packet list table is as follows:

No.	Time	Source	Destination	Protocol	Length	Info
4818	363.499645	10.1.0.2	10.1.0.1	DNS	84	Standard query 0xc36a AAA
4819	363.499679	10.1.0.2	10.1.0.1	DNS	84	Standard query 0x03ee A s
4820	363.502559	10.1.0.102	10.1.0.2	IMAP	68	Request: 1 capability
4821	363.509073	10.1.0.2	10.1.0.102	IMAP	162	Response: * CAPABILITY IM
4822	363.515890	10.1.0.102	10.1.0.2	IMAP	95	Request: 3 login "sam@515
4823	363.520309	10.1.0.2	10.1.0.1	TCP	66	49750 → 88 [SYN, ECN, CWR
4824	363.520574	10.1.0.1	10.1.0.2	TCP	66	88 → 49750 [SYN, ACK, ECN
4825	363.520591	10.1.0.2	10.1.0.1	TCP	54	49750 → 88 [ACK] Seq=1 Ac
4826	363.520608	10.1.0.2	10.1.0.1	KRB5	277	AS-REQ
4827	363.521861	10.1.0.1	10.1.0.2	KRB5	244	KRB Error: KRB5KDC_ERR_PR
4828	363.521926	10.1.0.2	10.1.0.1	TCP	54	49750 → 88 [FIN, ACK] Seq

The details pane for packet 4822 shows the following structure:

- > Frame 4822: 95 bytes on wire (760 bits), 95 bytes captured (760 bits) on interface 0
- > Ethernet II, Src: Microsof_01:ca:94 (00:15:5d:01:ca:94), Dst: Microsof_01:ca:92 (00:15:5d:01:ca:92)
- > Internet Protocol Version 4, Src: 10.1.0.102, Dst: 10.1.0.2
- > Transmission Control Protocol, Src Port: 1129, Dst Port: 143, Seq: 15, Ack: 124, Len: 41
- > Internet Message Access Protocol
 - Line: 3 login "sam@515support.com" "Pa\$\$w0rd"\r\n
 - Request Tag: 3
 - Request Command: login
 - Request: login "sam@515support.com" "Pa\$\$w0rd"


The packet bytes pane shows the raw data for the selected packet, with a hex and ASCII view. The ASCII view shows the login command: "login "sam@515support.com" "Pa\$\$w0rd"".

At the bottom, the status bar indicates: "Remainder of request line (imap.request), 37 bytes" and "Packets: 59212 · Displayed: 59212 (100.0%) | Profile: Default".

Review Activity: Network Interfaces

- Network Interface Cards
- Ethernet Frame Format
- Media Access Control Address Format
- Frame Length and Maximum Transmission Unit
- Packet Sniffers and Taps
- tcpdump
- Wireshark

Assisted Lab: Capture Network Traffic

- Lab types
 - Assisted labs guide you step-by-step through tasks
 - Applied labs set goals with limited guidance
- Complete lab
 - Submit all items for grading and check each progress box
 - Select “Grade Lab” from final page
- Save lab 
 - Select the hamburger menu and select “Save”
 - Save up to two labs in progress for up to 7 days
- Cancel lab without grading
 - Select the hamburger menu and select “End”

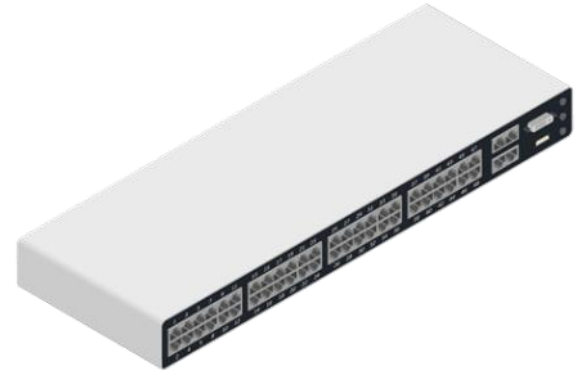
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Topic 3C

Deploy Common Ethernet Switching Features

Ethernet Switch Types

- Number of ports
- Unmanaged versus managed
- Stackable
- Modular versus fixed
- Desktop versus rack-mounted



Switch Interface Configuration

- Command mode
 - User EXEC
 - Privileged EXEC
 - Configuration modes
- Boot configuration versus running configuration
- Interface status
 - Interface IDs
 - Line status and protocol status
 - Configuration data and traffic statistics
- Autonegotiate speed/duplex versus static config

show config

show interface

Auto MDI/MDI-X

- End system
 - Media dependent interface (MDI)
 - Transmit on pins 1 and 2 and receive on pins 3 and 6
 - Straight through cable to connect to MDI-X port on hub/bridge/switch
- Intermediate system to intermediate system
 - Uplink ports and crossover cables
 - Auto MDI/MDI-X senses appropriate configuration regardless of cable

MAC Address Table and Port Security

- Database of MAC addresses associated with each port
- Switch floods frames when destination MAC is unknown
- Port security
 - Specify static list of allowed MACs
 - Accept given number of sticky MACs
 - Specify enforcement action for policy violation

```
show mac address-table
```

```
NYACCESS1#show mac address-table dynamic
Mac Address Table
```

```
-----
```

Vlan	Mac Address	Type	Ports
----	-----	-----	----
1	000a.8aa2.135e	DYNAMIC	Fa0/23
1	08cc.683e.fd18	DYNAMIC	Fa0/23
1	08cc.683e.fd40	DYNAMIC	Fa0/23
1	18e7.285f.0c28	DYNAMIC	Fa0/24
1	44ad.d916.2598	DYNAMIC	Fa0/24
1	5006.04be.159d	DYNAMIC	Fa0/1

```
Total Mac Addresses for this criterion: 6
```

Port Aggregation

- Combine multiple links into a single logical channel
 - NIC teaming
 - Bonding
- Aggregates link bandwidth
- Provides redundancy
- Link Aggregation Control Protocol (LACP)

Port Mirroring

- Configure switch to copy unicast frames for legitimate packet sniffing/network analysis
- Switched port analyzer (SPAN)
- Attach sniffer/monitor to destination port

```
cumulus@cumulus:mgmt:~$ net add port-mirror session 1 ingress span src-port swp5-8 dst-port swp4
cumulus@cumulus:mgmt:~$ net commit
--- /etc/cumulus/switchd.d/port-mirror.conf      2021-08-06 18:48:09.494000000 +0000
+++ /run/nclu/port_mirror/port-mirror.conf      2021-08-06 18:49:43.620000000 +0000
@@ -9,11 +9,16 @@
#
# [session_n]
# session-id = n
# mirror.session.n.direction = (ingress | egress)
# mirror.session.n.src = <swpx, bond>
# mirror.session.n.dest = (swpx | <src-ip> <dst-ip>)
# mirror.session.n.type = (span | erspan | none)
#
# Default is all sessions off
# mirror.session.all.type = none
-mirror.session.all.type = none
+[session_1]
+session-id = 1
+mirror.session.1.src = swp5-8
+mirror.session.1.direction = ingress
+mirror.session.1.dest = swp4
+mirror.session.1.type = span

net add/del commands since the last "net commit"
=====
```

User	Timestamp	Command
cumulus	2021-08-06 18:48:09.496506	net add port-mirror session 1 ingress span src-port swp5-8 dst-port swp4
cumulus	2021-08-06 18:49:43.621259	net add port-mirror session 1 ingress span src-port swp5-8 dst-port swp4
cumulus@cumulus:mgmt:~\$		net show port-mirror session 1
session-id	direction	type src dest
1	ingress	span swp5-8 swp4

Jumbo Frames and Flow Control

- Jumbo frames
 - Specify higher MTU (often ~ 9000 bytes)
 - Often used in storage area networks
- Flow control
 - Allow server to pause traffic
 - Configure switch port to enable or disable use of PAUSE frames

Power Over Ethernet


- Supply power over data cabling
- 802.3af
 - ~13 W (350mA@48V)
- 802.3at (PoE+)
 - ~25 W (600 mA)
- 802.3bt (Ultra PoE)
 - ~51 W (Type 3) or 73 W (Type 4)
- Endspan / power sourcing equipment (PSE)
- Midspan / power injector



Review Activity: Common Ethernet Switching Features

- Ethernet Switch Types
- Switch Interface Configuration
- Auto MDI/MDI-X
- MAC Address Table and Port Security
- Port Aggregation
- Port Mirroring
- Jumbo Frames and Flow Control
- Power Over Ethernet

Assisted Lab: Configure Interface Settings

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Summary