

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

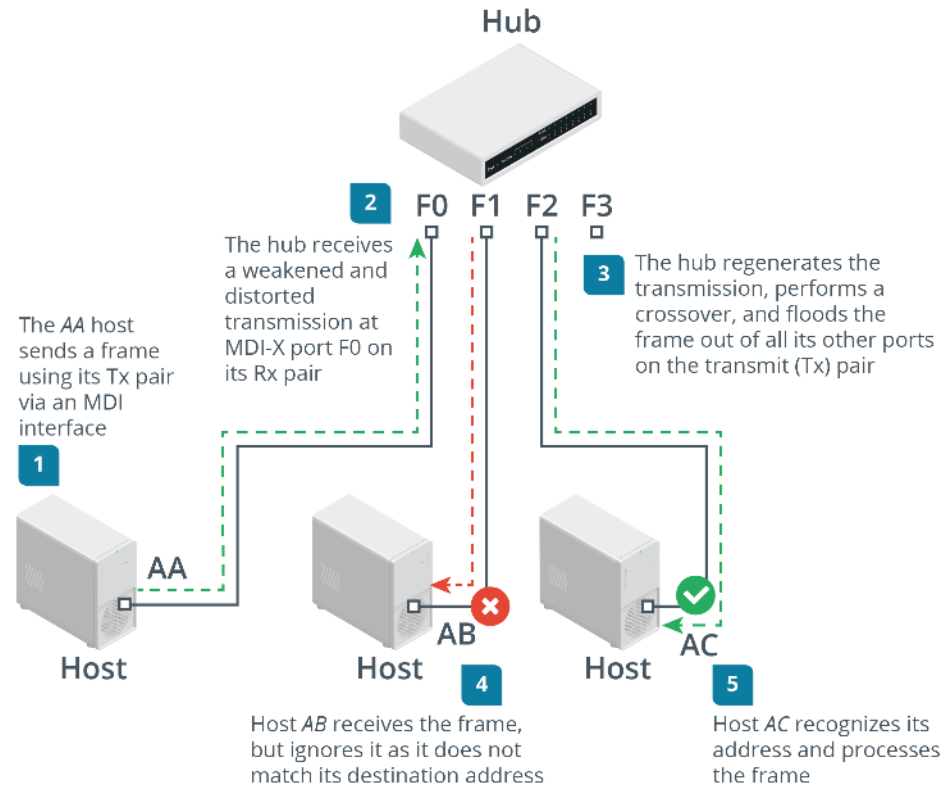
Deploy Networking Devices

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



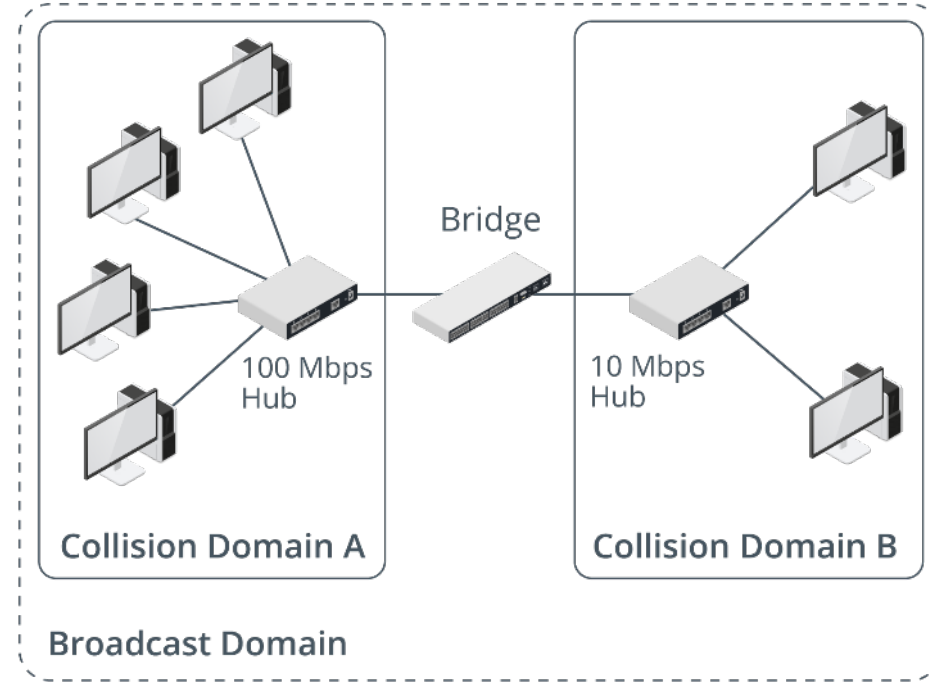
Hubs



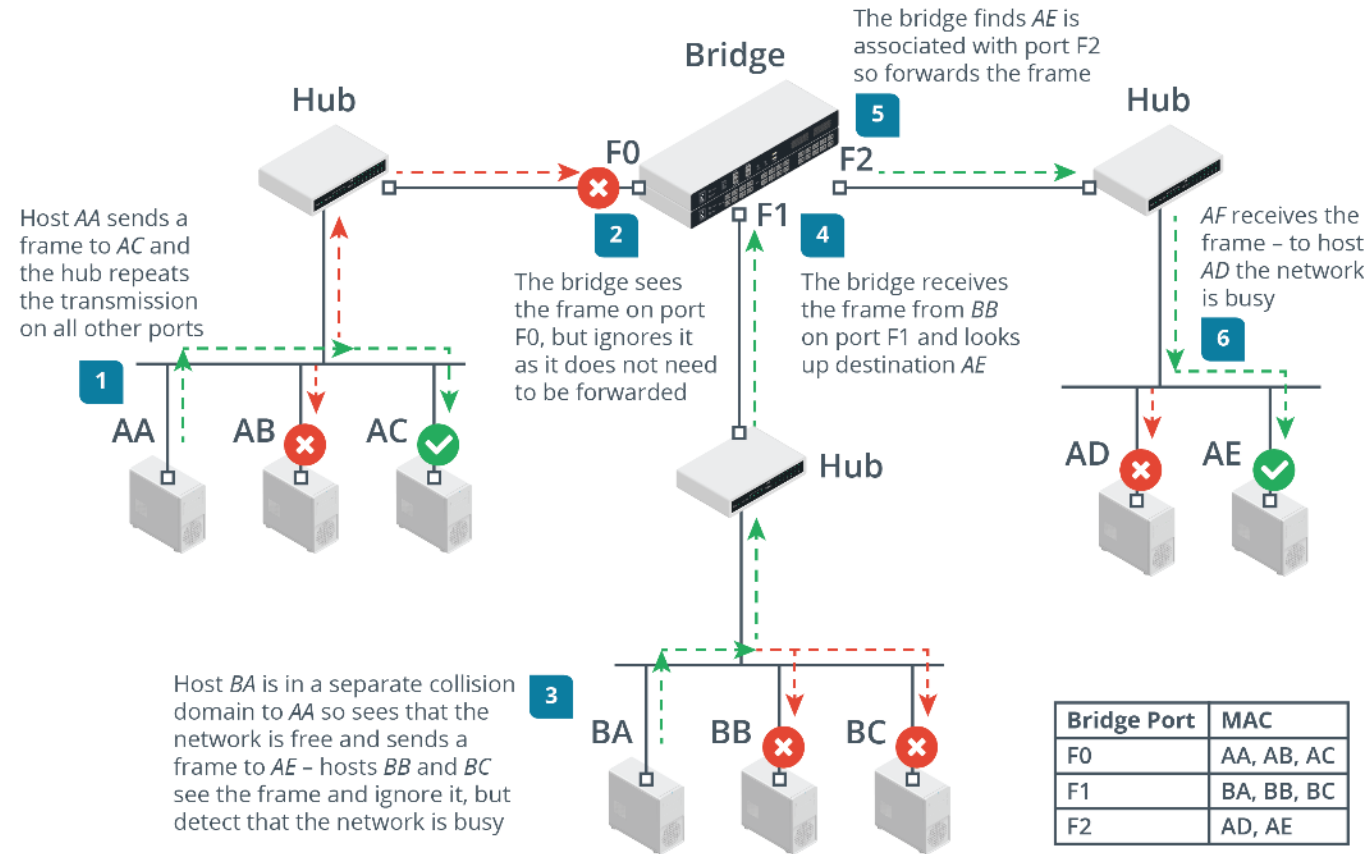
- Legacy intermediate system for Ethernet
- Multiport repeater working at physical layer
- All ports in the same collision domain
- Medium dependent interface (MDI)
 - End system to intermediate system
 - Transmit (Tx) --> Receive (Rx)
 - Hub ports are MDI-X (crossover)

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



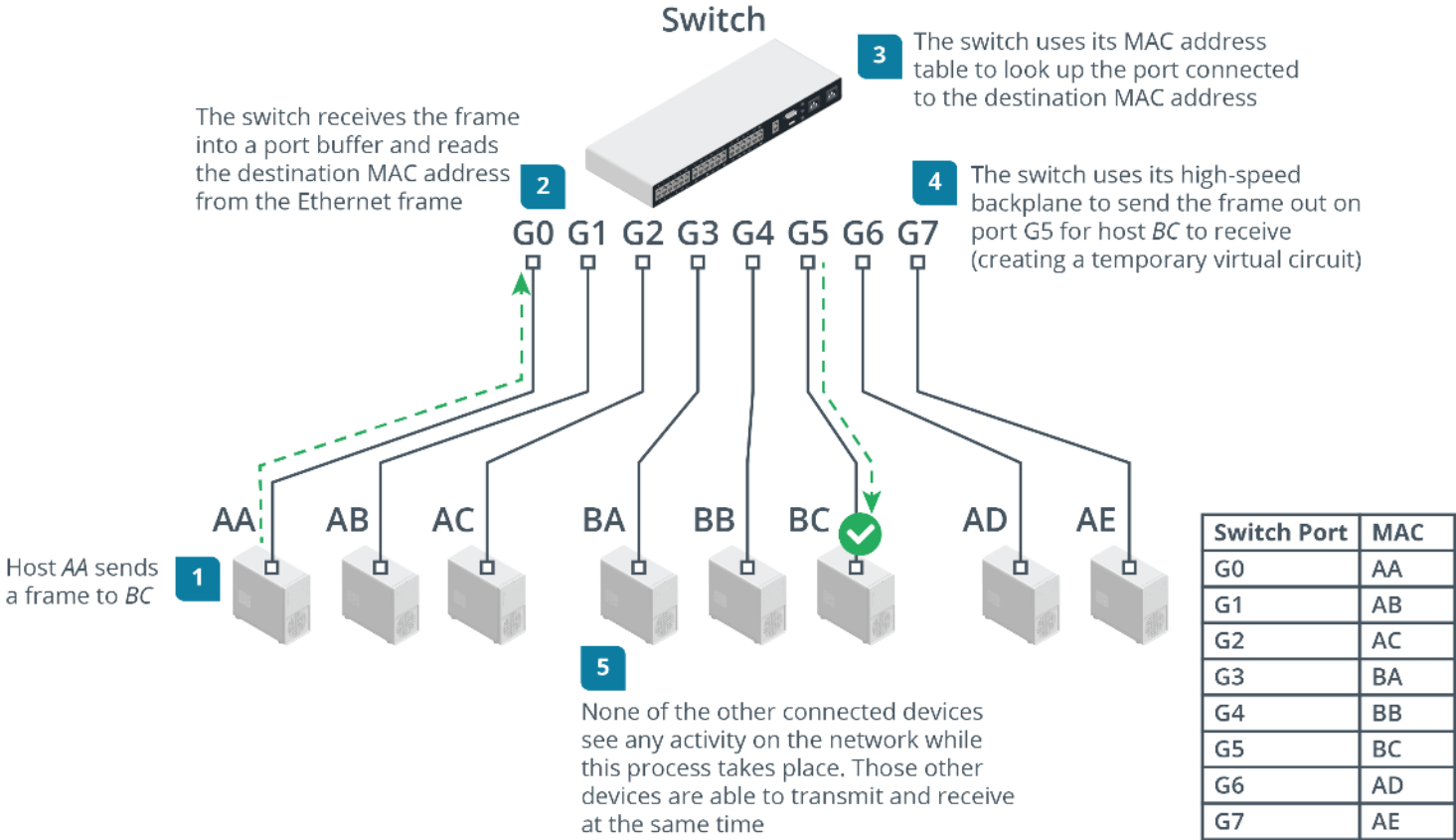
Bridges (Slide 2 of 2)



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

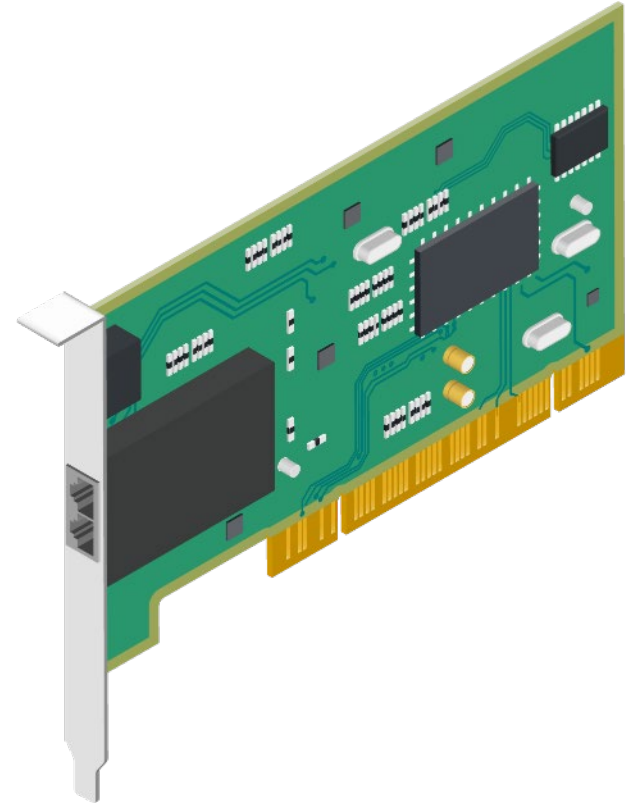
Lesson 3

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)

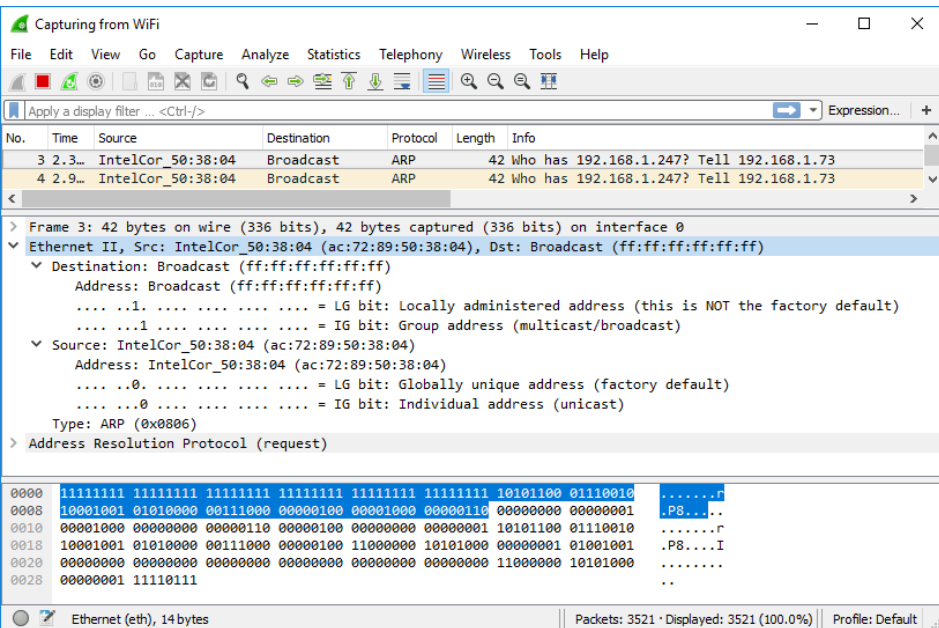


Ethernet Frame Format



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 table displays the following data:

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 packet details pane for the selected packet (No. 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 in hexadecimal and ASCII:


Offset	Hex	ASCII	
0030	02 00 61 06 00 00 33 20	6c 6f 67 69 6e 20 22 73	..a...3 login "s
0040	61 6d 40 35 31 35 73 75	70 70 6f 72 74 2e 63 6f	am@515su pport.co
0050	6d 22 20 22 50 61 24 24	77 30 72 64 22 0d 0a	m" "Pa\$\$ w0rd"...

The status bar at the bottom indicates: "Remainder of request line (imap.request), 37 bytes" | "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