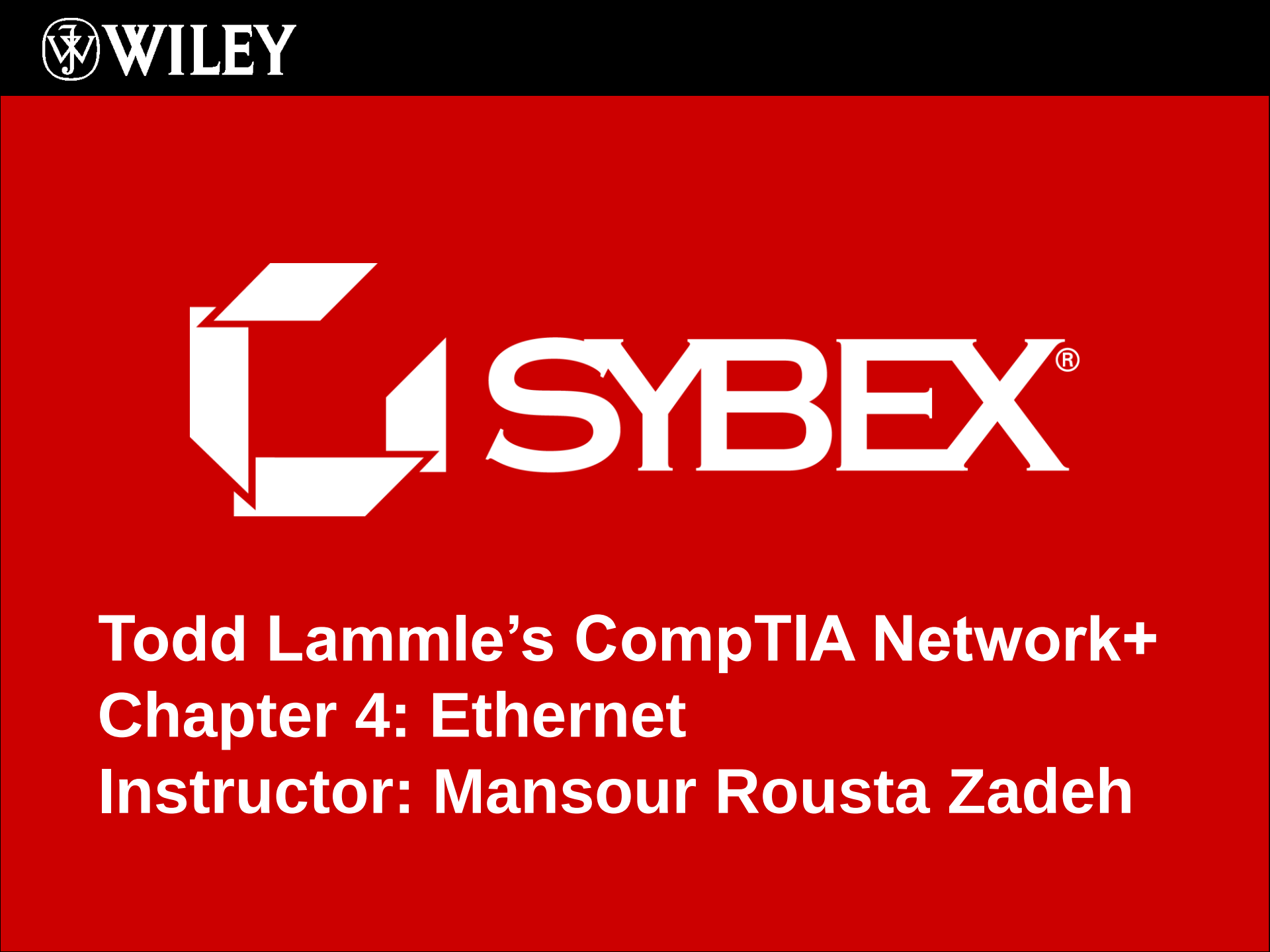
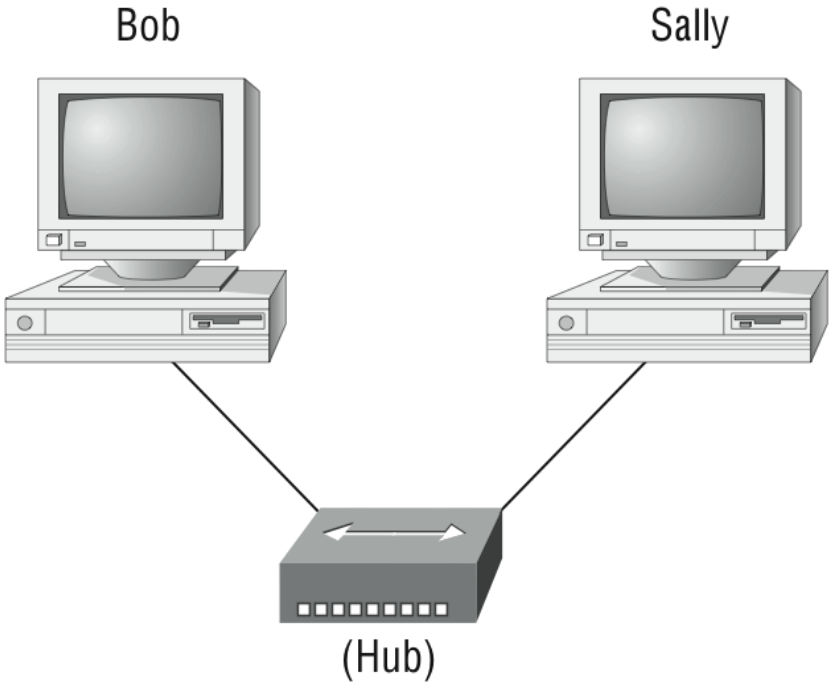



# Todd Lammle's CompTIA Network+
# Chapter 4: Ethernet
# Instructor: Mansour Rousta Zadeh

# Chapter 4 Objectives

- **2.6 Categorize LAN technology types and properties**
- **Types:**
  - **Ethernet**
  - **10BaseT**
  - **100BaseTX**
  - **100BaseFX**
  - **1000BaseT**
  - **1000BaseX**
  - **10GBaseSR**
  - **10GBaseLR**
  - **10GBaseER**
  - **10GBaseSW**
  - **10GBaseLW**
  - **10GBaseEW**
  - **10GBaseT**
- **Properties**
  - **CSMA/CD**
  - **Broadcast**
  - **Collision**
  - **Bonding**
  - **Speed**
  - **Distance**

# Network Communication Basics




The basic network allows devices to share information.
The term computer language refers to binary code (0s or 1s).
The two hosts above communicate using hardware or MAC addresses.

# Bob Communicates to Sally

- Here's the output from a network analyzer depicting a simple name-resolution process from Bob to Sally:

*Time Source Destination Protocol Info*

*53.892794 192.168.0.2 192.168.0.255 NBNS Name query NB* **SALLY** *<00>*

- Because the two hosts are on a local LAN, Windows (Bob) will broadcast to resolve the name Sally (the destination 192.168.0.255 is a broadcast address).
- Let's take a look at the rest of the information:

EthernetII,Src:192.168.0.2(00:14:22:be:18:3b),Dst:Broadcast(ff:ff:ff:ff:ff:ff*)*

- Before the name is resolved, the first thing Bob has to do is broadcast on the LAN to get Sally's MAC address so he can communicate to her PC and resolve her name to an IP address:

*Time Source Destination Protocol Info*

*5.153054 192.168.0.2 Broadcast ARP Who has 192.168.0.3? Tell 192.168.0.2*

Next, check out Sally's response:

*Time Source Destination Protocol Info*

*5.153403 192.168.0.3 192.168.0.2 ARP 192.168.0.3 is at 00:0b:db:99:d3:5e*

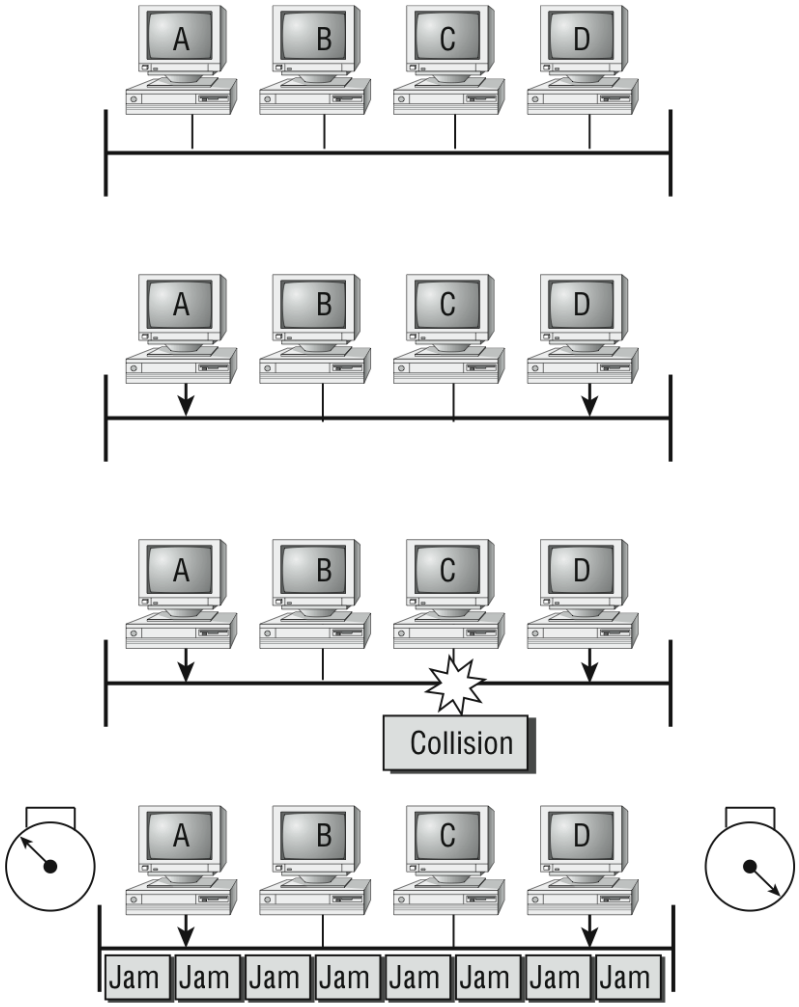
*5.53.89317 192.168.0.3 192.168.0.2 NBNS Name query response NB* ***192.168.0.3***

# Collision and Broadcast Domains

- The term *collision domain* is an Ethernet term that refers to a particular network scenario wherein one device sends a packet out on a network segment, thereby forcing every other device on that same physical network segment to pay attention to it. Ethernet uses both Data Link and Physical layer specifications.

- A *broadcast domain* refers to the set of all devices on a network segment that hear all the broadcasts sent on that segment. Even though a broadcast domain is typically a boundary delimited by physical media like switches and repeaters, it can also reference a logical division of a network segment where all hosts can reach each other via a Data Link layer (hardware address) broadcast. Broadcast domains are made smaller by routers.

# CSMA/CD




Carrier Sense Multiple Access with Collision Detection (CSMA/CD)

# Half and Full Duplex

- Basically, when you run half-duplex, you're using only one wire pair with a digital signal either transmitting or receiving.
- In contrast, full-duplex Ethernet uses two pairs of wires at the same time instead of one measly wire pair like half duplex employs.

# Full Duplex

- Full-duplex Ethernet can be used in many situations; here are some examples:
  - With a connection from a switch to a host
  - With a connection from a switch to a switch
  - With a connection from a host to a host using a crossover cable
- You can run full duplex with just about any device except a hub.

# Binary to Decimal to Hex

- Each digit used is limited to either a 1 (one) or a 0 (zero), and each digit is called 1 bit (short for *bi*nary digi*t*). Typically, you count either 4 or 8 bits together, with these being referred to as a *nibble* and a *byte*, respectively.

**Table 4.1: Binary Values**

| NIBBLE VALUES | BYTE VALUES |
|---|---|
| 8 4 2 1 | 128 64 32 16 8 4 2 1 |

# Binary to Decimal

- What all this means is that if a one digit (1) is placed in a value spot, then the nibble or byte takes on that decimal value and adds it to any other value spots that have a 1. And if a zero (0) is placed in a bit spot, you don't count that value.
- Let's work through an example:

  10010110
- Which bits are on? The 128, 16, 4, and 2 bits are on, so we'll just add them up:

  128 + 16 + 4 + 2 = 150.

# Binary to Decimal Chart

**Table 4.2: Binary-to-Decimal Memorization Chart**

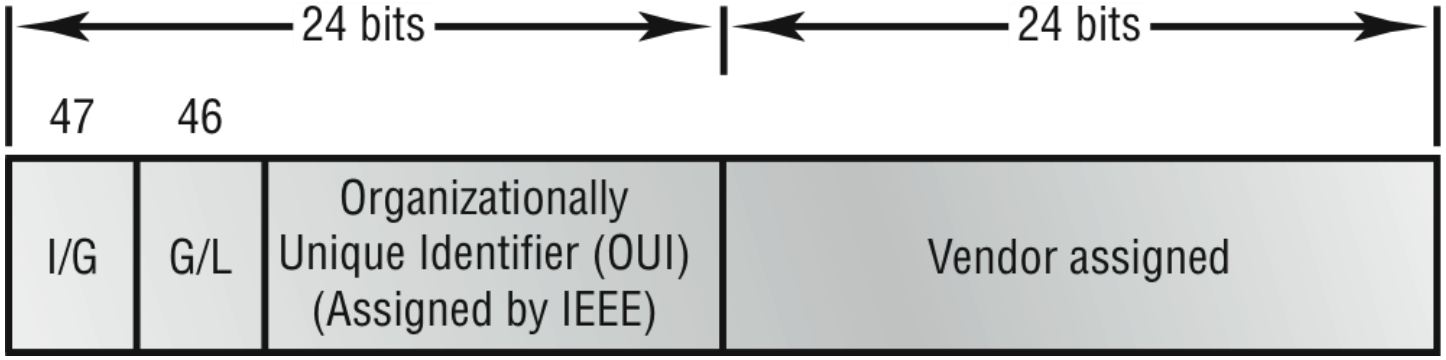
| Binary Value | Decimal Value |
|---|---|
| 10000000 | 128 |
| 11000000 | 192 |
| 11100000 | 224 |
| 11110000 | 240 |
| 11111000 | 248 |
| 11111100 | 252 |
| 11111110 | 254 |
| 11111111 | 255 |

# Hex to Binary to Decimal

**Table 4.3: Hex-to-Binary to Decimal Chart**

| Hexadecimal Value | Binary Value | Decimal Value |
|---|---|---|
| 0 | 0000 | 0 |
| 1 | 0001 | 1 |
| 2 | 0010 | 2 |
| 3 | 0011 | 3 |
| 4 | 0100 | 4 |
| 5 | 0101 | 5 |
| 6 | 0110 | 6 |
| 7 | 0111 | 7 |
| 8 | 1000 | 8 |
| 9 | 1001 | 9 |
| A | 1010 | 10 |
| B | 1011 | 11 |
| C | 1100 | 12 |
| D | 1101 | 13 |
| E | 1110 | 14 |
| F | 1111 | 15 |

# Ethernet Addressing

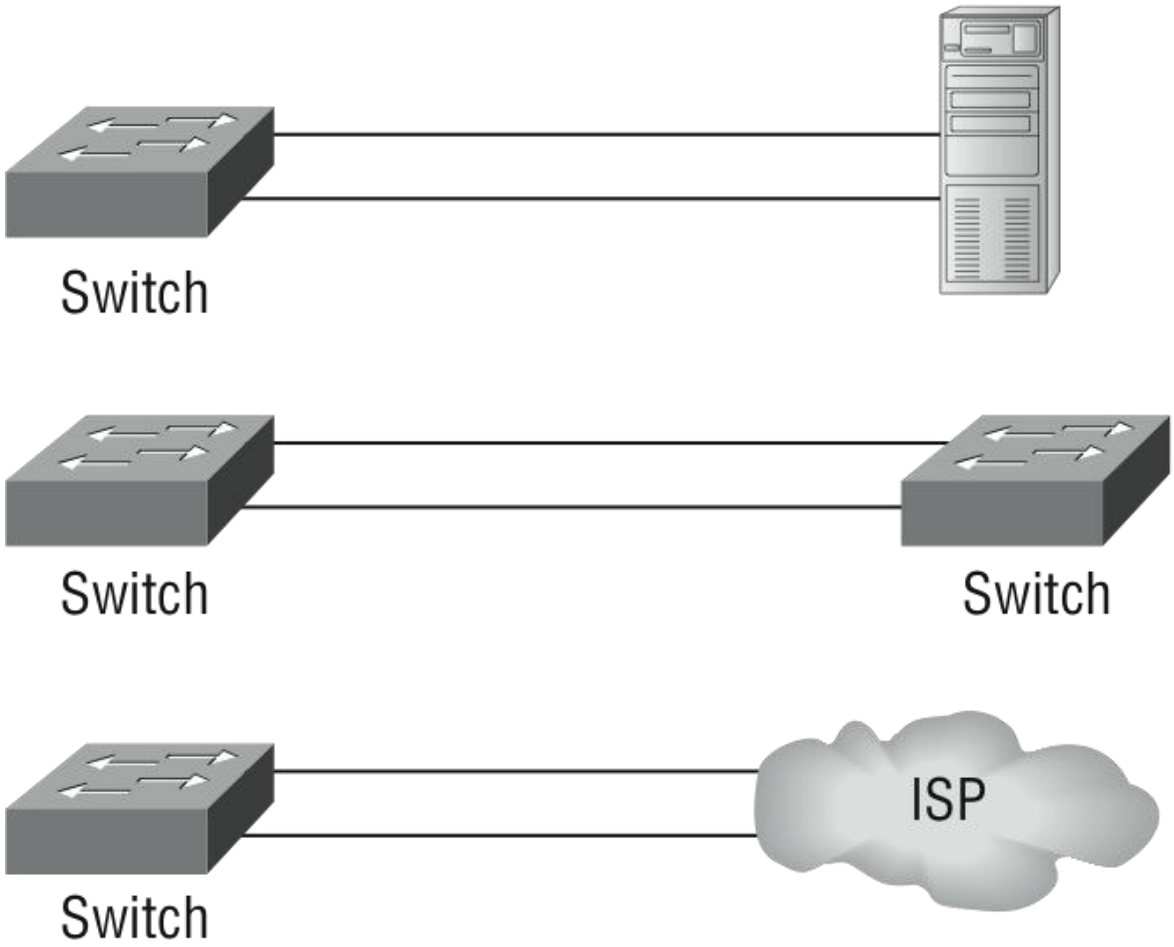


# Ethernet Frames

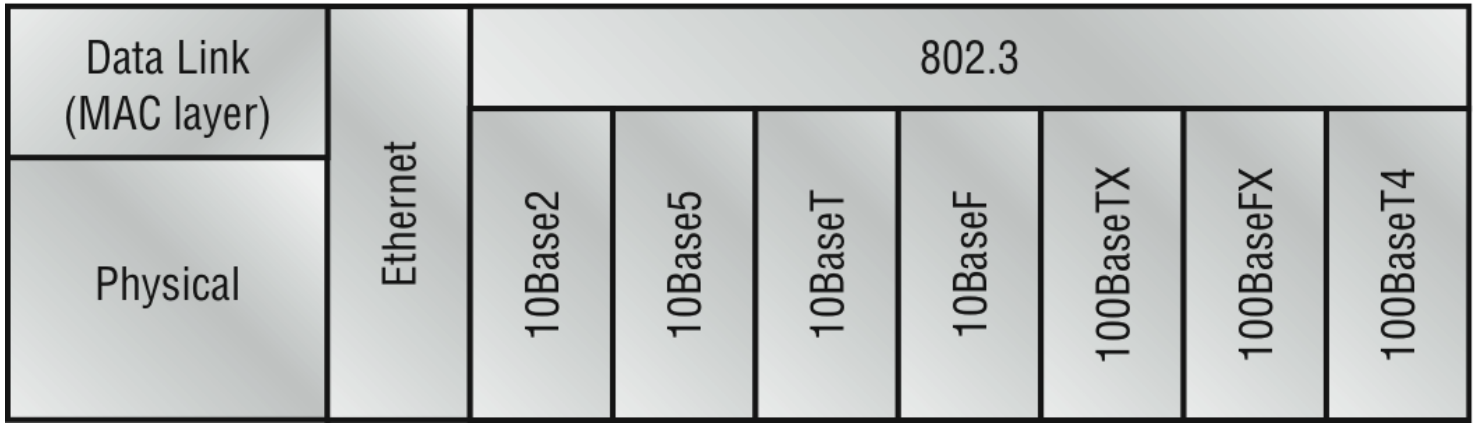
**Ethernet_II**


**802.3_Ethernet**

# Ethernet/Channel Bonding



# Ethernet at Layers 1 and 2



# IEEE Ethernet Standards

- **100Base-TX (IEEE 802.3u)**
  - 100Base-TX, most commonly known as Fast Ethernet, uses EIA/TIA Category 5, 5E, or 6, UTP two-pair wiring. One user per segment; up to 100 meters long. It uses an RJ-45 connector with a physical star topology and a logical bus.
- **100Base-FX (IEEE 802.3u)**
  - Uses fiber cabling 62.5/125-micron multimode fiber. Point-to-point topology; up to 412 meters long. It uses ST and SC connectors, which are media-interface connectors.
- **1000Base-CX (IEEE 802.3z)**
  - Copper twisted-pair called twinax (a balanced coaxial pair) that can run only up to 25 meters and uses a special 9-pin connector known as the High Speed Serial Data Connector (HSSDC).
- **1000Base-T (IEEE 802.3ab)**
  - Category 5, four-pair UTP wiring up to 100 meters long.

# IEEE Standards (cont.)

- **1000Base-SX (IEEE 802.3z)**
  - The implementation of Gigabit Ethernet running over multimode fiber-optic cable (instead of copper twisted-pair cable) and using short wavelength laser. Multimode fiber (MMF) using 62.5- and 50-micron core; uses an 850 nanometer (nm) laser and can go up to 220 meters with 62.5-micron, 550 meters with 50-micron.
- **1000Base-LX (IEEE 802.3z)**
  - Single-mode fiber that uses a 9-micron core and 1300 nm laser and can go from 3 km up to 10 km.
- **10GBase-T**
  - 10GBase-T is a standard proposed by the IEEE 802.3an committee to provide 10Gbps connections over conventional UTP cables (Category 5e, 6, or 7 cables). 10GBase-T allows the conventional RJ-45 used for Ethernet LANs. It can support signal transmission at the full 100-meter distance specified for LAN wiring.

# IEEE Standards (cont.)

- **10GBase-SR**
  - An implementation of 10 Gigabit Ethernet that uses short-wavelength lasers at 850 nm over multimode fiber. It has a maximum transmission distance of between 2 and 300 meters, depending on the size and quality of the fiber.
- **10GBase-LR**
  - An implementation of 10 Gigabit Ethernet that uses long-wavelength lasers at 1,310 nm over single-mode fiber. It also has a maximum transmission distance between 2 meters and 10 km, depending on the size and quality of the fiber.
- **10GBase-ER**
  - An implementation of 10 Gigabit Ethernet running over single-mode fiber. It uses extra-long-wavelength lasers at 1,550 nm. It has the longest transmission distances possible of the 10-Gigabit technologies: anywhere from 2 meters up to 40 km, depending on the size and quality of the fiber used.

# 802.3 Standards (cont.)

- **10GBase-SW**
  - 10GBase-SW, as defined by IEEE 802.3ae, is a mode of 10GBase-S for MMF with a 850 nm laser transceiver with a bandwidth of 10Gbps. It can support up to 300 meters of cable length. This media type is designed to connect to SONET equipment.
- **10GBase-LW**
  - 10GBase-LW is a mode of 10GBase-L supporting a link length of 10 km on standard single-mode fiber (SMF) (G.652). This media type is designed to connect to SONET equipment.
- **10GBase-EW**
  - 10GBase-EW is a mode of 10GBase-E supporting a link length of up to 40 km on SMF based on G.652 using optical-wavelength 1550 nm. This media type is designed to connect to SONET equipment.

# Summary

- Summary
- Exam Essentials Section
- Written Labs
- Review Questions