CCNA 1 v3.1 Module 6 Ethernet Fundamentals

Purpose of This PowerPoint

- **This PowerPoint primarily consists of the Target Indicators (TIs) of this module in CCNA version 3.1.**
- **It was created to give instructors a PowerPoint to take and modify as their own.**
- **This PowerPoint is:**

  NOT a study guide for the module final assessment.

  NOT a study guide for the CCNA certification exam.
- **Please report any mistakes you find in this PowerPoint by using the Academy Connection Help link.**

To Locate Instructional Resource Materials on Academy Connection:

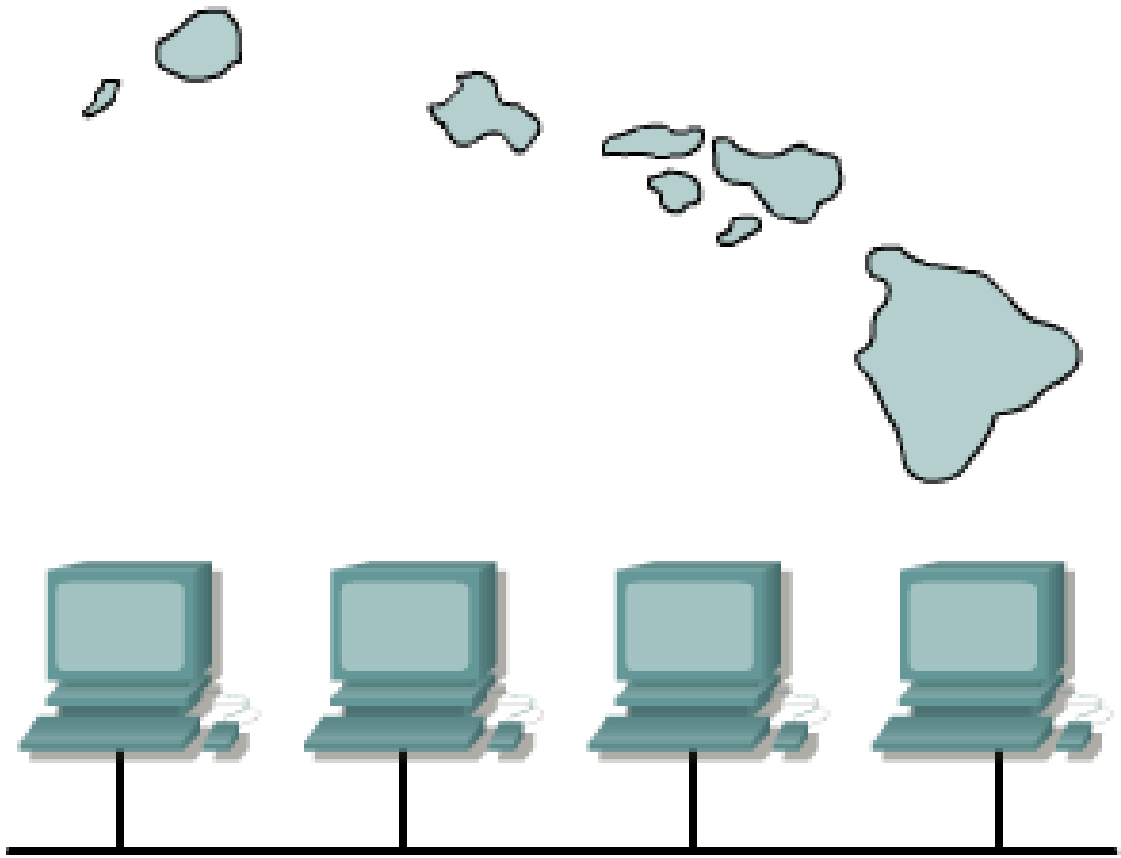
- Go to the Community FTP Center to locate materials created by the instructor community
- Go to the Tools section
- Go to the Alpha Preview section
- Go to the Community link under Resources
- See the resources available on the Class home page for classes you are offering
- Search http://www.cisco.com
- Contact your parent academy!

Objectives

Cisco.com

Upon completion of this module, the student will be able to perform tasks related to the following:	
6.1	Ethernet Fundamentals
6.2	Ethernet Operation

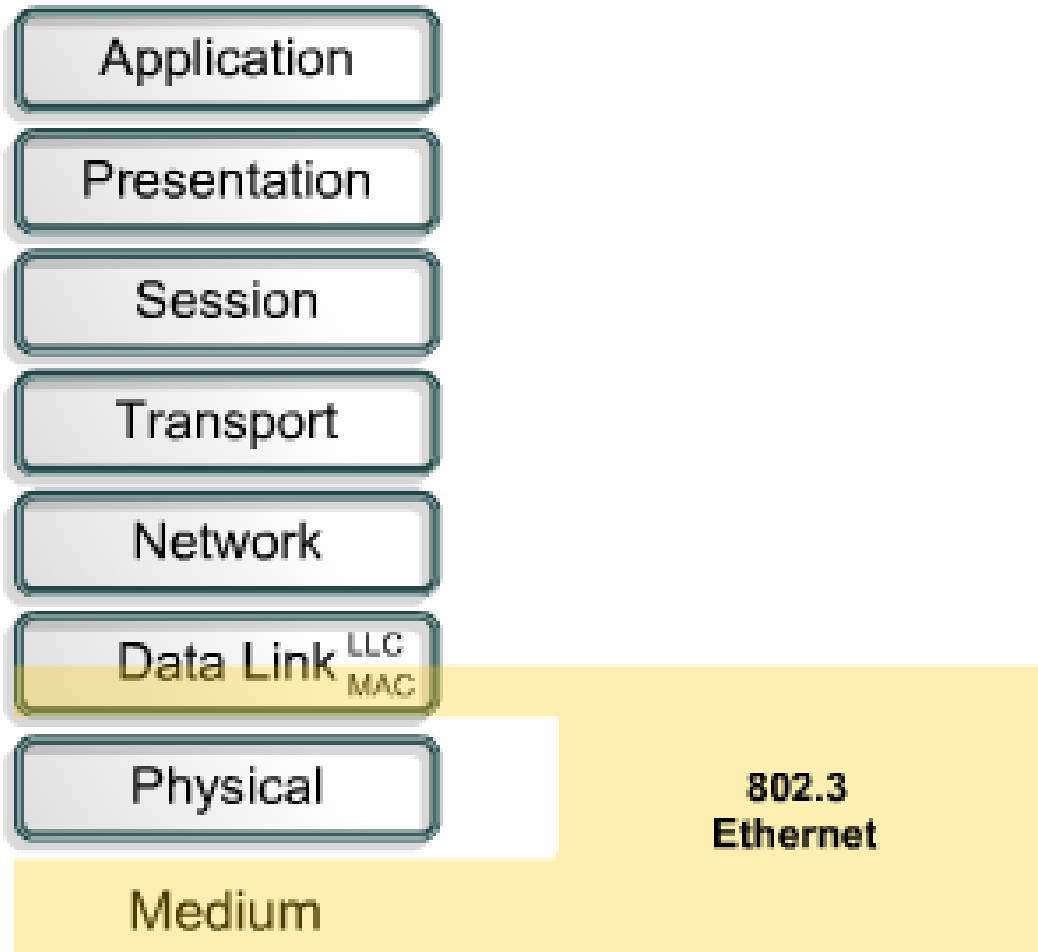
Introduction to Ethernet



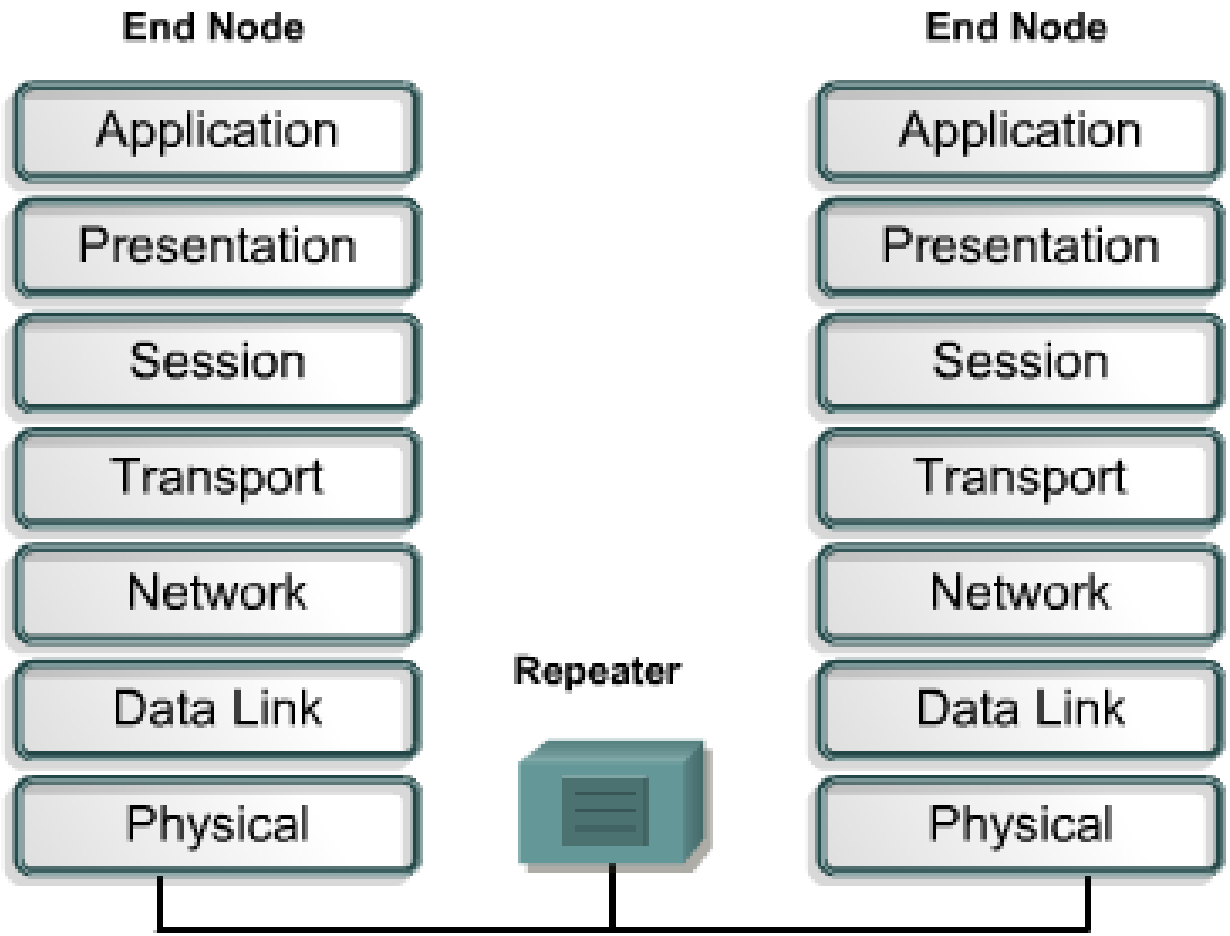
IEEE Ethernet Naming Rules

Speed	Signal Method	Medium
10	BASE	2
100	BROAD	5
1000		-T
10G		-TX
		-SX
		-LX

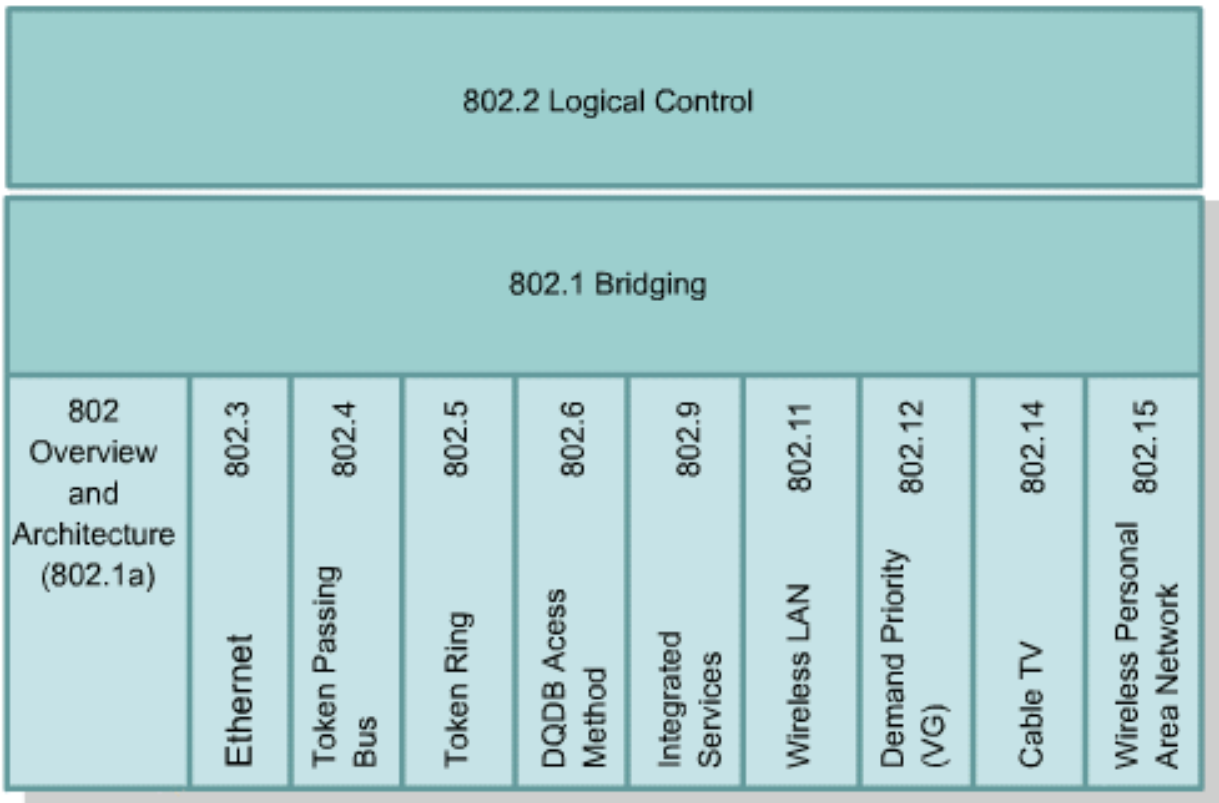
Ethernet and the OSI Model



Ethernet and the OSI Model



Ethernet and the OSI Model



Ethernet and the OSI Model

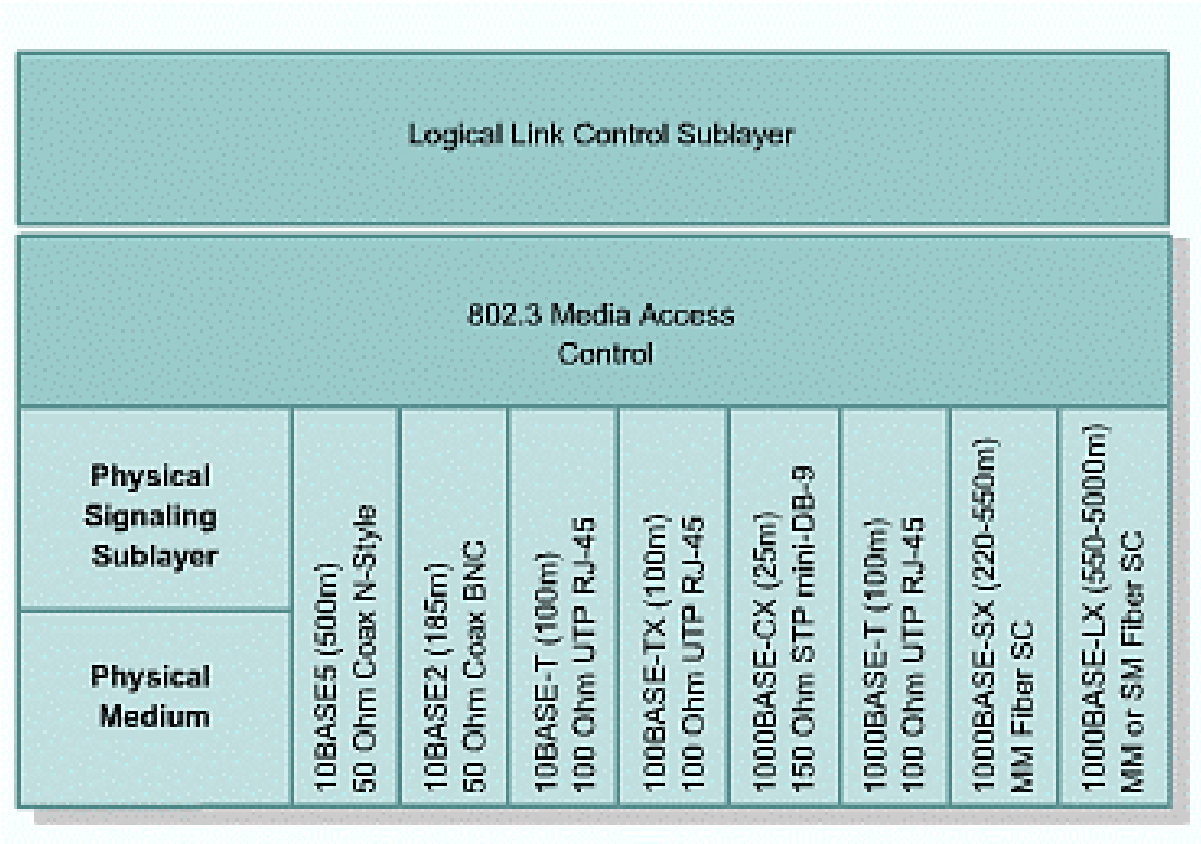
- Layer 1 cannot communicate with the upper-level layers.
- Layer 2 does this with Logical Link Control (LLC).

- Layer 1 cannot identify computers.
- Layer 2 uses an addressing process.

- Layer 1 can only describe streams of bits.
- Layer 2 uses framing to organize or group the bits.

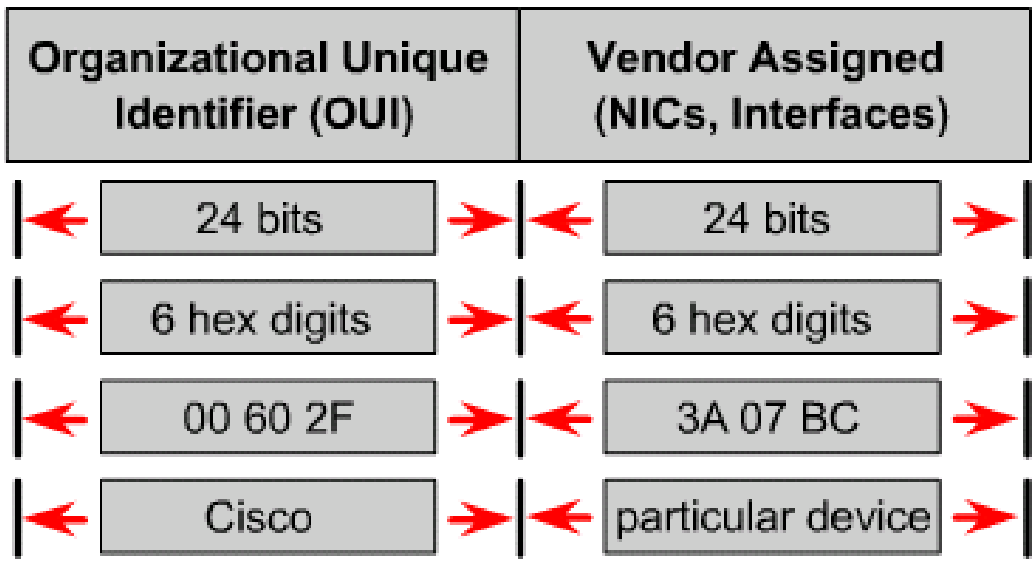
- Layer 1 is unable to decipher which computer will transmit binary data from a group that are all trying to transmit at the same time.
- Layer 2 uses a system called Media Access Control (MAC).

Ethernet and the OSI Model

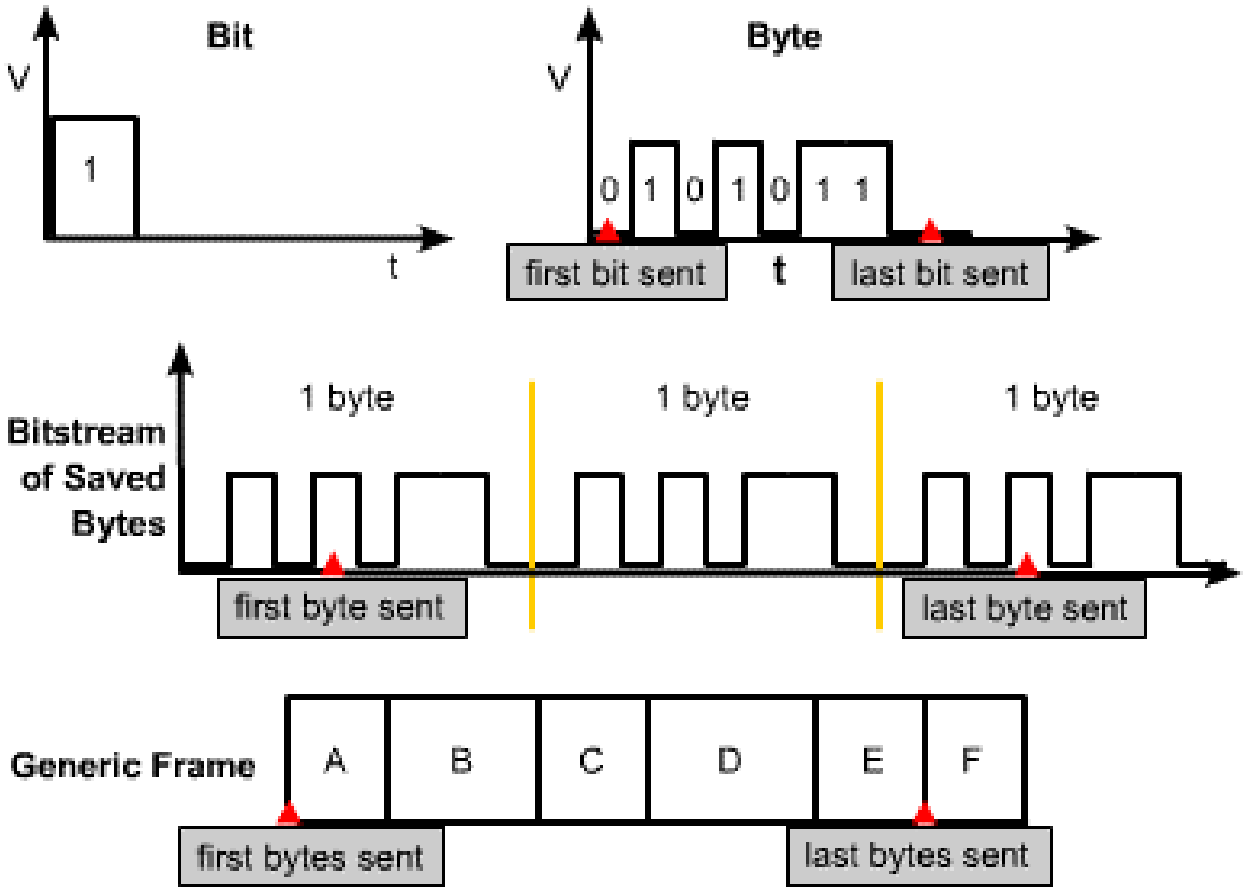


Naming

Naming



Layer 2 Framing



A, B, C, D, E, F multiple, often many, bytes

Layer 2 Framing

Field Names				
A	B	C	D	E
Start Frame Field	Address Field	Type/Length Field	Data Field	FCS Field

Ethernet Frame Structures

FCS Calculation							
Preamble 7	SFD 1	Destination 6	Source 6	Length/ Type 2	Data 46 to 1500	Pad	FCS 4

EEE 802.3 Ethernet frame fields

Octets	Description
• 7	Preamble
• 1	Start Frame Delimeter(SFD)
• 6	Destination MAC Address
• 6	Source MAC Address
• 2	Lenght/Type Field (Length if less than 0600 in hexadecimal,otherwise protocol Type)
• 46 to 1500	Data* (If less than 46 octets, then a pad must be added to the end)
• 4	Frame Check Sequence (CRC Checksum)

Ethernet Frame Structures

Octets	Description
8	Preamble (ending in pattern 10101011, the 802.3 SFD)
6	Destination MAC Address
6	Source MAC Address
2	Type Field
46 to 1500	Data* (If less than 46 octets, then a pad must be added to the end)
4	Frame Check Sequence (CRC Checksum)

Ethernet Frame Structures

- Standard introduced by DIX.
- Used by TCP/IP networks
- Uses Type field to determine higher layer protocol.
- Type examples:
  - 0x0806 = ARP
  - 0x0800 = IPv4

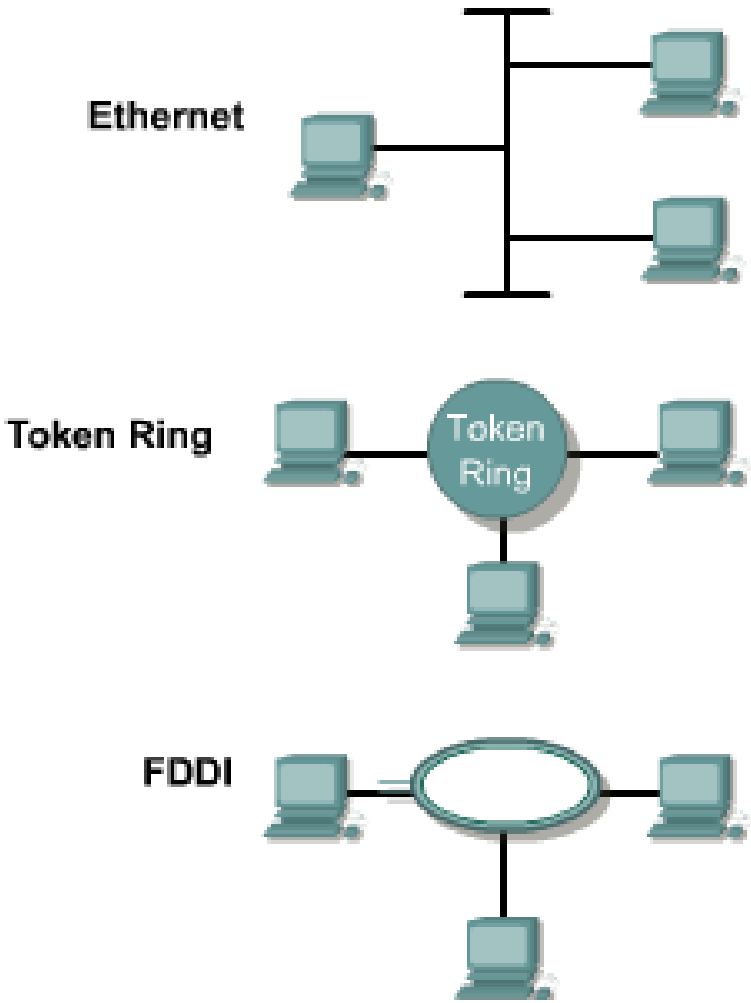
Ethernet Frame Fields

IEEE 802.3						
7	1	6	6	2	64 to 1500	4
Preamble	Start of Frame Delimeter	Destination Address	Source Address	Length Type	802.2 Header and Data	Frame Check Sequence

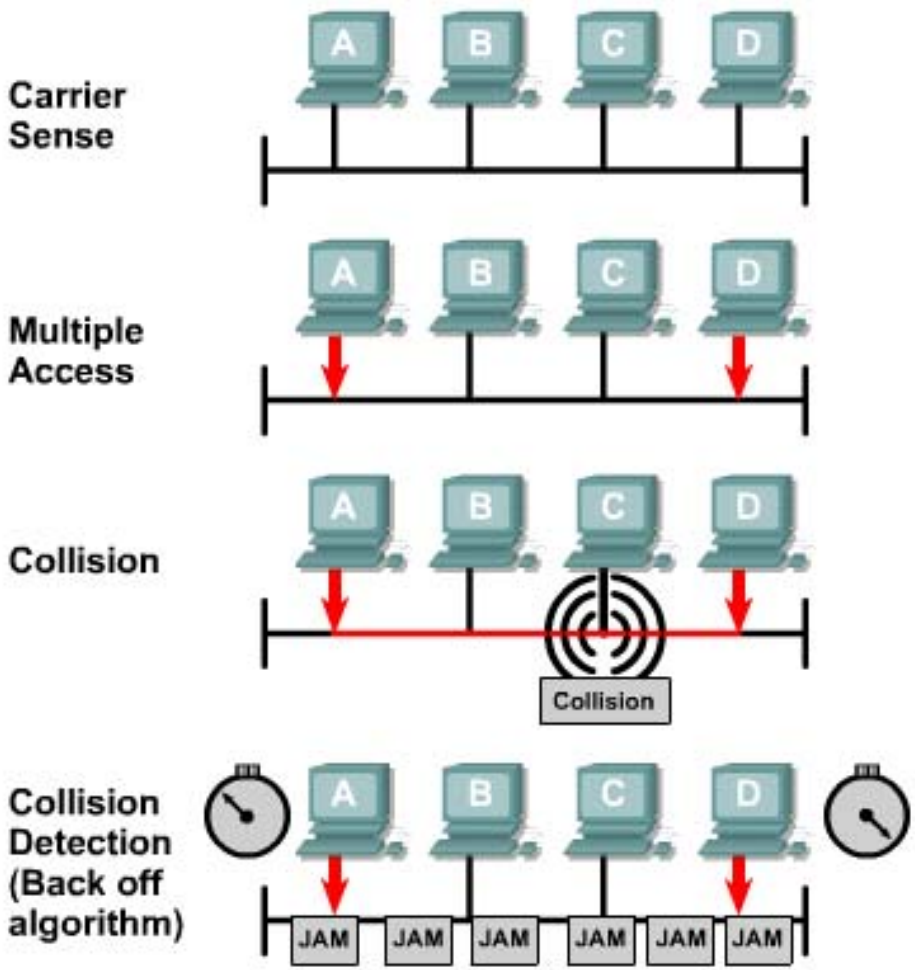
Ethernet					
8	6	6	2	64 to 1500	4
Preamble	Destination Address	Source Address	Type	Data	Frame Check Sequence

Ethernet Frame Fields

Media Access Control (MAC)

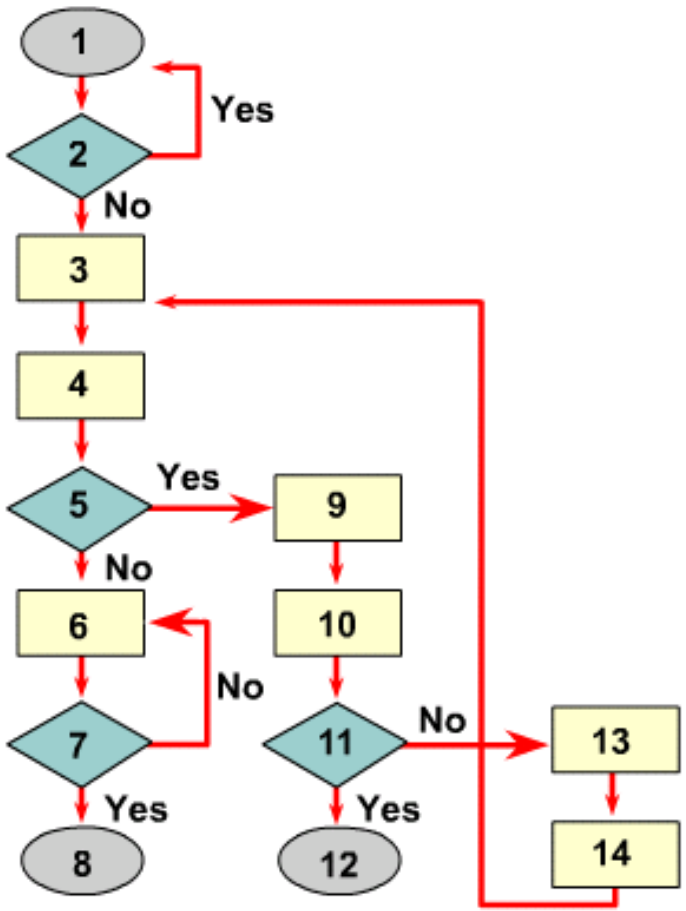


MAC Rules and Collision Detection/Backoff



MAC Rules and Collision Detection/Backoff

1. Host wants to transmit
2. Is carrier sensed?
3. Assemble frame
4. Start transmitting
5. Is a collision detected?
6. Keep transmitting
7. Is the transmission done?
8. Transmission completed
9. Broadcast jam signal
10. Attempts = Attempts + 1
11. Attempts > Too many?
12. Too many collisions; abort transmission
13. Algorithm calculates backoff
14. Wait for t microseconds



Ethernet Timing

Ethernet Speed	Bit Time
10 Mbps	100 ns
100 Mbps	10 ns
1000 Mbps = 1 Gbps	1 ns
10,000 Mbps = 10 Gbps	.1 ns

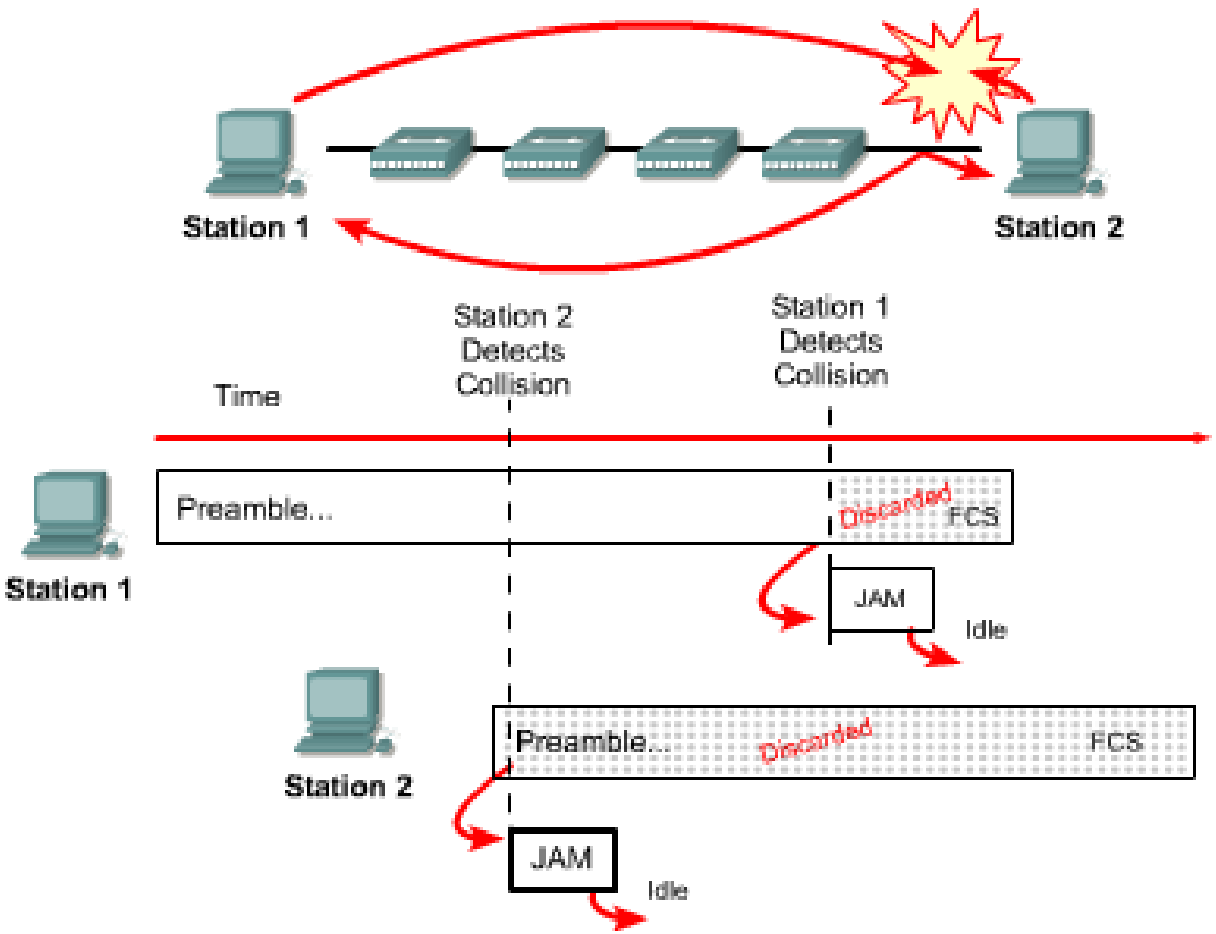
Interframe Spacing and Backoff

Speed	Interframe Spacing	Time Required
10 Mbps	96 bit-times	9.6 µs
100 Mbps	96 bit-times	0.96 µs
1 Gbps	96 bit-times	0.096 µs
10 Gbps	96 bit-times	0.0096 µs

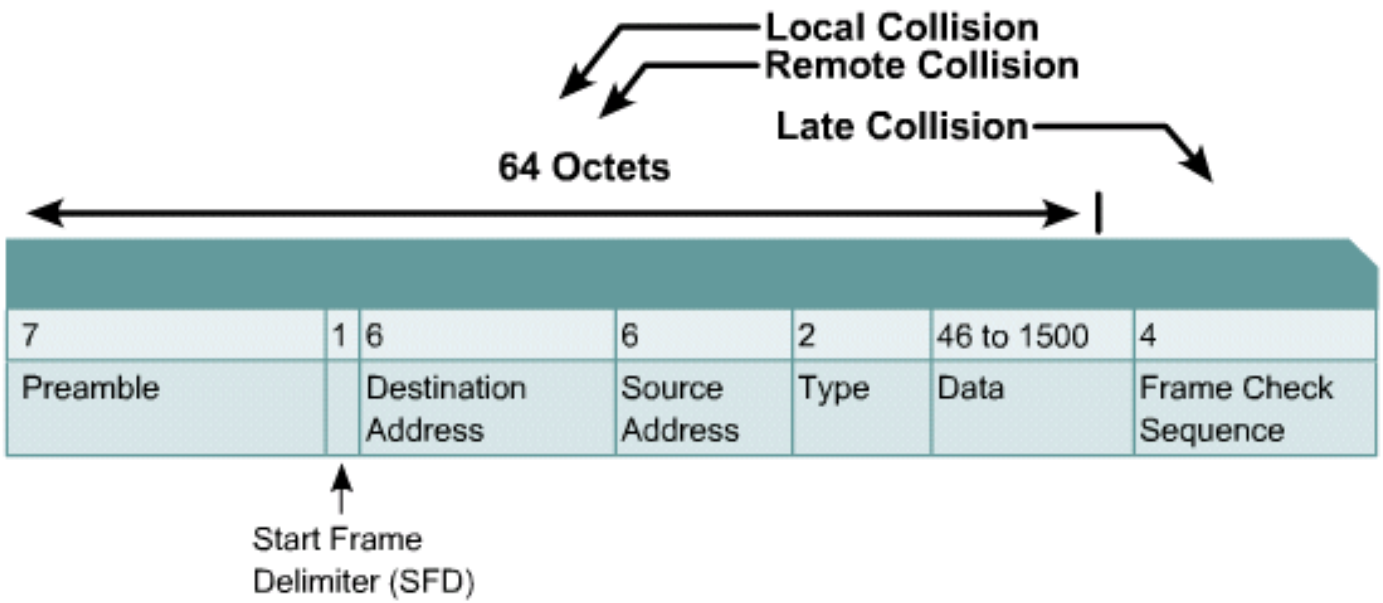
Interframe Spacing and Backoff

Speed	Slot Time	Time Interval
10 Mbps	512 bit-times	51.2 µs
100 Mbps	512 bit-times	5.12 µs
1 Gbps	4096 bit-times	4.096 µs
10 Gbps	not applicable	not applicable

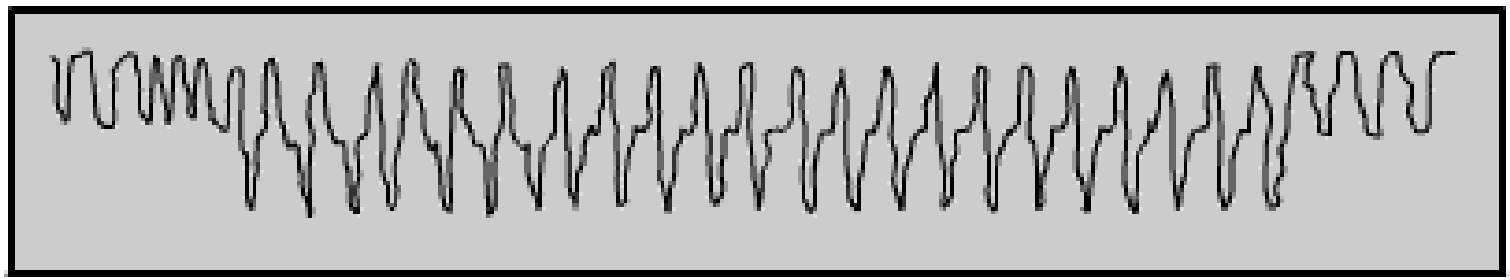
Error Handling



Types of Collisions

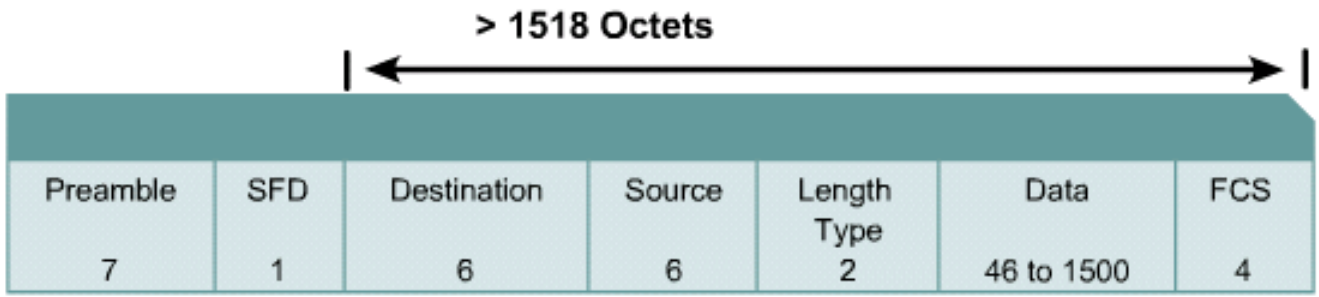


Types of Collisions



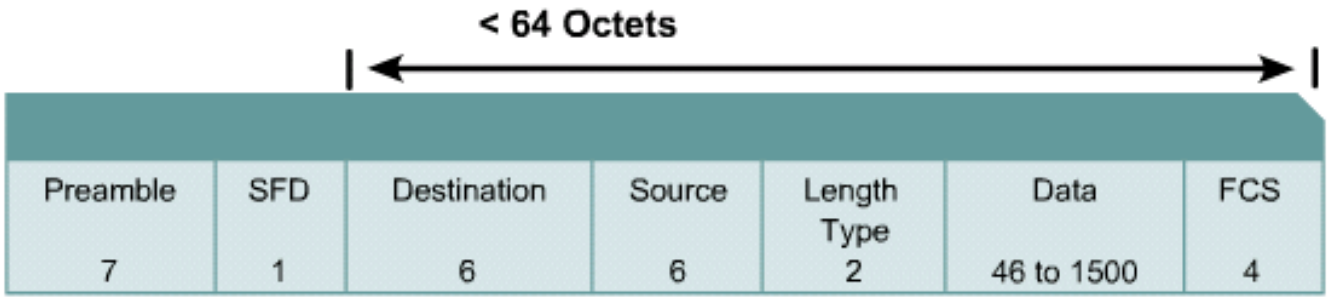
Midframe 10BASE2 /10BASE5 collision captured by a digital storage oscilloscope.

Ethernet Errors



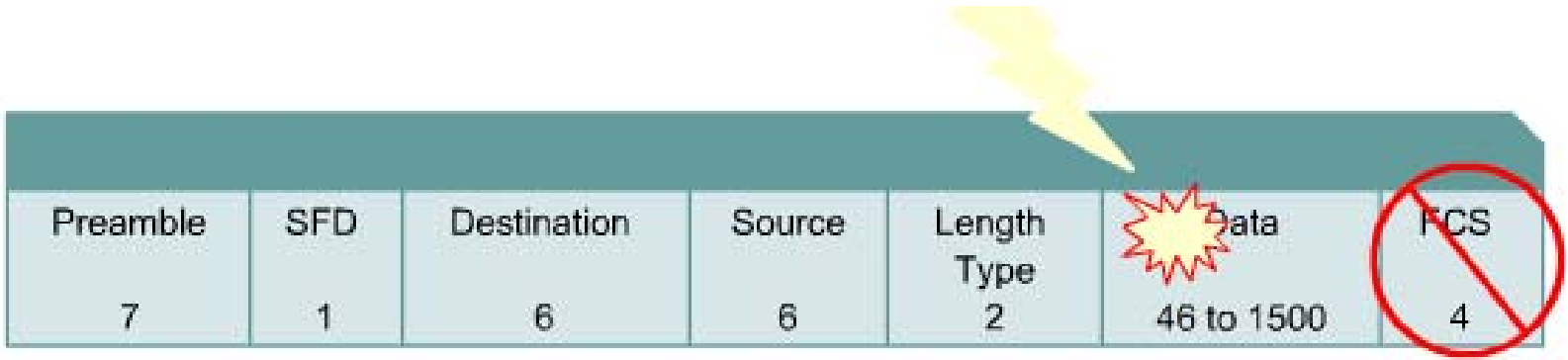
Jabber and Long Frames are both in excess of the maximum frame size. Jabber is significantly larger.

Ethernet Errors

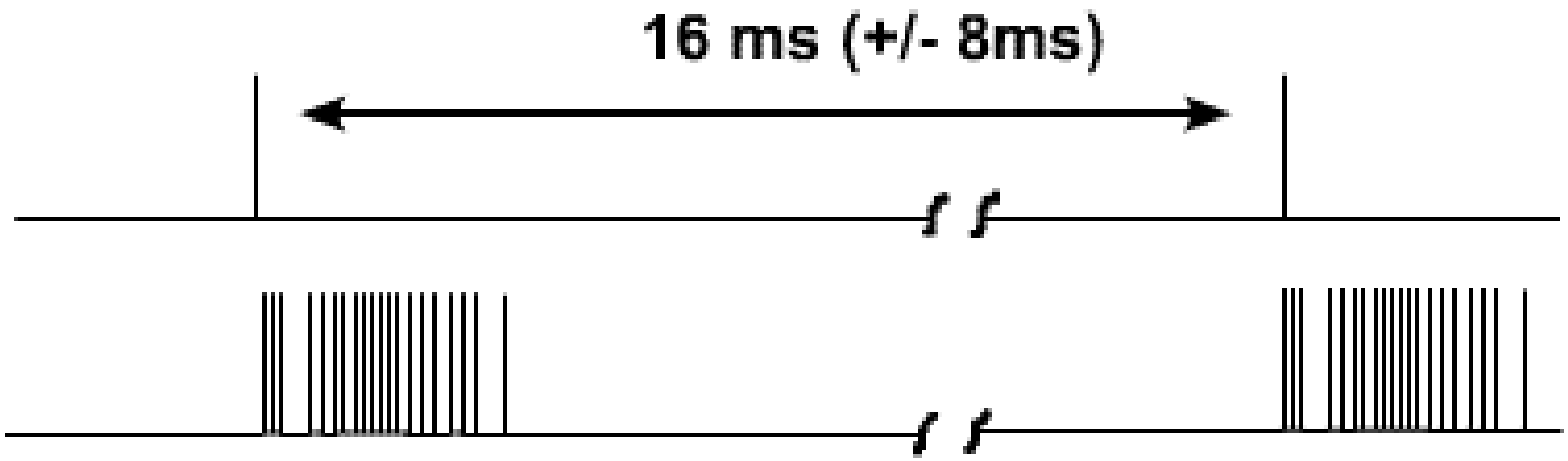


Short frames are properly formed in all but one aspect and have valid FCS checksums, but are less than the minimum frame size (64 octets).

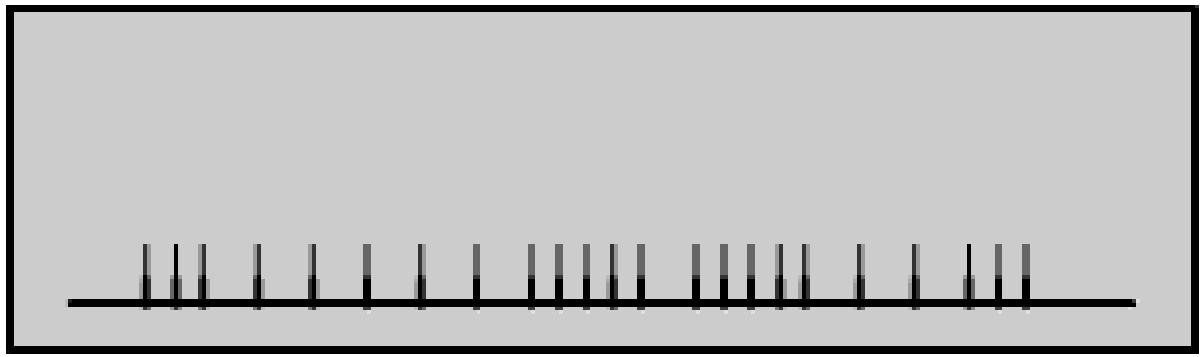
FCS Errors



Ethernet Auto-Negotiation



Ethernet Auto-Negotiation



The FLP burst is made up of multiple NLP link pulses.

Transmission Priority Rank

- 1000BASE-T full duplex
- 1000BASE-T half duplex
- 100BASE-TX full duplex
- 100BASE-TX half duplex
- 10BASE-T full duplex
- 10BASE-T half duplex

Summary