

CCNA 1 v3.1 Module 6 Ethernet Fundamentals

Purpose of This PowerPoint

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- 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 <u>http://www.cisco.com</u>
- Contact your parent academy!

Objectives

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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

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IEEE Ethernet Naming Rules

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



End Node Application Application Presentation Presentation Session Session Transport Transport Network Network Repeater Data Link Data Link Physical Physical



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802.2 Logical Control									
802.1 Bridging									
802 Overview and Architecture (802.1a)	Ethernet 802.3	Token Passing 802.4 Bus	Token Ring 802.5	DQDB Acess Method 802.6	Integrated Services	Wireless LAN 802.11	Demand Priority 802.12 (VG)	Cable TV 802.14	Wireless Personal 802.15 Area Network

- 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).

Logical Link Control Sublayer 802.3 Media Access Control 1000BASE-LX (550-5000m) 1000BASE-SX (220-550m) Physical 150 Ohm STP mini-DB-9 Signaling 50 Ohm Coax N-Style 1000BASE-CX (25m) 100BASE-TX (100m) 100 Ohm UTP RJ-45 100 Ohm UTP RJ-45 100 Ohm UTP RJ-45 1000BASE-T (100m) MM or SM Fiber SC Sublayer 50 Ohm Coax BNC 10BASE-T (100m) 10BASE5 (500m) 10BASE2 (185m) MM Fiber SC Physical Medium

Naming



Naming



Layer 2 Framing

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

Layer 2 Framing

Field Names							
А	В	С	D	E			
Start Frame Field	Address Field	Type/Length Field	Data Field	FCS Field			

Ethernet Frame Structures

.411111111

		<				\rightarrow	
		F	CS Calcu	lation			
Preamble 7	SFD 1	Destination 6	Source 6	Length/ Type 2	Data 46 t	Pad o 1500	FCS 4

EEE 802.3 E	thernet 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

Preamble	Destination	Source	Type	Data	Pad	FCS
8	6	6	2	46 to	1500	4

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

.4111111

- 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

a1111111

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

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

Ethernet Frame Fields

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10101010 10101010 10101010 10101010 10101010 10101010 10101010

Media Access Control (MAC)



MAC Rules and Collision Detection/Backoff



MAC Rules and Collision Detection/Backoff

Yes 2 No 3 Yes 5 9 No 10 6 No No 11 13 7 Yes Yes 14 12 8

- 1. Host wants to transmit
- 2. Is carrier sensed?
- Assemble frame
- Start transmitting
- 5. Is a collision detected?
- 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

 100 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

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Types of Collisions



Types of Collisions

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

Ethernet Errors

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

Ethernet Errors

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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

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						-
Preamble	SFD	Destination	Source	Length Type	Anta	Acs
7	1	6	6	2	46 to 1500	4

Ethernet Auto-Negotiation



Ethernet Auto-Negotiation

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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

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802.2 Logical Link Control									
802.1 Bridging									
802 Overview & Architecture (802.1a)	802.3	802.4	802.5	802.6	802.9	802.11	y 802.12	802.14	nal 802.15
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