



Network Fundamentals – Chapter 9



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Objectives:

- Identify the basic characteristics of network media used in Ethernet.
- Describe the physical and data link features of Ethernet.
- Describe the function and characteristics of the media access control method used by Ethernet protocol.
- Explain the importance of Layer 2 addressing used for data transmission and determine how the different types of addressing impacts network operation and performance.
- Explain the application and benefits of using Ethernet switches to control Broadcast and Collision Domains
- Explain the ARP process.



Ancient Ethernet:



Current Environment is "Transparent Switching"

Migration to Ethernet Switches

An Ethernet LAN switch:

- Manages Collisions
- Provides Full Duplex
- Manages Frame Delivery
- Manages BW Differences
- Provides Management
- Provides Trunking
- Provides for VLANs





Ethernet used for WAN Topography

Gigabit Ethernet

Gigabit Ethernet technology is applied beyond the enterprise LAN to MAN and WAN-based networks.





Physical and Data Link Features of Ethernet

Standards and Implementation





Ethernet operates across two layers of the OSI model:

Layer 2 Addresses Layer 1 Limitations



Logic Link Control – Connecting Upper Layers

Logical Link Control (LLC)



Frames the Network layer packet

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- Identifies the Network layer protocol
- Remains relatively independent of the physical equipment

Logical Link Control Sublayer								
802.3 Media Access Control								
Physical Signaling Sublayer	0m) 50 Ohm -Style	5m) 50 Ohm BNC	100m) 100 P R.J-45	(100m) 100 P R.J-45	X (25m) 150 mini-DB-9	(100m) 100 P R.J-45	((220-550m) er SC	(550-5000m) Fiber SC
Physical Medium	10BASE5 (50) Coax N	10BASE2 (18 Coax	10BASE-T (0hm UTI	100BASE-TX Ohm UTI	1000BASE-C Ohm STP	1000BASE-T Ohm UTI	1000BASE-SX MM Fib	1000BASE-LX MM of SM



Media Access Control (MAC)

MAC—Getting Data to the Media

MEDIA ACCESS CONTROL

- Data Encapsulation
 - Frame delimiting
 - Addressing
 - Error detection
- Media Access Control
 - Control of frame placement on and off the media
 - media recovery



Physical Implementations of the Ethernet

Physical Devices Implementing Ethernet



UTP patch panels in a rack



Ethernet switches



Ethernet fiber connectors



Ethernet switch

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Switches: LANs and Ethernet



6500 Family of Switches



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Home



Stackable Switches



Small Switch



Media Access Control in Ethernet

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



CSMA/CD controls access to the shared media. If there is a collision, it is detected and frames are retransmitted.

Listen Before Transmitting—Carrier signal detected

Carrier sense multiple access with collision avoidance (CSMA/CA)

A carrier sensing scheme is used:

- A node first listens to the channel for a predetermined amount of time to determine if another node is transmitting on the channel within the wireless range.
- If the channel is sensed "idle," then the node is permitted to begin the transmission process.
- If the channel is sensed as "busy," the node defers its transmission for a random period of time.
- Once the transmission process begins, it is still possible for the actual transmission of application data to not occur.



The Frame – Encapsulating the Packet

Comparison of 802.3 and Ethernet Frame Structures and Field Size



Type and Length Field



IEEE 802.3							
7	1	6	6	2	46 to 1500	4	
Preamble	Start of Frame delimiter	Destination Address	Source Address	Length/ Type	802.2 Header and Data	Frame Check Sequence	

Layer 2 addressing and Encapsulation

Hexadecimal Numbering and Addressing

Hexadecimal Numbering

Decimal and Binary equivalents of 0 to F Hexadecimal

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Decimal	Binary	Hexadecimal
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
10	1010	Α
11	1011	В
12	1100	С
13	1101	D
14	1110	E
15	1111	F

Selected Decimal, Binary and Hexadecimal equivalents

Decimal	Binary	Hexadecimal	
0	0000 0000	00	
1	0000 0001	01	
2	0000 0010	02	
3	0000 0011	03	
4	0000 0100	04	
5	0000 0101	05	
6	0000 0110	06	
7	0000 0111	07	
8	0000 1000	08	
10	0000 1010	0A	
15	0000 1111	0F	
16	0001 0000	10	
32	0010 0000	20	
64	0100 0000	40	
128	1000 0000	80	
192	1100 0000	C0	
202	1100 1010	CA	
240	1111 0000	F0	
255	1111 1111	FF	

Layer 2 addressing and Encapsulation

The Ethernet MAC Address

The MAC Address—Addressing in Ethernet

All Ethernet nodes share the media. To receive the data sent to it, each node needs a unique address.



Layer 2 vs. Layer 3 Addressing

Different Layers of Addressing





Ethernet Unicast, Multicast and Broadcast





Collusion Domain vs. Broadcast Domain

Switch Uses



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ARP – Destinations Outside the Local Network

The ARP Process—ARP Entry Enables Frame to be Sent





ARP – Removing Address Mappings

The ARP Process - Removing Address Mappings



Summary

In this chapter, you learned to:

- · Identify the basic characteristics of network media used in Ethernet.
- Describe the Physical and Data Link layer features of Ethernet.
- Describe the function and characteristics of the media access control method used by Ethernet protocol.
- Explain the importance of Layer 2 addressing used for data transmission and determine how the different types of addressing impacts network operation and performance.
- Compare and contrast the application and benefits of using Ethernet switches in a LAN as opposed to using hubs.
- Explain the ARP process.

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