Data Communication BLM3051

Furkan ÇAKMAK

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Lecture Information Form - Weekly Subjects

BLM3051 Data Communication

Week 9

Week	Date	Subjects
1	04.10.2022	Introduction to Data Communication Standards Used on Data Communication, Architectural models
2	11.10.2022	OSI Reference Model , Layers and Their Functions
3	18.10.2022	Signaling and Signal Encoding
4	25.10.2022	Parallel and Serial Transmission, Communication Media and Their Technical Specs., Multiplexing (TDM, FDM)
5	01.11.2022	Error Detection and Error Correction Techniques
6	08.11.2022	Data Link Control Techniques, Flow Control
7	15.11.2022	Asynchronous and Synchronous Data Link Protocols (BSC, HDLC)
8	22.11.2022	1. Vize Haftası
9	29.11.2022	LAN Technologies Continued, IEEE 802.4, 802.5, 802.11
10	06.12.2022	Connectionless and Connection Oriented Services, Switching
11	13.12.2022	Wide Area Networking Technologies (X.25, ISDN, FR, ATM, xDSL.)
12	20.12.2022	Communications Equipment's, TCP/IP Model, Security Issues
13	27.12.2022	Research Presentation 1
14	03.01.2022	Research Presentation 2

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LAN – Local Area Networks

- Multi-point mode
- Basic models:
  - Ethernet - IEEE 802
  - Token Bus - IEEE 802
  - Token Ring - IEEE 802
  - FDDI/CDDI (Fiber/Copper Distributed Data Interface) - ANSI
  - WLAN (Wireless LAN) - IEEE 802
- Data Link Layer is consist of HDLC
- 3 types of Media Access:
  - Fixed Based
    - TDMA, FDMA veya CDMA (Time/Frequency/Code Division Multiple Access)
  - Contention Based
    - Aloha, CMSA
  - Token/Reservation Based
    - Token Ring

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IEEE 802 Project

- LANs
  - 802.3 Ethernet
  - 802.4 Token Bus
  - 802.5 Token Ring
- Wireless LANs
  - 802.11 Wi-Fi
- Wireless PANs
  - 802.15 WPAN
  - 802.15.1 BlueTooth
  - 802.15.4 Zigbee
- WANs
  - 802.16 Wi-Max

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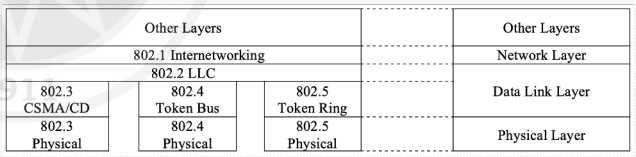
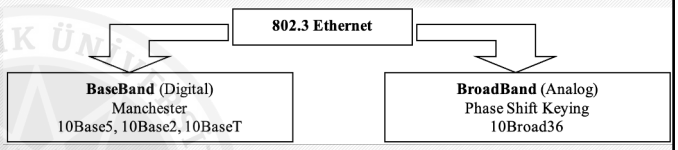
IEEE 802 Project – Con't

- to ensure compatibility between protocols used in LANs
- MAC (Media Access Control)
- LLC (Logical Link Control)
  - Un-ack connectionless service
  - Connection mode sevice
  - Ack connectionless service
- PDU (Protocol Data Unit)
  - in LLC
  - DSAP (Destination Service Access Point)
  - SSAP (Source Service Access Point)
  - Control Field
  - Information Field



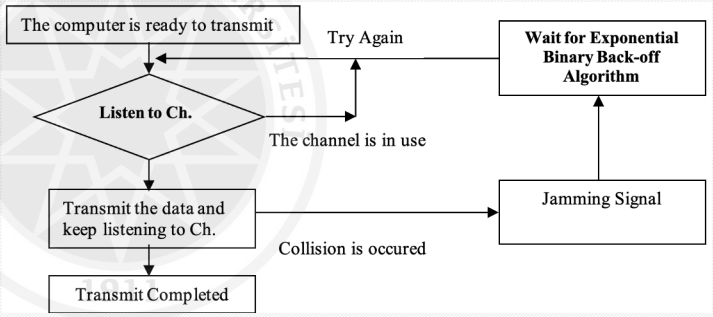
IEEE 802.3 Ethernet

- **1972**
- **Xerox Corp.**
- **Aloha**
  - **Bob Metcalfe**
  - **1973**
  - **Hawaii Islands**
    - Radio network
  - **Collision?**
  - **Utility Rate: 18%**
- **Slotted Aloha**
  - **Utility Rate: 37%**



CSMA (Carrier Sense Multiple Access)

- The goal is to improve the Slotted Aloha.
- Nonpersistent CSMA
- 1-Persistent CSMA
- p-Persistent CSMA
- CSMA/CD (Collision Detect)



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IEEE 802.3 Ethernet - Frame

7 byte	1byte	2-6 byte	2-6 byte	2 byte	46-1500	4byte
Preemble	SFD	Dest.Addr	Src.Addr.	Length	Data. Unit	CRC

- Preemble: **10101010**
  - for sync.
- SFD (Start of Frame Delimitter): **10101011**

- Shared and Switched Ethernet

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IEEE 802.3 Ethernet Variations

- **IEEE 802.3u - IEEE 802.3y - Fast Ethernet**
  - 10 Mbps -> 100 Mbps
  - Auto Negotiation
- **IEEE 802.3z - IEEE 802.3ab Gigabit Ethernet**
  - Cat5/5e/6/7/8
  - 100 Mbps -> 1000 Mbps
  - Auto Negotiation
- **IEEE 802.3ae – IEEE 802.3ak - IEEE 802.3an - IEEE 802.3aq - 10 GigE**
  - 1 Gbps -> 10 Gbps
- **IEEE 802.3ba – 40/100G Ethernet**
  - 40-100 Gbps

Metro Ethernet, *Power over Ethernet (PoE)*

IEEE 802.4-Token Bus

- In worst case scenarios, some computers seem to wait too long to transmit.
  - General Motors
  - 1980s
- Bus and Tree Topology
- Each computer recognizes the computers on its right and left.
- After the logical ring is established, the computer with the highest number will transmit
- Gives the control frame (Token) to its neighbor
- Collision is impossible
- New computers can be added or removed.
- IEEE 802.4 MAC protocol is quite complex
  - Each computer included in the system must keep up to 10 different time information and
  - Evaluate approximately 24 status information.
- 75Ω Coaxial Cable
- 3 Different Modulation Techniques are used
  - Phase continious frequency shift keying
  - Phase coherent frequency shift keying
  - Multilevel duobinary amplitude modulated shift keying
- Max speeds: 1,5 ve 10 Mbps

IEEE 802.4-Token Bus - Framing

- SD: Starting Delimitter
- FC: Frame Control
- ED: Ending Delimitter
- Frame size is almost 5 times bigger than 802.3.
- Priority mechanism:
  - 4 levels priority: 0, 2, 4, 6

1 byte	1byte	1byte	2-6 byte	2-6 byte	0-8182	4byte.	1byte
Preemble	SD	FC	Dest.Addr	Src.Addr.	Data. Unit	CRC	ED

IEEE 802.5-Token Ring

- It uses a technique based on the principle that the computers to be transmitted send their data sequentially.
- Token size: 3 bytes (even if the line is empty)
- Token Re-Sizing
- Physical Length of a Bit

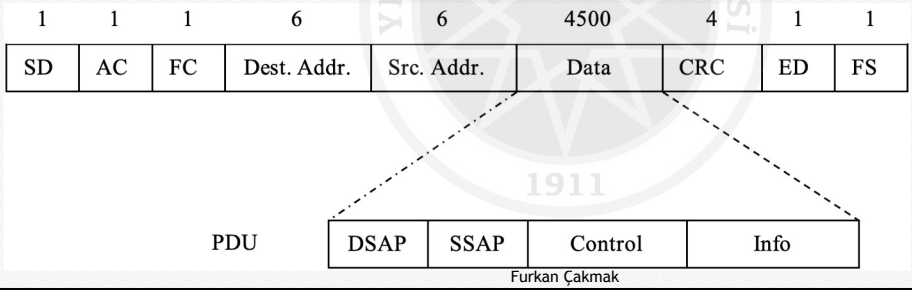
- Example: Transmission speed: R Mbps
- Bit extraction rate: 1/R μsec
- Signal propagation rate: SP m/μsec
- Every bit occupies on ring: SP/R m
- What is the number of bits (b) that can be simultaneously on an L-meter ring?
- $b = L * R / SP$

IEEE 802.5-Token Ring - Priority and Reservation

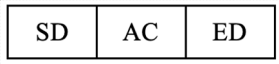
- For reservation: AC (Access Control) is used.
- Time Limitation
- Monitor Station
  - No Token Frame
  - Orphan Frame

IEEE 802.5-Token Ring - Frame

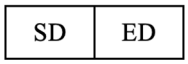
- NIC (Network Interface Card) Addresses (6-byte)
- Differential Manchester Coding
- Max speeds are 4 and 16 Mbps (IEEE 802.5t: 100 Mbps, IEEE 802.5v: 1 Gbps)
- First sending bit is MSB (different from 802.3 and 802.4)



Token



Abort



FDDI (Fiber Distributed Data Interface)

- ANSI and ITU-U standart
- Fiber optics: 100 Mbps
- Token
- S-Frame (Synchronous Frame) - priority
- A-Frame (Asynchronous Frame)
- Timing Register
  - SA (Synch. Allocation)
  - TTRT (Target Token Rotation Time)
  - AMT (Absolute Maximum Time)
  - TRT (Token Rotation Timer)
  - THT (Token Holding Time)

FDDI (Fiber Distributed Data Interface) – Con't

- 4B/5B Coding
  - Using NRZ-I

5 Bit	Explanation
00000	Q (Quit)
11111	I (Idle)
00100	H (Halt)
11000	J (Used as a starting marker)
10001	K (Used as a starting marker)
01101	T (Used as a ending marker)
11001	S (Set)
00111	R (Reset)

4 Bit	5 Bit	4 Bit	5 Bit
0000	11110	1000	10010
0001	01001	1001	10011
0010	10100	1010	10110
0011	10101	1011	10111
0100	01010	1100	11010
0101	01011	1101	11011
0110	01110	1110	11100
0111	01111	1111	11101

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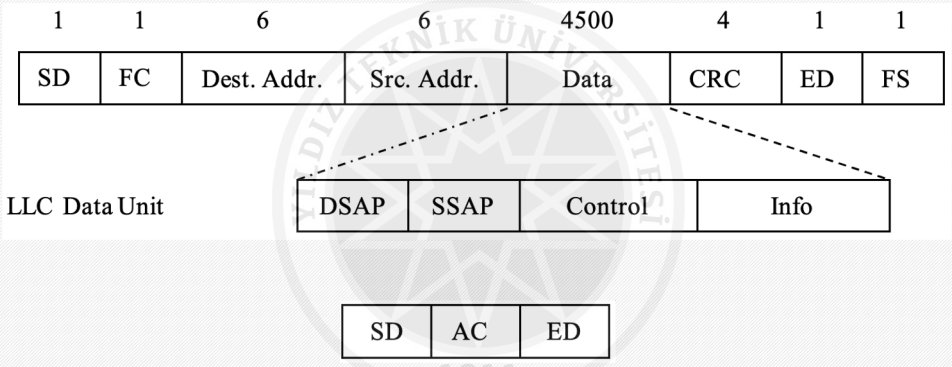
FDDI – Framing



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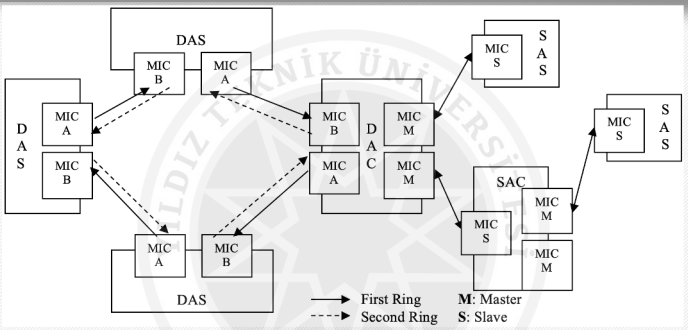
FDDI – Mechanism



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Thank you for your listening.

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