Data Communication and Computer Network

BLM3051

Dr. Öğr. Üyesi Furkan ÇAKMAK

Lecture Information

BLM3051 Data Communication and Computer Network - 1

- Course Hours: **Tuesday 09:00 - 11:50**
- All courses will be face 2 face.
- For announcements: https://avesis.yildiz.edu.tr/fcakmak/dokumanlar
  - OBS Course/Bulk Messaging System
  - Google Classroom Class Code: b5ggwqk
  - You can ask your questions via Google Classroom
  - Zoom Personal Room:
  - https://us04web.zoom.us/j/3752287039?pwd=TTFKNittZWJTUEhHREovckl0VTVYUT09
  - Meeting ID: 375 228 7039
  - Passcode: 5AXMNd
- For your questions and consultations about the course, make an appointment **AT LEAST 1 (ONE) DAY BEFORE** via the link below.
  - https://fcakmak.simplybook.it/v2/
  - No appointment will be made by e-mail.
  - Please be at the above mentioned Zoom room at the appointment time.

Lecture Information Form - Weekly Subjects

BLM3051 Data Communication and Computer Network - 1

Hafta	Tarih	Konular
1	20.02.2024	Introduction to Data Communication Standards Used on Data Communication, Architectural models
2	27.02.2024	OSI Reference Model , Layers and Their Functions, Signaling and Signal Encoding
3	05.03.2024	Parallel and Serial Transmission, Communication Media and Their Technical Specs., Multiplexing (TDM, FDM)
4	12.03.2024	Error Detection and Error Correction Techniques, Data Link Control Techniques, Flow Control
5	19.03.2024	Asynchronous and Synchronous Data Link Protocols (BSC, HDLC)
6	26.03.2024	LAN Technologies Continued, IEEE 802.4, 802.5, 802.11
7	02.04.2024	Connectionless and Connection Oriented Services, Switching
8	09.04.2024	Tatil - Ramazan Bayramı Arifesi
9	16.04.2024	1. Ara Sınav
10	23.04.2024	Tatil - 23 Nisan Ulusal Egemenlik ve Çocuk Bayramı
11	30.04.2024	Static and Dynamic Routing, Congestion in the Network Layer, Its Causes and Solutions
12	07.05.2024	IP (Internetworking Protocol), ICMP, BOOTP, DHCP
13	14.05.2024	2. Ara Sınav
14	21.05.2024	UDP (User Datagram Protocol), TCP (Transmisson Control Protocol)

Lecture Information Form– Coursebook

BLM3051 Data Communication and Computer Network - 1

	Coursebooks
1	Introduction to Data Communications & Networking, Behrouz Foruzan
2	Computer Networks 2e, Andrew S. Tanenbaum
3	Data Networks:Concepts, Theory and Practice, Uyless D.Black
4	Routing & Switching: Time of convergence, Puzmanova

Lecture Information Form- Evaluation

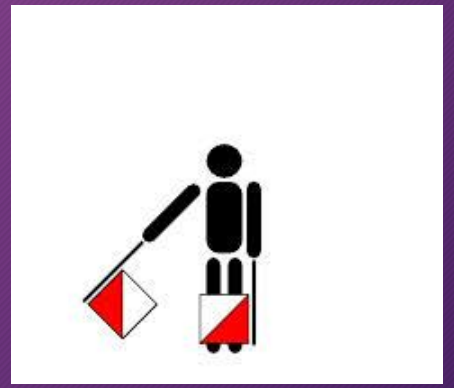
	Method	#	Impact (%)
Evaluation System	Midterms	2	40
	Quizs	-	-
	Homeworks	-	-
	Projects	1	20
	Semester Project	-	-
	Laboratory	-	-
	Other	-	-
	Final Exam	1	40

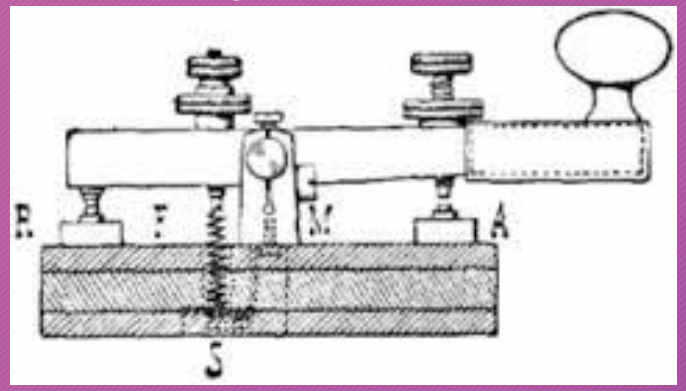
What is Communication?

- Sharing information/data
- Telecommunication (Tele -> far *Greek)
- Communication Aim: Trafic data
- Telephone, Television, vb.
  - Ses, video, resim
- Computer
  - Medium/Media -> 0/1
- Protocol Stack: Software and Hardware

What is Communication? – Con't

- Humanity History: 200k
- Sumerians: B.C 4000
- ***«Verba volant, scripta manent»***
- Copper Cable
  - Telegraph: 1837-1838
  - Telephone: 1876

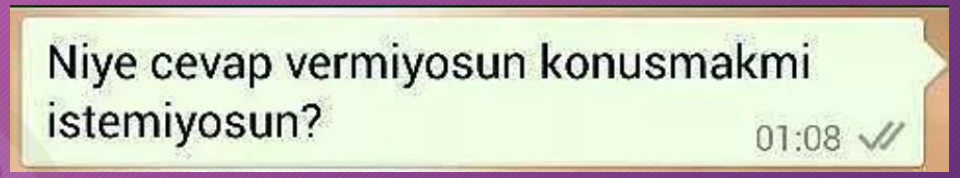


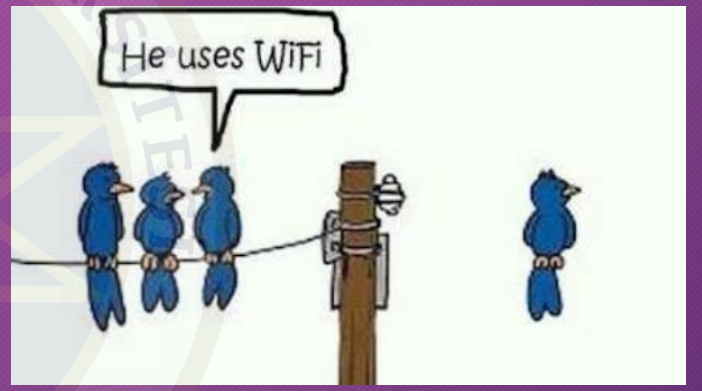


Essentials of Data Communication

BLM3051 Data Communication and Computer Network - 1

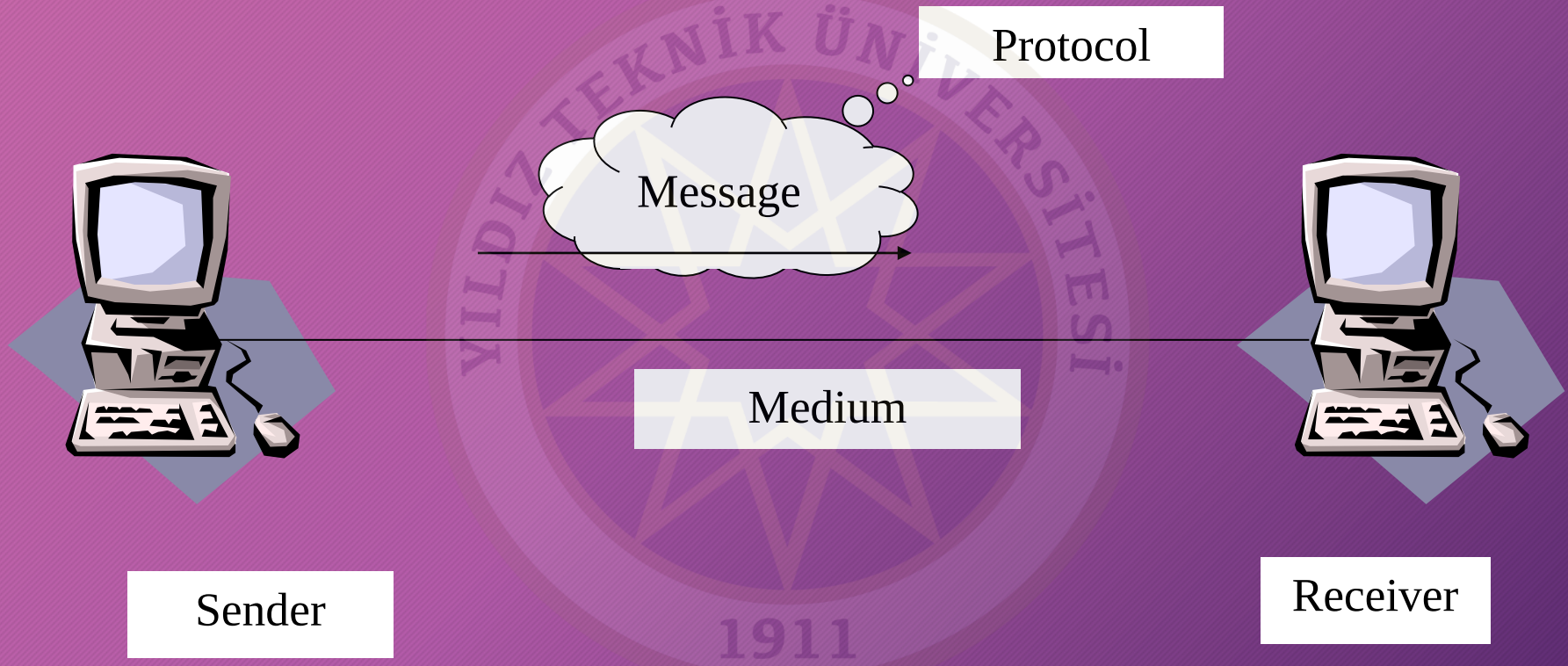
- Message
- Sender
- Receiver
- Medium
- Protocol





Data Communication

BLM3051 Data Communication and Computer Network - 1

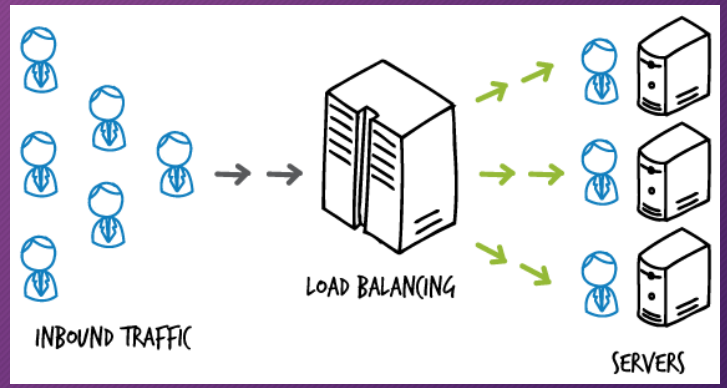


Data Comm. Features

- Delivery
- Accuracy
- Timeliness

Pros of Computer Network

- Resource Sharing
- Info/Data Sharing
- Load Sharing / Balancing
- Reliability
- Econmony
- Efficient communication between in different places



Evaluation Criteria for Computer Networks

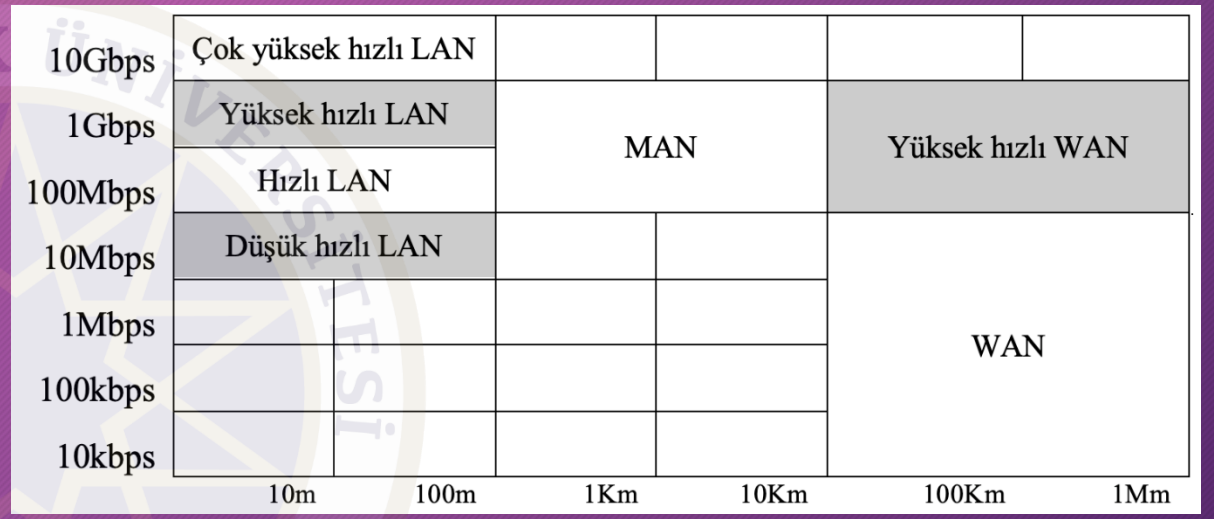
- Performance
  - Transmit time
  - Response time
- QoS
  - Circuit-switched (Synchronous)→ Bit rate, Min Error Rate, Transmission Rate
  - Packet-switched (Asynchronous) → Maximum Packet Size, Mean Packet Transfer Rate, Mean Packet Error Rate, Jitter, Mean Packet Transmit Delay
- Reliability/Availability
  - MTBF – Mean Time Between Failure
  - Restoring Time
  - 5-9 → 99,999%
- Security
- Scaleable
- Adaptable
  - Software, Hardware

Network Standards

- De Jure
  - ISO (International Organization for Standardization)
  - ITU (The **International** Telegraph and **Telephone** Consultative Committee)
  - IEEE (The Institute of Electrical and Electronics Engineers)
  - ETSI (The European Telecommunications Standards Institute)
  - EIA (Energy Information Administration)
  - TIA (Telecommunications Industry Association)
  - ANSI (American National Standards Institute)
  - TSE (Türk Standartları Enstitüsü)
  - IETF (Internet Engineering Task Force)
- De Facto
  - QWERTY keyboards
  - VHS video format
  - PDF document type
  - Buttons on men's shirts are on the right, buttons on women's shirts are on the left.

Computer Network (CN)

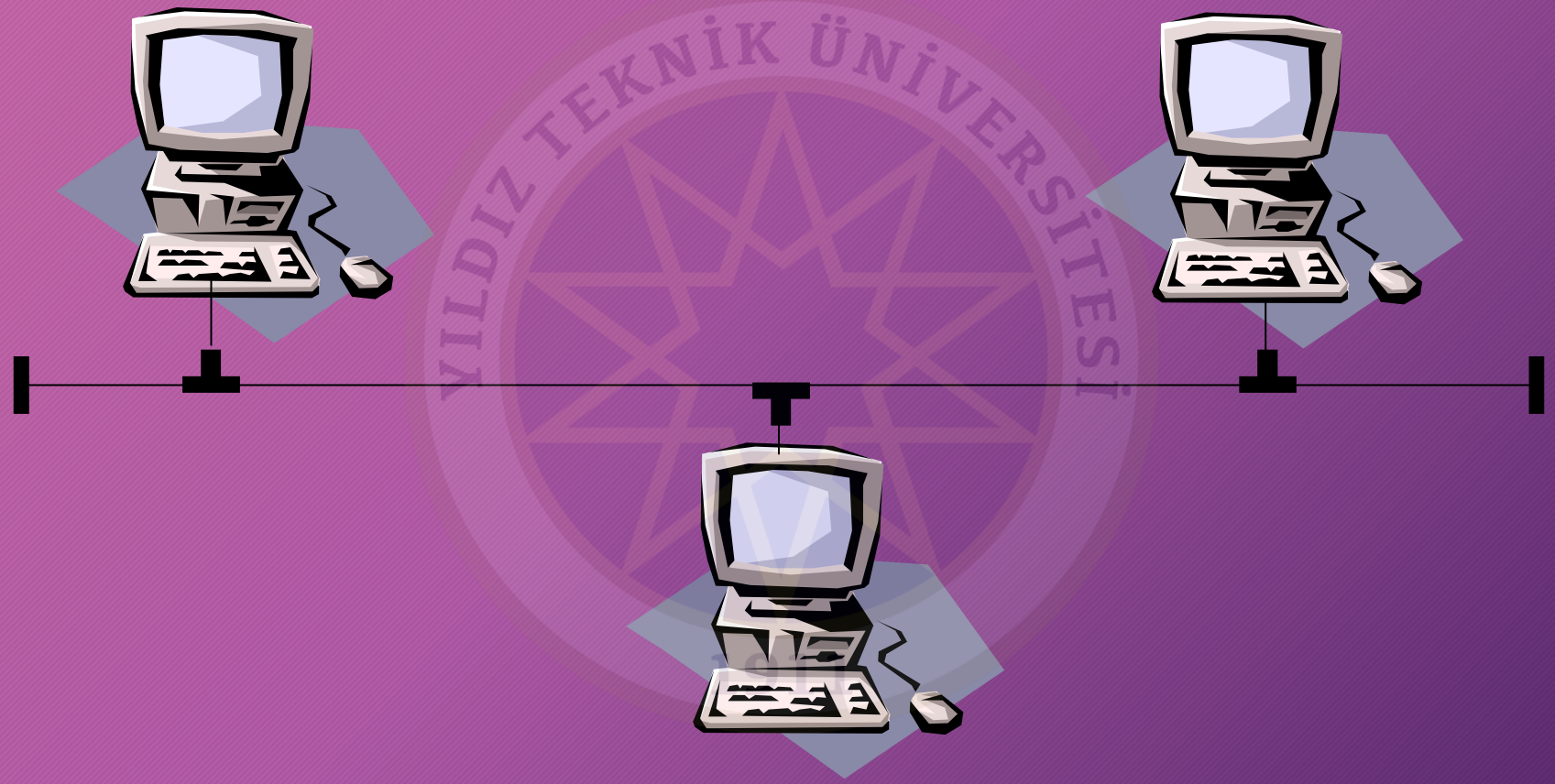
- ARPANET (1970s)
- Classification of CN
  - Technique of Tranmission
    - Broadcast
    - Peer to peer – P2P
  - Network Dimension
    - PAN-Personal Area Network (< 10m)
    - LAN-Local Area Network (< 100m-200m)
    - CAN-Campus Area Network (< 1-5km)
    - MAN-Metropolitan Area Network (< 10-50km)
    - RAN-Regional Area Network (< 100-200km)
    - WAN- Wide Area Network (< 1000km)
  - Bit Rate



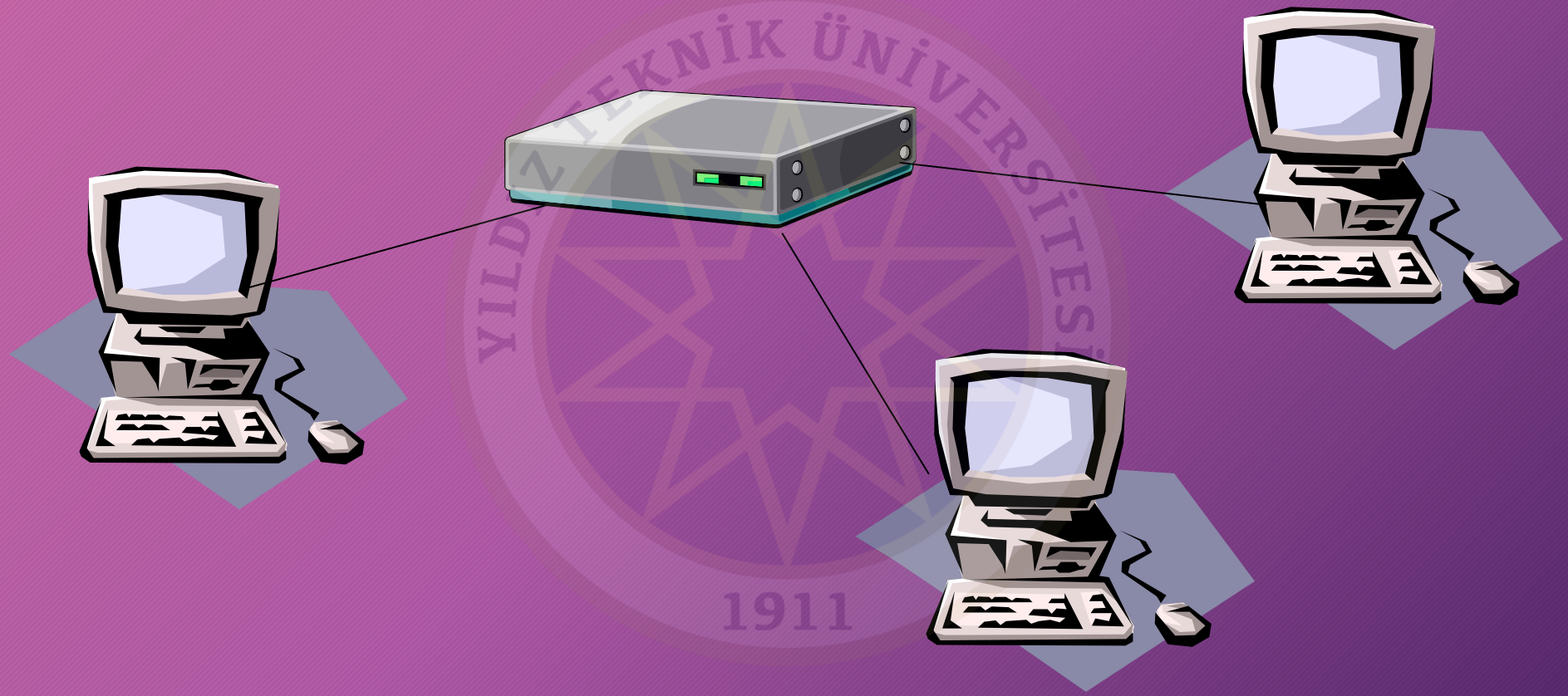
Topology

- Bus
- Star
- Tree
- Ring
- Mesh
- Hybrid

Bus Topology

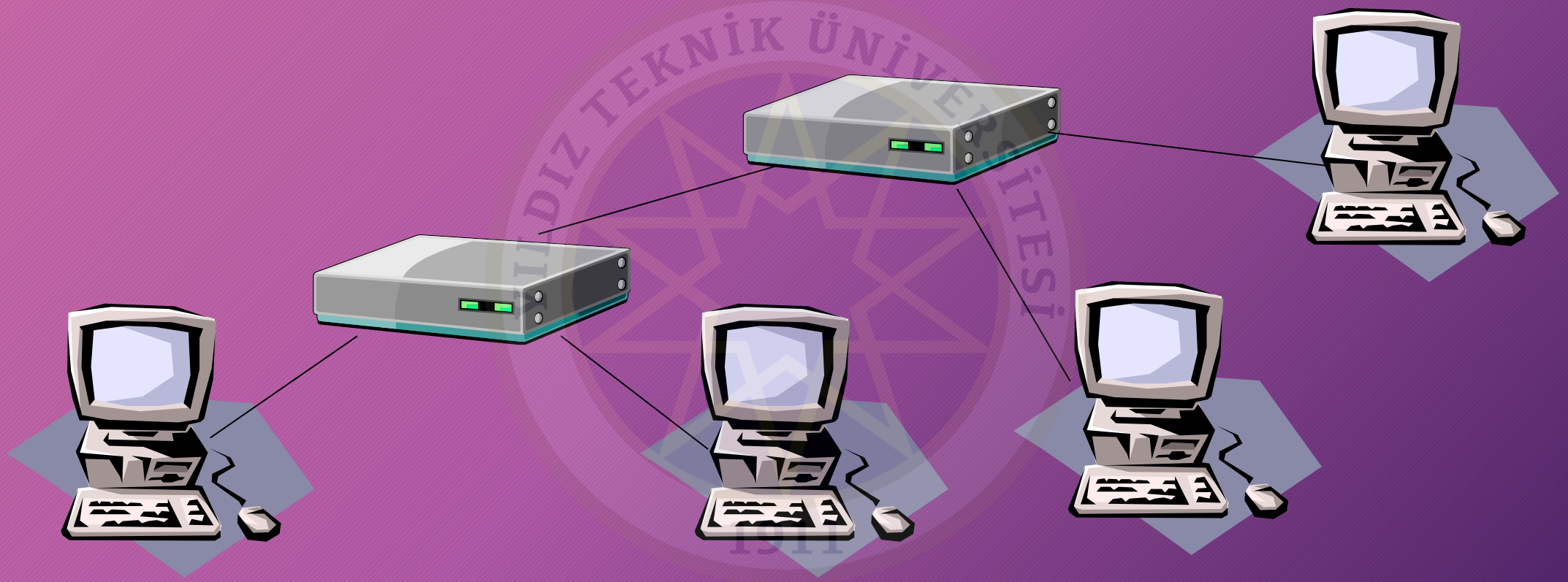


Star Topology

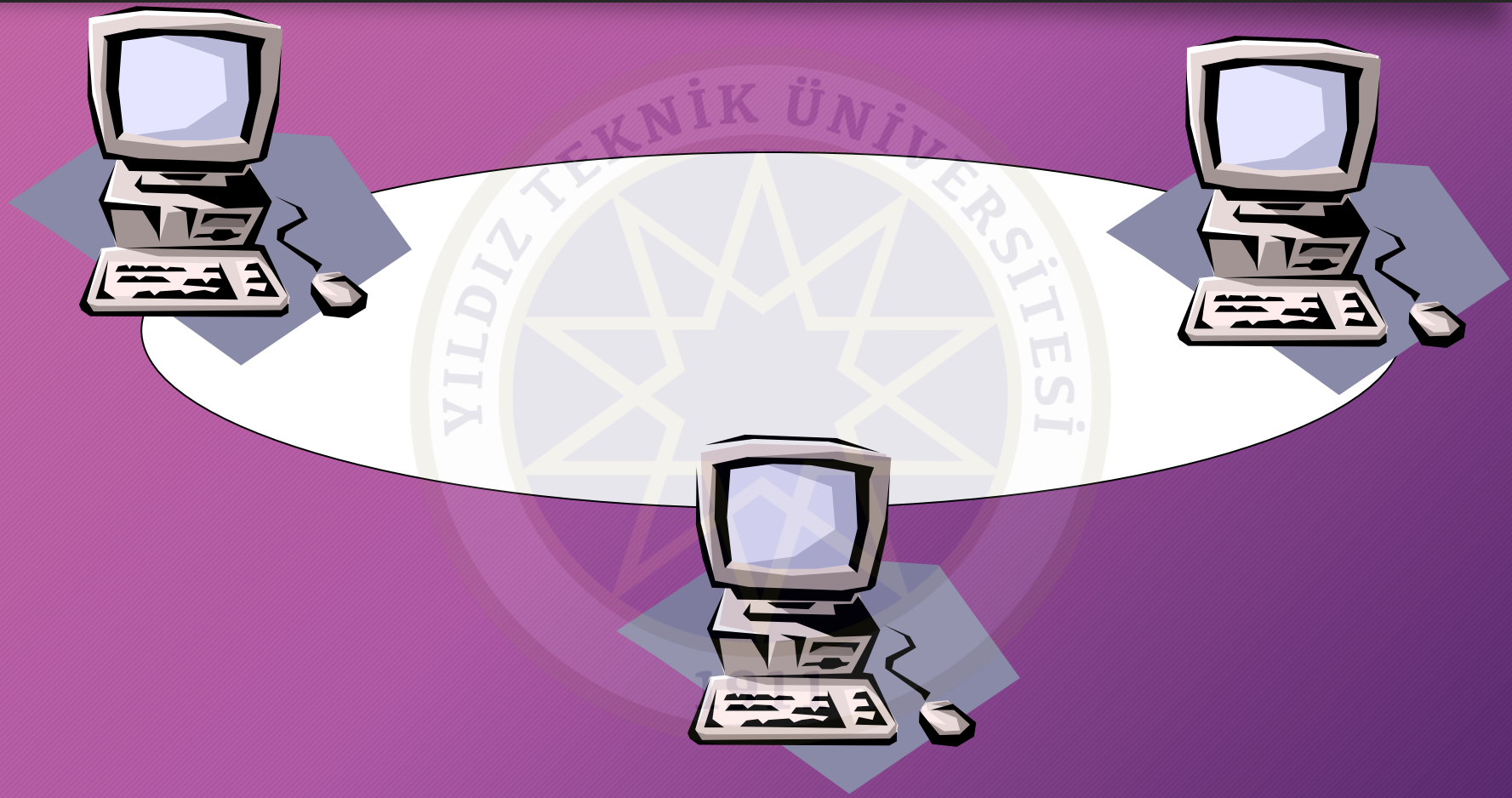


Tree Topology

BLM3051
Data
Communication
and Computer
Network - 1

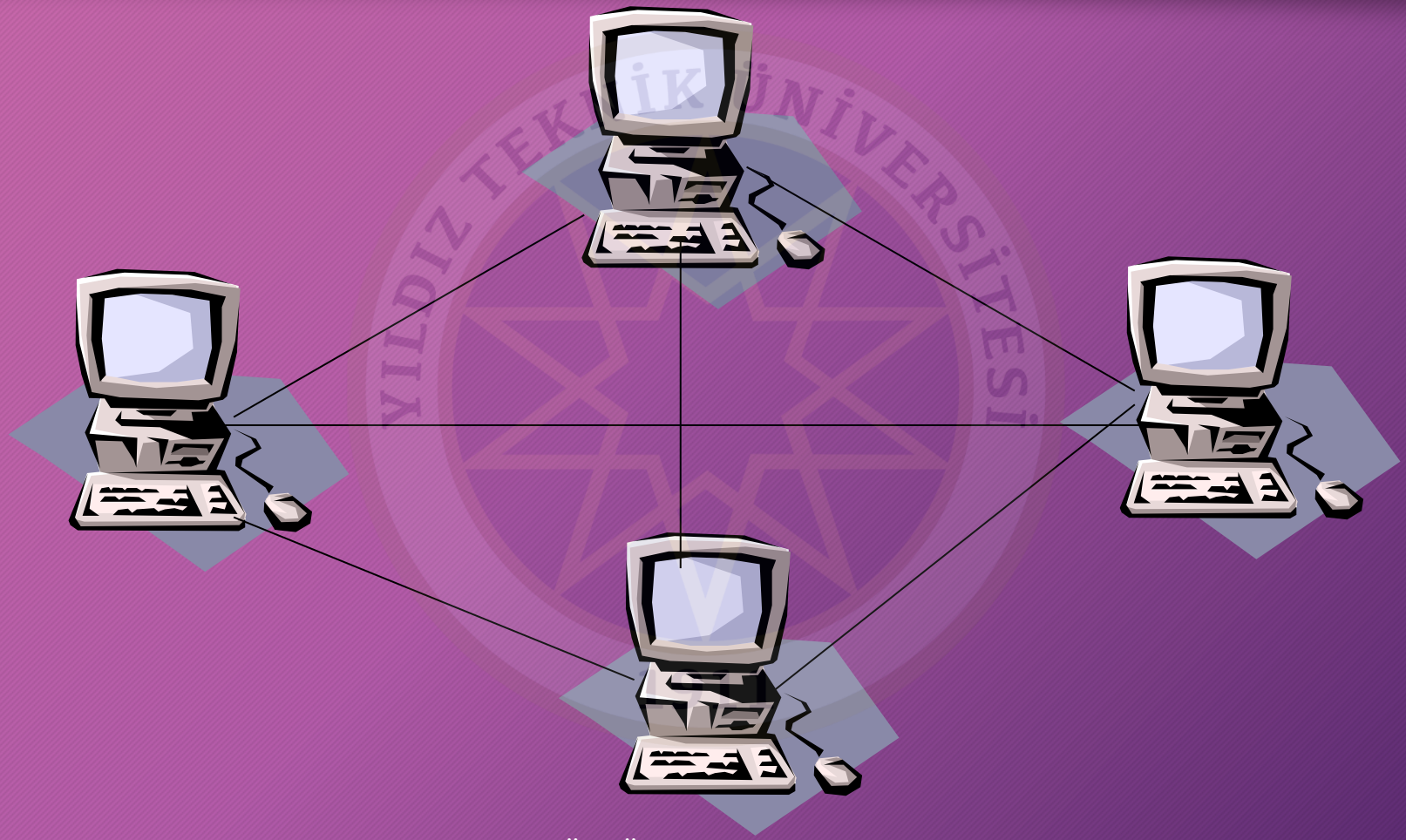


Ring Topology



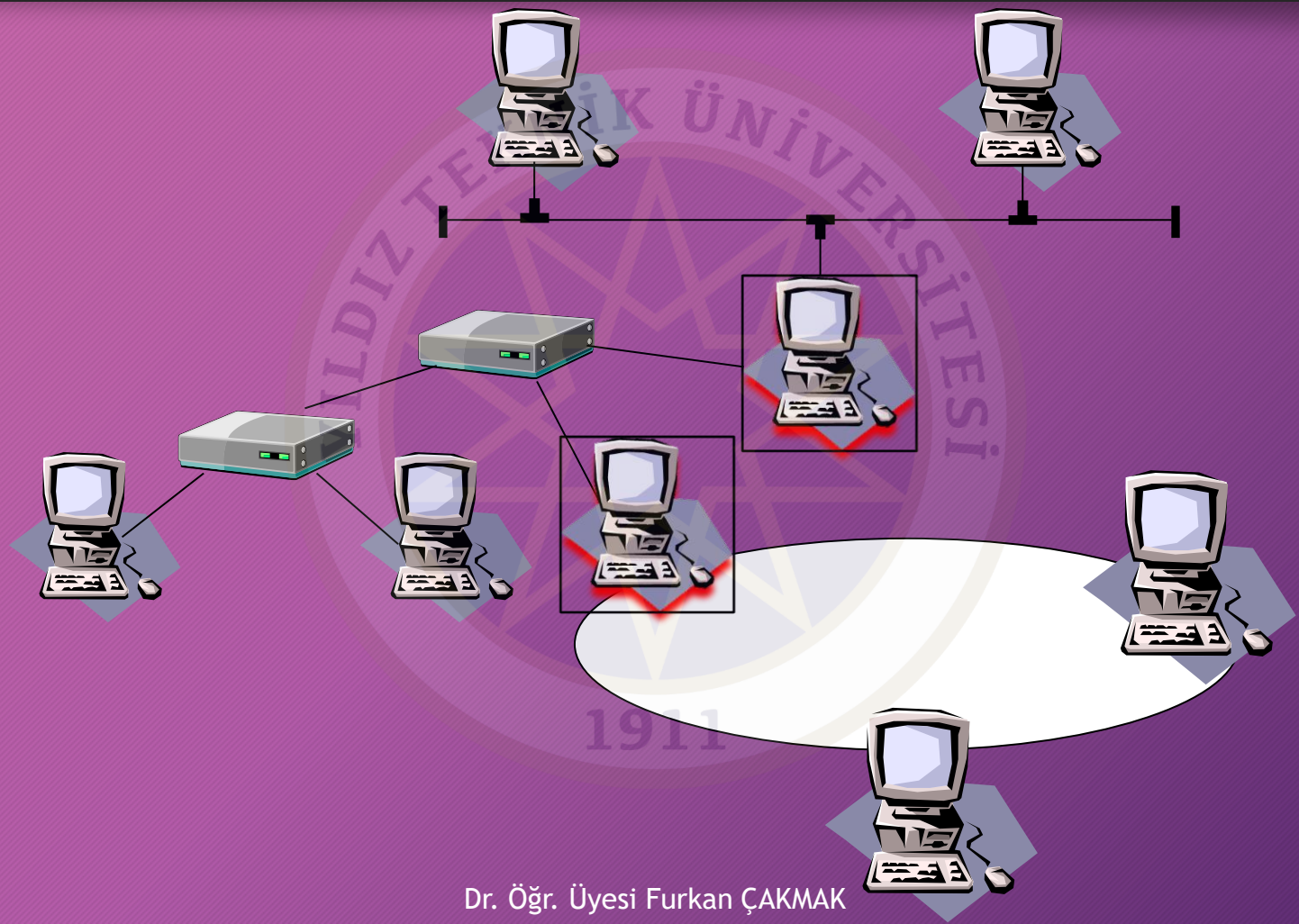
Mesh Topology

BLM3051 Data Communication and Computer Network - 1



Hybrid Topology

BLM3051
Data
Communication
and Computer
Network - 1



Transmission Model

- Simplex
  - Mouse
  - Bar Code Reader
- Half-Duplex
  - Radio
- Duplex
  - LAN

Addressing Model

- Broadcast
  - TV
- Multicast
  - Stream Video
- Anycast
  - DNS
- Unicast
  - Letter

Data Flow Density, Bit Rate, Throughput

- Symmetric
- Asymmetric

- bps (bit-ps), Bps (Byte-ps)
  - Kilo (k), Mega (M), Giga (G), Tera (T), Peta (P), Exa (E), Zetta (Z) ve Yotta (Y)

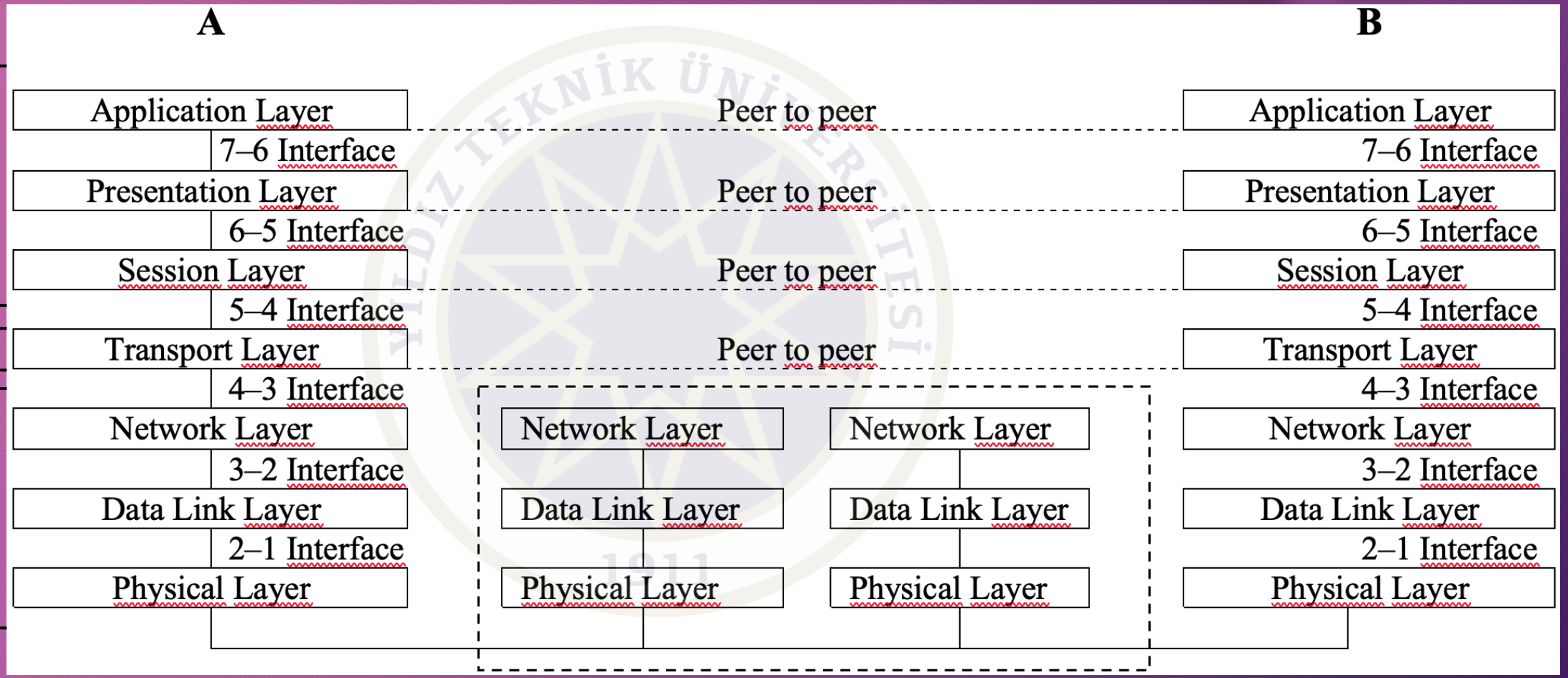
- Throughput
- Response time
- Jitter

OSI Reference Model

- ISO – 1984
- De Jure
- Features
  - Open
  - Flexible
  - Robust
  - Interoperable
  - Easy to explain
  - Easy to understand
- 7-layers
- Never applied / Ideal Model

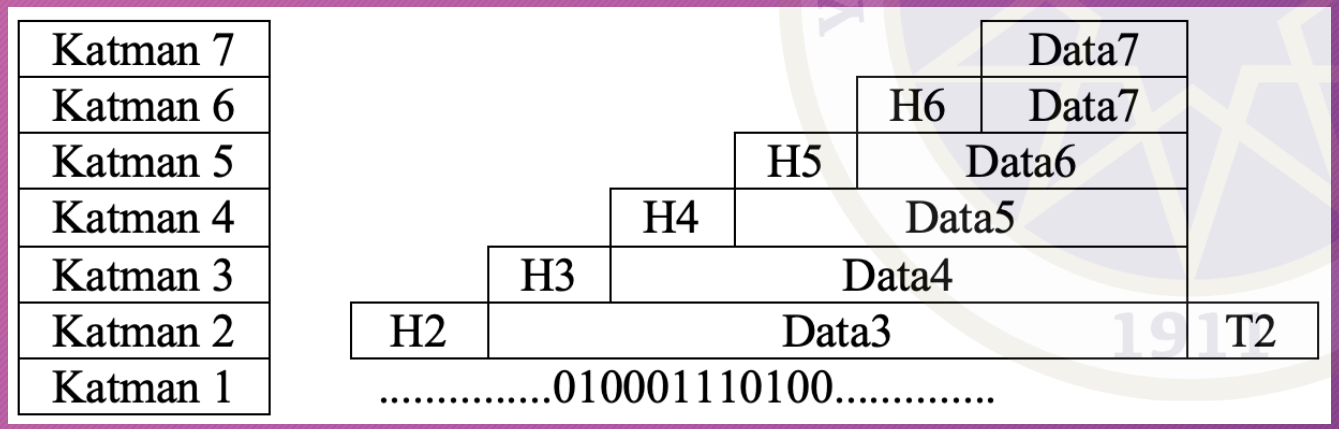
7	Application Layer
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI Reference Model – Con't



OSI Reference Model – Con't

- Each layers add a **header** package.
- Only second layer (Data link) add a **trailer** end of the package.
  - Error control
- Encapsulation



OSI – Physical Layer

- Responsible for **trasmitting bit arrays** between peers.
- General functions of the Physical Layer;
  - Electromechanic
  - **Direction** of the package
  - Determining **magnitudes** of signals
    - Amplitude, Wavelength, Frequency
  - **Initiation** and **termination** of the physical connection.

7	Application Layer
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	**Physical Layer**

OSI – Data Link Layer

- Extract/divide **frames** from the messages.
- Send frames to receiver side **in an order.**
- Using acknowledgment (ACK) info;
  - In case of an **error,**
  - In case of **not receive** the package,
  - **Re-transmission**
- Add **header** and **trailer** data to frames.
  - To determine the **starting and ending points** of the frame.
- Header includes;
  - Sender address,
  - Receiver address,
  - Order info
- Trailer includes;
  - A code (to check errors)

7	Application Layer
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	Network Layer
2	**Data Link Layer**
1	Physical Layer

OSI – Data Link Layer – Con't

- General functions of the Data Link Layer;
  - Node to node **error free** delivery
  - Addressing (in header part)
    - MAC Address
  - Access Control
  - Flow Control
  - Error Handling
  - Synchronization
- In Local Area Network (LAN)
  - DLL divides into 2 different layers;
    - LLC (Logical Link Control)
    - MAC (Media Access Control)
- Communication at the data link layer is in the **same network**.

7	Application Layer
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI – Network Layer

BLM3051 Data Communication and Computer Network - 1

- Network layer is responsible for;
  - **Efficiently** and **accurately** forwarding the packet
  - From source to destination **over different network links**.
- Communication at the network layer is in the **different network**
  - **Router (3rd level devices)**
- **Switching**
  - Connection oriented
    - like telephone infrastructure system
- **Routing**
  - **Determining the path between sender and receiver**
  - **Connectionless**
    - **Delivering packages**
  - **In DLL, data transfer occurs between nodes**

7	Application Layer
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI – Network Layer – Con't

- Address must be different from DLL's addresses.
  - Logical Address
- **Data transfer occurs between the source and the destination.**
- General functions of the Network Layer;
  - **Source to Destination packet delivery**
  - **Logical addressing**
  - **Routing**
  - **Address transformation**
    - Between logical and physical addresses
  - **Multiplexing**
    - Multiple physical connections on a single newtwork connection at the same time

7	Application Layer
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	**Network Layer**
2	Data Link Layer
1	Physical Layer

OSI – Transport Layer

- Responsible for the **transmission of data**
  - from source to destination
- Network layer responsible for delivering data
- Transport layer responsible for delivering packages
  - data = package[]
- Data transmission is between applications, not computers.
- An additional addressing mechanism is required
  - to **distinguish the applications from each other**.
  - **Service Access Point – SAP**
    - Ports, Sockets
- Transport layer **divides the incoming information into pieces (*segment*)** in sizes **supported by the infrastructure**.
  - Segmentation
    - Sequence number
    - Re-assembly

7	Application Layer
6	Presentation Layer
5	Session Layer
4	**Transport Layer**
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI – Transport Layer – Con't

- There are **two types** of services.
  - **Connectionless**
    - Like post services
  - **Connection oriented**
    - Like phone services
      - Establish connection
      - Data transmission
      - Terminate connection
    - **More control over the data to be transferred**
- General functions of the Transport Layer;
  - Data transmission between source and destionation nodes
  - To **provide data flow** between applications with **the help of service points**
  - **Segmentation & Re-assembling**
  - Ensuring connection control
    - Connectionless | Connection oriented

7	Application Layer
6	Presentation Layer
5	Session Layer
4	**Transport Layer**
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI – Session Layer

- This layer is responsible for **ensuring continuity**.
  - Synchronization
- Choosing connection type
  - Half-duplex
  - Duplex
- Session data transfering
  - Password
  - Logon verification
- **Sessions** can **be split into sub-sessions** to ensure the **reliability of the connection**
- Sub-sessions are provided with **checkpoint** information.

7	Application Layer
6	Presentation Layer
5	**Session Layer**
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI – Session Layer – Con't

- General functions of the Session Layer;
  - **Managing the session**
  - **Communication control**
    - if it is half-duplex
  - **Ensuring synchronization**
  - **Gracefull close**

7	Application Layer
6	Presentation Layer
5	**Session Layer**
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI – Presentation Layer

- General functions of the Presentation Layer;
  - **Provides interoperability** by **eliminating possible differences** in **information representation** between devices during data communication
    - Abstract data syntax
  - **Encryption & Decryption**
  - **Compression & Decompression**

7	Application Layer
6	**Presentation Layer**
5	Session Layer
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

OSI – Application Layer

BLM3051 Data Communication and Computer Network - 1

- User Interfaces
  - Electronical mail (e-mail)
  - File transfering
  - Remote desktop control
  - Internet explorer
  - vb.

7	**Application Layer**
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

Other Network Models

OSI Modeli	TCP/IP Modeli	DNA
Uygulama Katmanı	Uygulama Katmanı	Ağ Uygulama
Sunu Katmanı		Son Kullanıcı
Oturum Katmanı		Oturum
Taşıma Katmanı	Taşıma Katmanı	Ağ Servisleri
Ağ Katmanı	Internet Katmanı	Taşıma Katmanı
Veri Bağı Katmanı	Ağ Erişim Katmanı	Veri Bağı Katmanı
Fiziksel Katman		Fiziksel Katmanı

Thank you for your listening.

BLM3051
Data Communication and Computer Network - 1

Dr. Öğr. Üyesi Furkan ÇAKMAK