Veri İletişimi ve Bilgisayar Ağları
BLM3051

Dr. Öğr. Üyesi Furkan ÇAKMAK

Ders Bilgilendirme Formu – Haftalık Konular

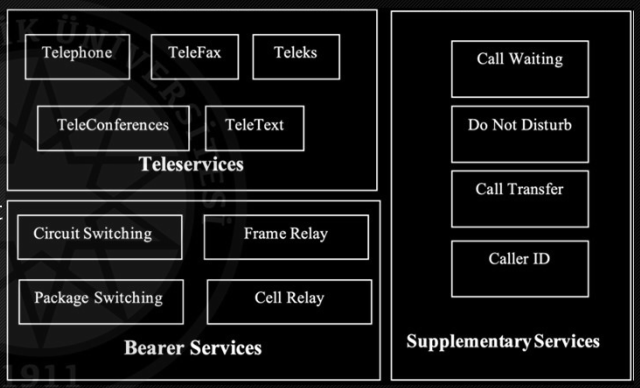
Week #	Date	Subjects
1	20.02.2025	Veri İletişimine Giriş, Mimari Modeller
2	27.02.2025	OSI Referans Modeli, Katmanları, Fonksiyonları
3	06.03.2025	Fiziksel Katman, Sinyalleşme
4	13.03.2025	Paralel ve Seri İletişim, Haberleşme Ortamları ve Teknik Özellikleri, Multiplexing (TDM, FDM)
5	20.03.2025	Hata Tespiti ve Düzeltme Yöntemleri
6	27.03.2025	Veri Bağı Kontrol Teknikleri ve Akış Kontrolü
7	03.04.2025	Senkron ve Asenkron Veri Bağı Protokolleri (BSC, HDLC)
8	10.04.2025	Ara Sınav
9	17.04.2025	LAN Teknolojileri, IEEE 802.3, IEEE 802.4, 802.5, 802.11
10	24.04.2025	Geniş Alan Ağlarında Kullanılan Teknolojiler (X.25, ISDN, FR, ATM, xDSL.)
11	01.05.2025	Emek ve Dayanışma Günü
12	08.05.2025	Ağ Katmanı, Anahtarlama, Bağlantılı ve Bağlantısız Servisler, Statik ve Dinamik Routing
13	15.05.2025	Ağ Katmanında Sıkışıklık, Sebepleri ve Çözümleri, IP (Internetworking Protocol)
14	22.05.2025	ICMP, BOOTP, DHCP, Taşıma Katmanı - UDP (User Datagram Protocol), TCP (Transmisson Control Protocol)
15	29.05.2025	Öğrenci Proje Sunumları

Wide Area Networks (WANs)

- Circuit Switching Techniques
  - Leased Line
  - N-ISDN (Narrowband ISDN)
- Package Switching Techniques
  - X25
  - Frame Relay
  - ATM (Asynchronous Transfer Mode)

ISDN (Integrated Services Digital Network)

- ITU-T
- Circuit Switching
- Voice and Data
- ISDN Digital Services
  - Bearer Services (Transfer of informat
  - Teleservices
  - Supplementary Service

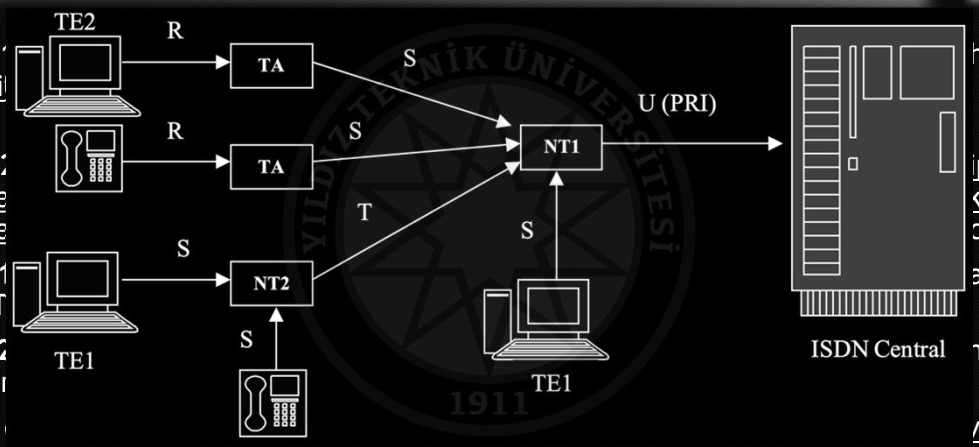


ISDN Layers

- ISDN Layers
  - B/H (Bearer/Hybrid)
    - Data Transfer
  - D (Data)
    - Control Signaling
  - Physical Layer
    - BRI (Basic Rate Interface - I.430)
    - PRI (Primary Rate Interface - I.431)
  - Data Link Layer
    - LAPB (Link Access Protocol B-Channel)
    - LAPD (Link Access Protocol D-Channel)
  - Network Layer
    - X25
    - ATM
    - FR
    - Q.931

	B/H Channel	D Channel
Upper Layers	Left to the user's choice	End-to-end user signaling
Network Layer	X.25, FR, ATM (Package switching servises)	Q.93 (Link control protocol)
Data Link Layer	LAPB	LAPD
Physical Layer	BRI (I.430) and/or PRI (I.431)	

ISDN Equipments



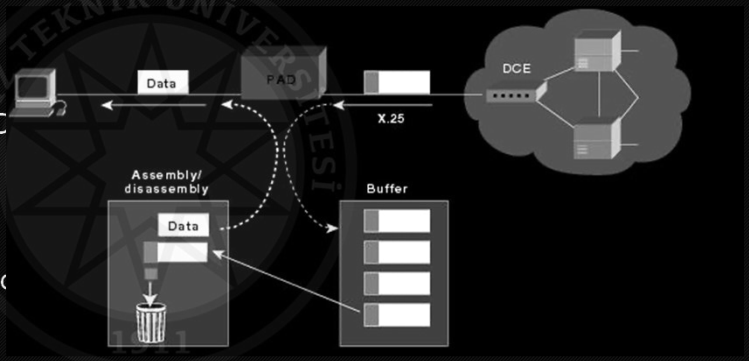
- **NT** ...he ISDN swi...
  - ...
- **NT** ...iplexing ope... ketizing ope... device.
- **TE** ...andards (DT...
- **TE** ...he ISDN sta...
- **TA** ...versions to connect devices that do not support ISDN (TE2) to the ISDN structure.

ISDN Connections

- Narrowband ISDN provides 6 different types of end-to-end services.
  - Circuit-switched calls over channel B or H
  - Semi-permanent connections over channel B or H
  - Packet switched calls over channel B or H
  - Packet switched calls over channel D
  - Frame Relay calls over channel B or H
  - Frame Relay calls over channel D

X.25

- The first packet-switched WAN service
  - 1970s
  - High error rates
  - Low speed networks
- The service between DTE (PC
- VC Package Switching
  - Full duplex
- Asynchronous TDM
- Error Detection on each devi
- Sliding Window
- Go Back N

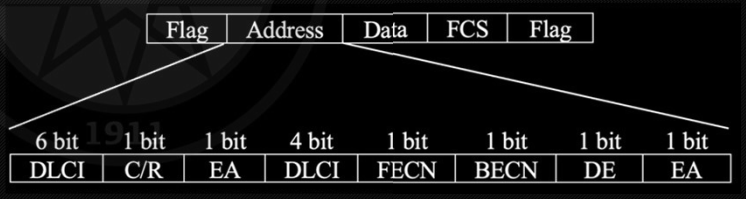


Frame Relay

- Works on Physical and Data Link Layer
- Better Error Rate (10^{-7})
  - Error detections are only at the ends.
  - Control signaling is separated from user data and transmitted over a different logical channel.
  - Significant performance increase compare to X.25
- Uses PVC
- FRAD (Frame Relay Assembler/Disassembler)
  - Connecting LANS to WANs

FR Frame Structure

- DLCI (Data Link Connection Identifier)
- C/R (Command/Response)
- EA (Extended Address)
  - 0 or 1
- FECN (Forward Explicit Congestion Notification)
- BECN (Backward ECN)
- DE (Discard Eligibility)
  - Congestion Recovery
    - Leaky Bucket
  - Congestion Avoidance

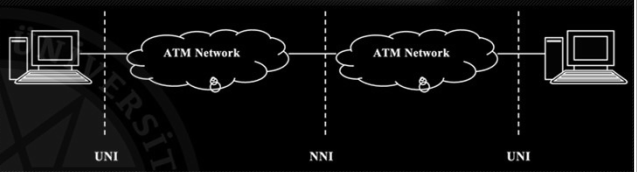


ATM (Asynchronous Transfer Mode)

- Designed by ATM Forum, accepted by ITU-T
- A cell-switched protocol
- Especially fiber optic transmission media
- It works compatible with packet switching structures used in WANs.
- It is easily preferred due to its low cost.
- Provides support for existing communication hierarchy and interoperability.
- Thanks to its connection-oriented structure, it creates an accurate and predictable transmission technique.
- It aims to achieve high transmission speeds by performing the functions on the hardware side - as much as possible.

ATM (Asynchronous Transfer Mode)

- A cell-switched protocol
  - Data: 48-byte
  - Header: 5-byte
- VPI-VCI
- Speed is higher compare to X.25 and FR
- ATM can be seen as an advanced form of circuit switching
  - Multiple virtual channels
  - It extends circuit switching to create multiple channels, each with a data rate determined by need.
- NNI (Network to Network Interface): Connecting the ATM switching device
- UNI (User Network Interface): Connecting end systems in the ATM structure with ATM switches

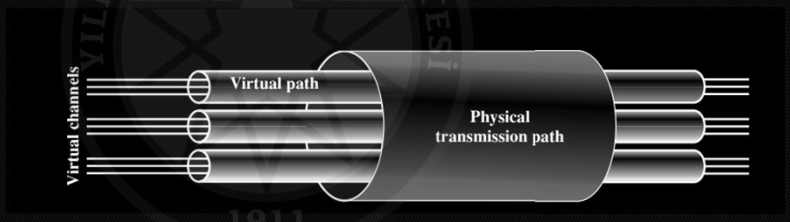


ATM Layers

- 3 layer structre:
  - Physical Layer
  - ATM Layer
  - AAL (Application Adaptation Layer-ATM Adaptation Layer)
- AAL is used to enable existing packet switched networks to benefit from ATM facilities.
- AAL different traffic levels:
  - **AAL 1:** Constant bit rate data (CBR): These cover real-time applications (real-time audio, video) where latency is minimal.
  - **AAL 2:** Variable bit rate data (VBR): Covers applications that can vary in bit rates (compressed audio, data, video).
  - **AAL 3/4:** Connection oriented packet data: Includes applications that use virtual circuits (VCs), such as X.25 and TCP.
  - **AAL 5:** Connectionless packet data: Includes applications that use datagram structure, such as IP.

ATM Layers (Con't)

- 3 layer structre:
  - Physical Layer
  - **ATM Layer**
  - ~~AAL (Application Adaptation Layer-ATM Adaptation Layer)~~
- ATM Layer:
  - Routing
  - Switching
  - Multiplexing



Thank you for listening…

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