Course: Computer and Communication Networks

Topic: Asynchronous Transfer Mode (ATM) and Softswitch Architecture

Presentation by

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(Deemed to be University)
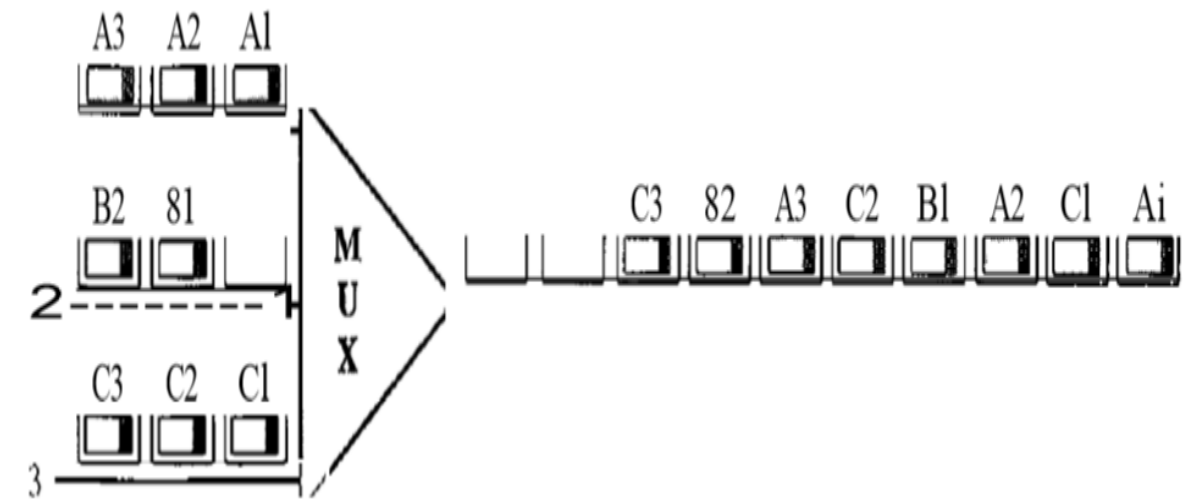Bhadson Road, Patiala, Punjab, Pin-147004
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THAPAR INSTITUTE
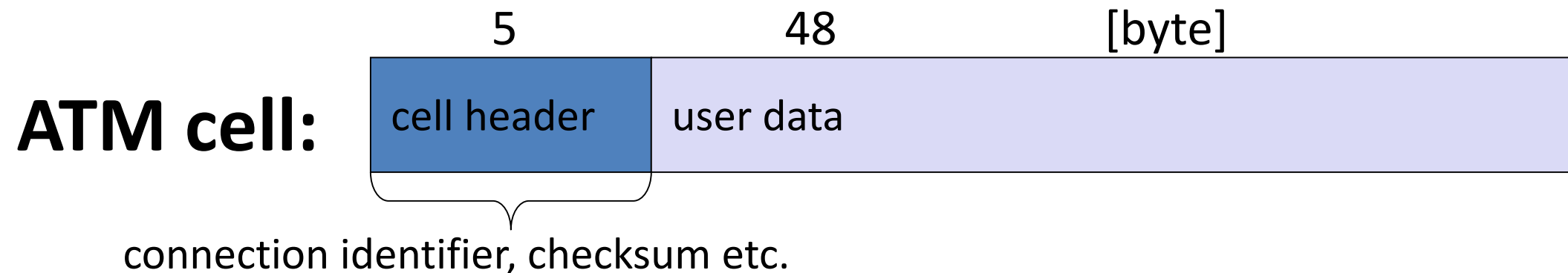OF ENGINEERING & TECHNOLOGY
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ATM: Design Goals

❑ seamless connection to wired ATM, an integrated services high-performance network supporting different types a traffic streams

❑ ATM networks scale well: private and corporate LANs, WAN

❑ B-ISDN uses ATM as backbone infrastructure and integrates several different services in one universal system

❑ mobile phones and mobile communications have an ever increasing importance in everyday life

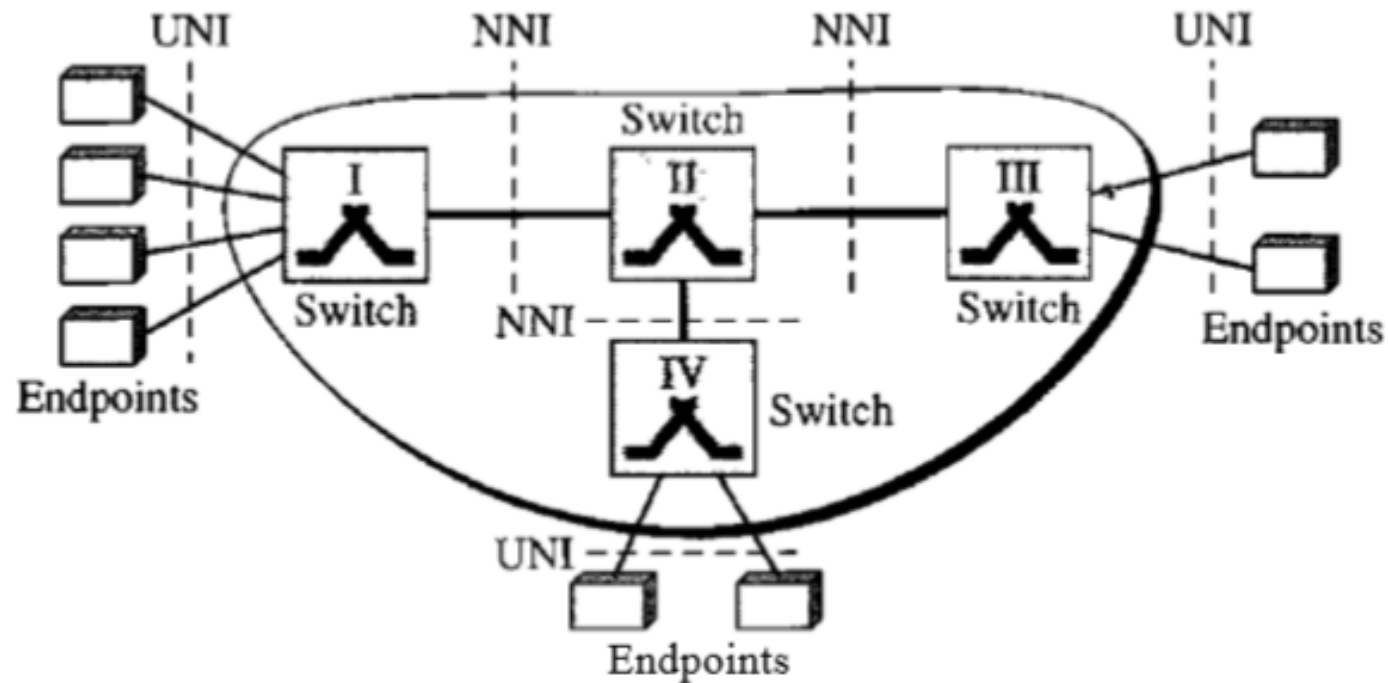❑ current wireless LANs do not offer adequate support for multimedia data streams

Reference: 1. Ferouzan, Behrouz A., Data Communications and Networking, 2. Stallings William, Data and Computer Communication. 3. https://ieeexplore.ieee.org

ATM - basic principle

–   statistical (asynchronous, on demand) TDM (ATDM, STDM)

–   cell header determines the connection the user data belongs to

–   mixing of different cell-rates is possible

different bit-rates, constant or variable, feasible

–   interesting for data sources with varying bit-rate:

- ### e.g., guaranteed minimum bit-rate

- ### additionally bursty traffic if allowed by the network

	5	48	[byte]
ATM cell:	cell header	user data	

connection identifier, checksum etc.

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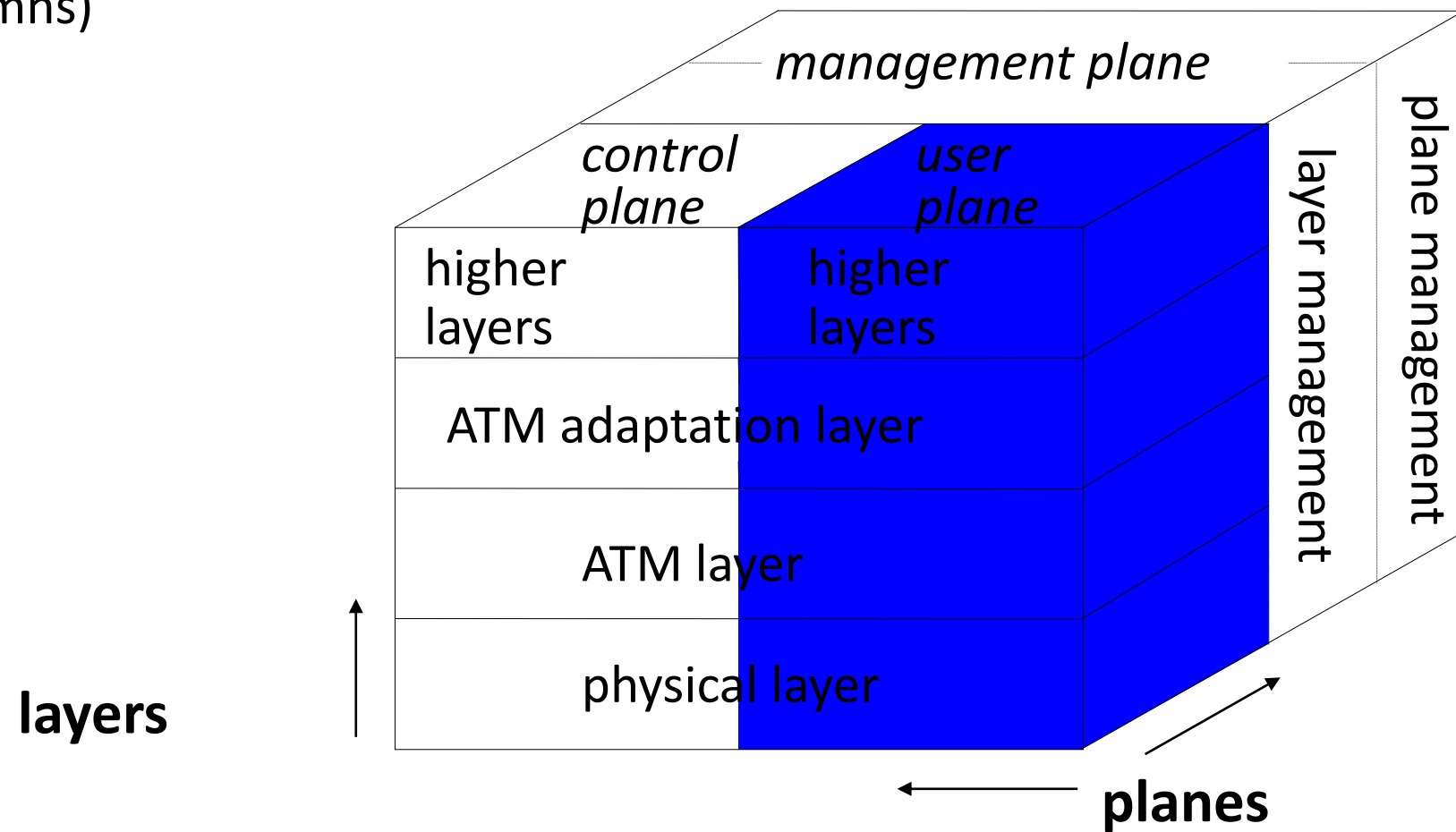
ATM Architecture

- asynchronous, cell-based transmission as basis for ATM, continuous cell-stream

- additional cells necessary for operation and maintenance of the network (OAM cells; Operation and Maintenance)

- OAM cells can be inserted after fixed intervals to create a logical frame structure

- if a station has no data to send it automatically inserts idle cells that can be discarded at every intermediate system without further notice

Reference: 1. Ferouzan, Behrouz A., Data Communications and Networking, 2. Stallings William, Data and Computer Communication. 3. https://ieeexplore.ieee.org

ATM

3 dimensional reference model
- three vertical planes (columns)
  - user plane
  - control plane
  - management plane
- three hierarchical layers
  - physical layer
  - ATM layer
  - ATM adaptation layer

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ATM layers

Physical layer, consisting of two sub-layers

- physical medium dependent sub-layer
  - coding
  - bit timing
  - transmission
- transmission convergence sub-layer
  - HEC (Header Error Correction) sequence generation and verification
  - transmission frame adaptation, generation, and recovery
  - cell delineation, cell rate decoupling

ATM layer

- cell multiplexing/demultiplexing
- VPI/VCI translation
- cell header generation and verification
- GFC (Generic Flow Control)

ATM adaptation layer (AAL)

ATM adaptation layer (AAL)

Provides different service classes on top of ATM based on:
- bit rate:
  - constant bit rate: e.g. traditional telephone line
  - variable bit rate: e.g. data communication, compressed video
- time constraints between sender and receiver:
  - with time constraints: e.g. real-time applications, interactive voice and video
  - without time constraints: e.g. mail, file transfer
- mode of connection:
  - connection oriented or connectionless

AAL consists of two sub-layers:
- Convergence Sublayer (CS): service dependent adaptation
  - Common Part Convergence Sublayer (CPCS)
  - Service Specific Convergence Sublayer (SSCS)
- Segmentation and Reassembly Sublayer (SAR)
- sub-layers can be empty

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ATM services

Office environment
– multimedia conferencing, online multimedia database access

Universities, schools, training centers
– distance learning, teaching

Industry
– database connection, surveillance, real-time factory management

Hospitals
– reliable, high-bandwidth network, medical images, remote monitoring

Home
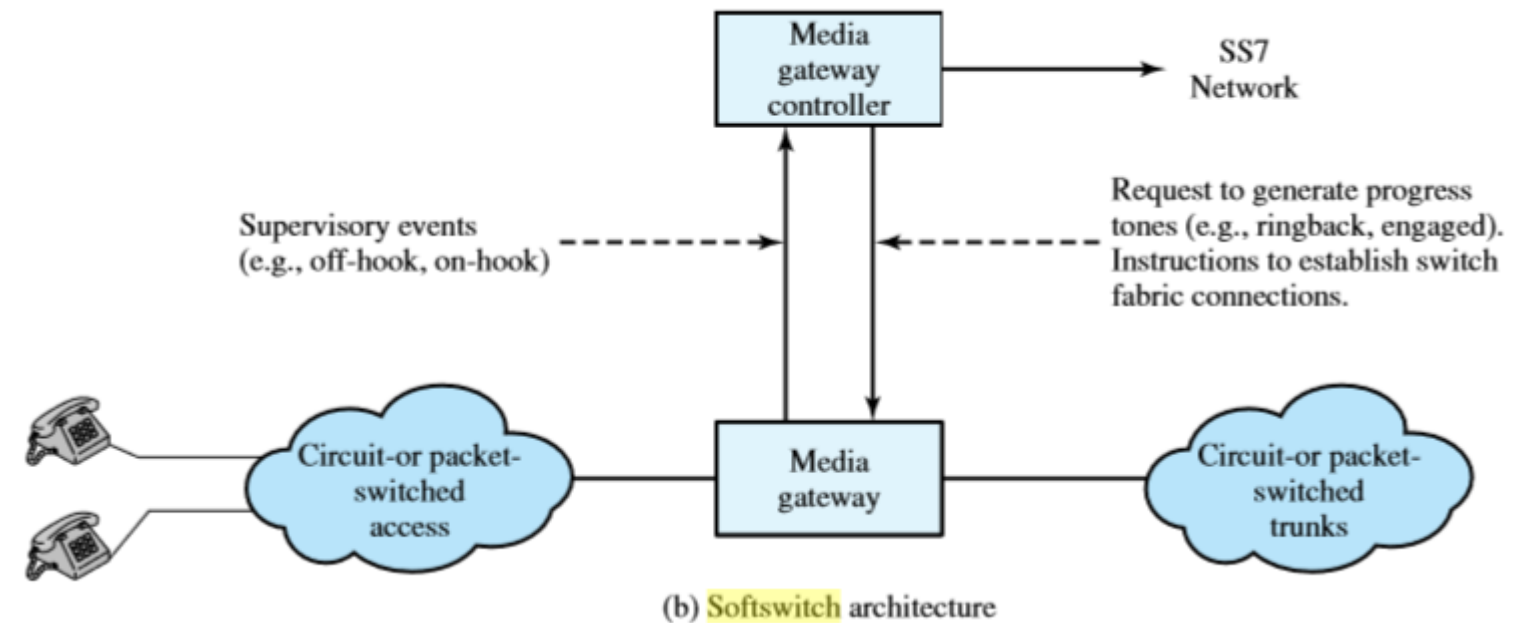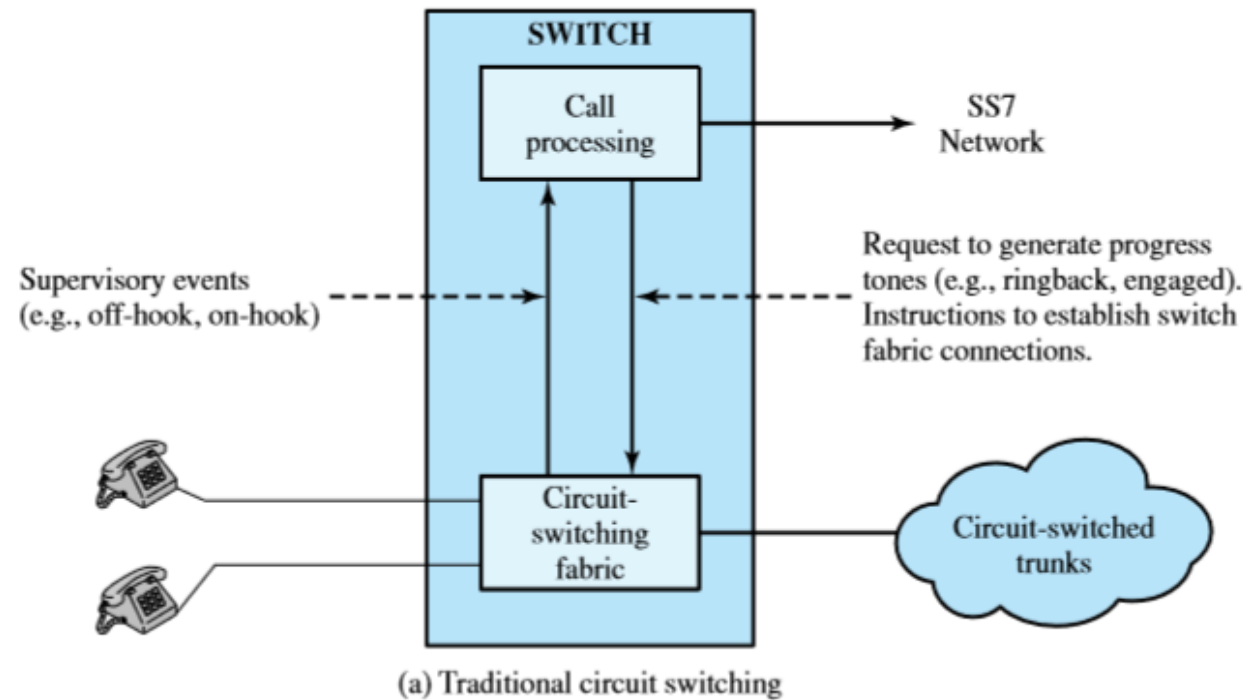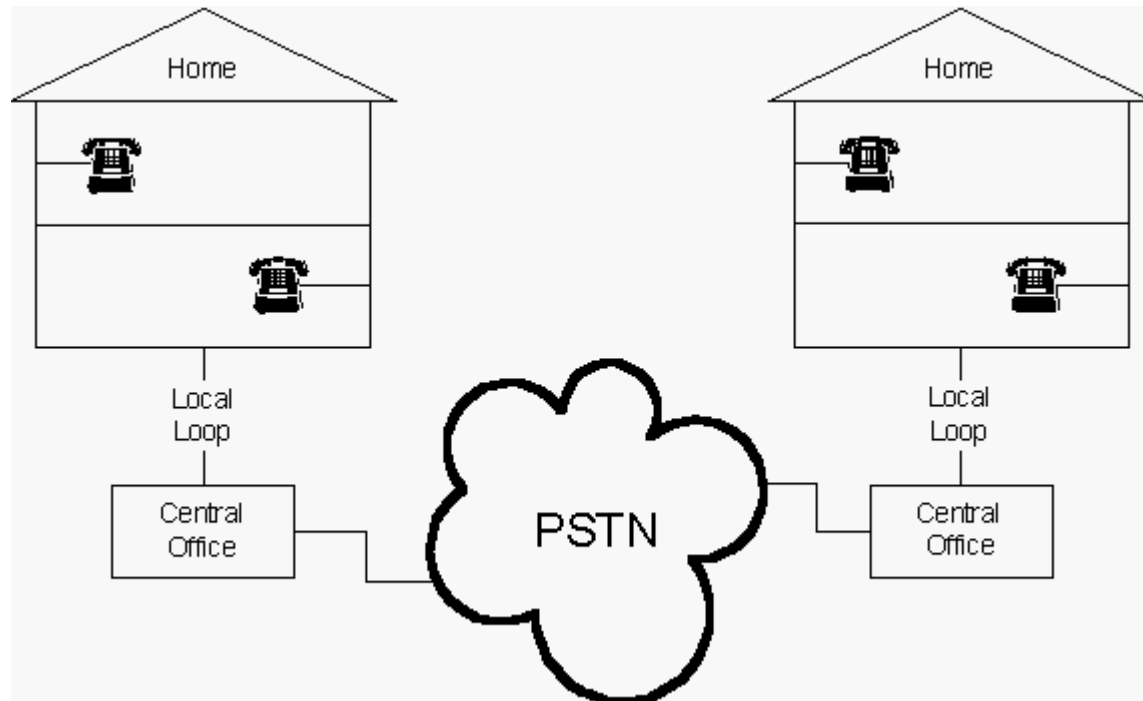– high-bandwidth interconnect of devices

Networked vehicles
– trucks, aircraft etc. MANET

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Circuit switching and Soft Switch Architecture

SWITCH

Call processing

SS7 Network

Supervisory events (e.g., off-hook, on-hook)

Request to generate progress tones (e.g., ringback, engaged). Instructions to establish switch fabric connections.

Circuit-switching fabric

Circuit-switched trunks

(a) Traditional circuit switching

Media gateway controller

SS7 Network

Supervisory events (e.g., off-hook, on-hook)

Request to generate progress tones (e.g., ringback, engaged). Instructions to establish switch fabric connections.

Circuit-or packet-switched access

Media gateway

Circuit-or packet-switched trunks

(b) Softswitch architecture

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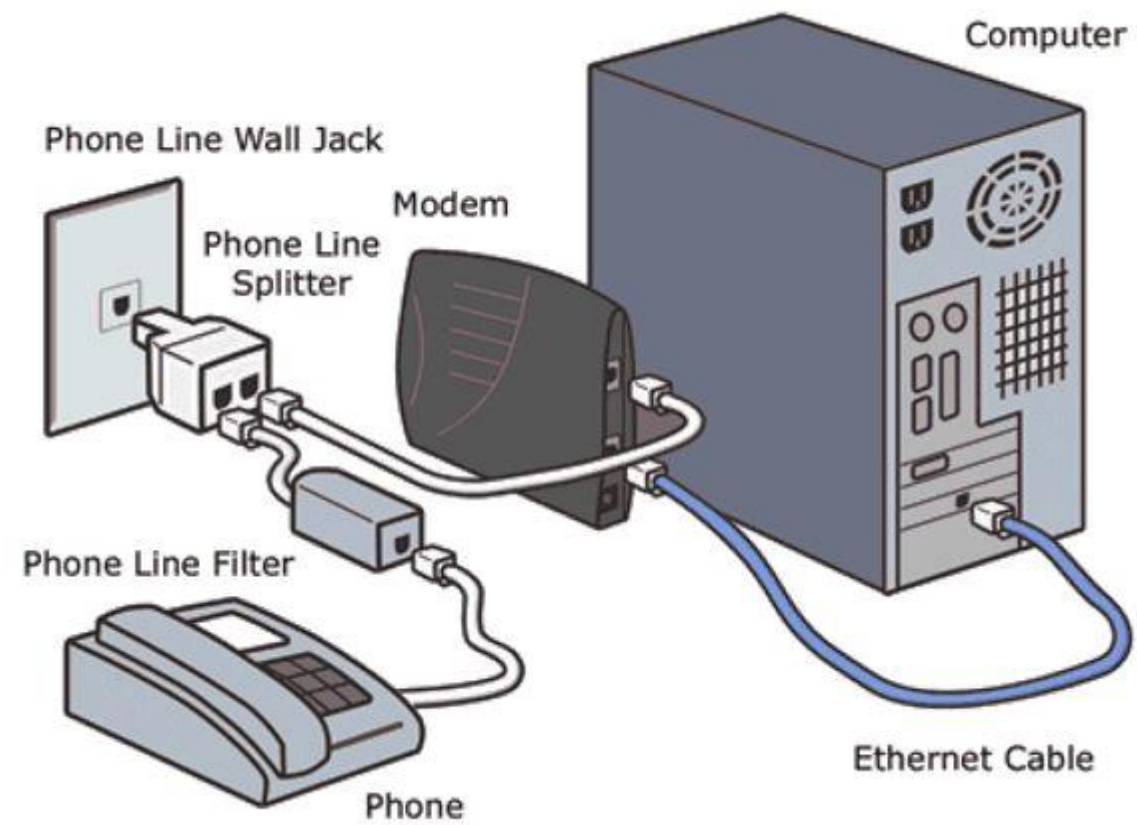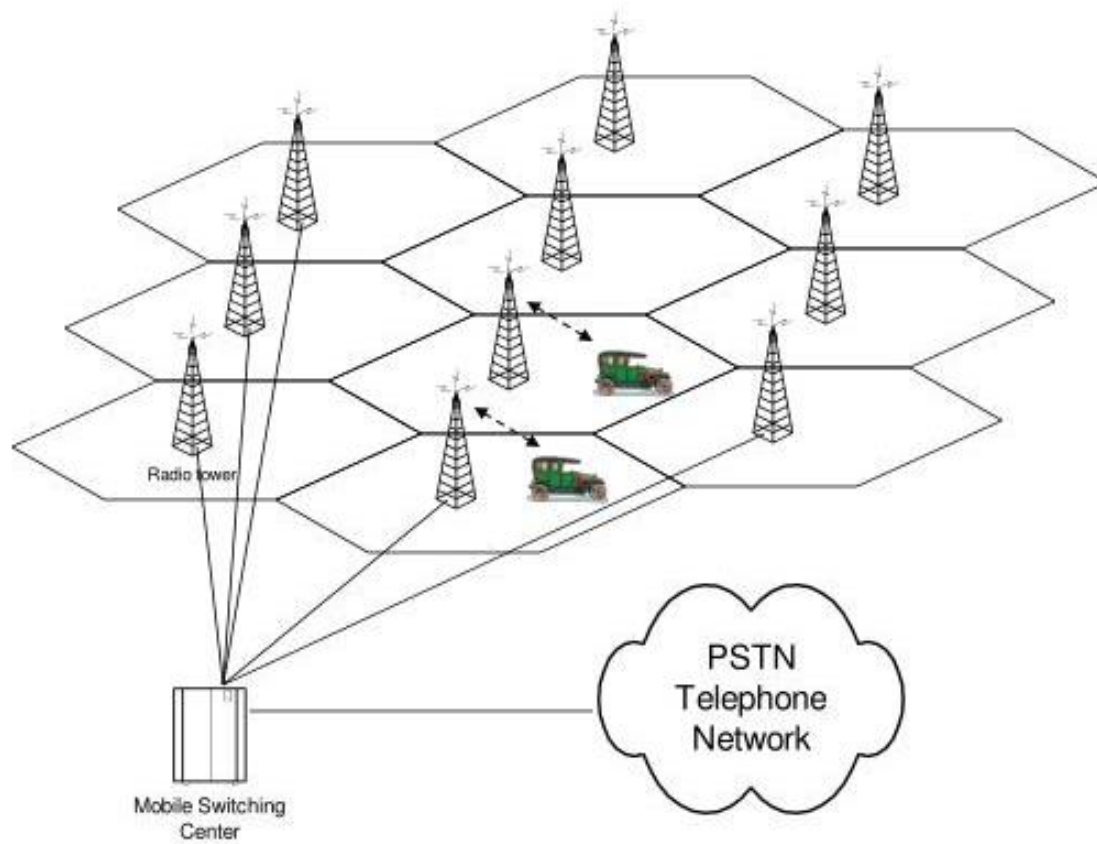
Telephone networks

Advanced Mobile Phone Service (AMPS)

Base station transmission band	869 to 894 MHz
Mobile unit transmission band	824 to 849 MHz
Spacing between forward and reverse channels	45 MHz
Channel bandwidth	30 kHz
Number of full-duplex voice channels	790
Number of full-duplex control channels	42
Mobile unit maximum power	3watts
Cell size, radius	2 to 20 km
Modulation	FM
Data transmission rate	10 kbps
Error control coding	BCH

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Cellular telephony

Radio tower

Mobile Switching Center

PSTN Telephone Network

Phone Line Wall Jack

Phone Line Splitter

Modem

Computer

Phone Line Filter

Phone

Ethernet Cable

X-DSL

POTS

Upstream

Downstream

| 0 | 20 | 25 | ≈200 | ≈250 | 1000 kHz |

Reference: 1. Ferouzan, Behrouz A., Data Communications and Networking, 2. Stallings William, Data and Computer Communication. 3. https://ieeexplore.ieee.org