



SNS COLLEGE OF TECHNOLOGY

Coimbatore – 35

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19ECT311 / Wireless Communication

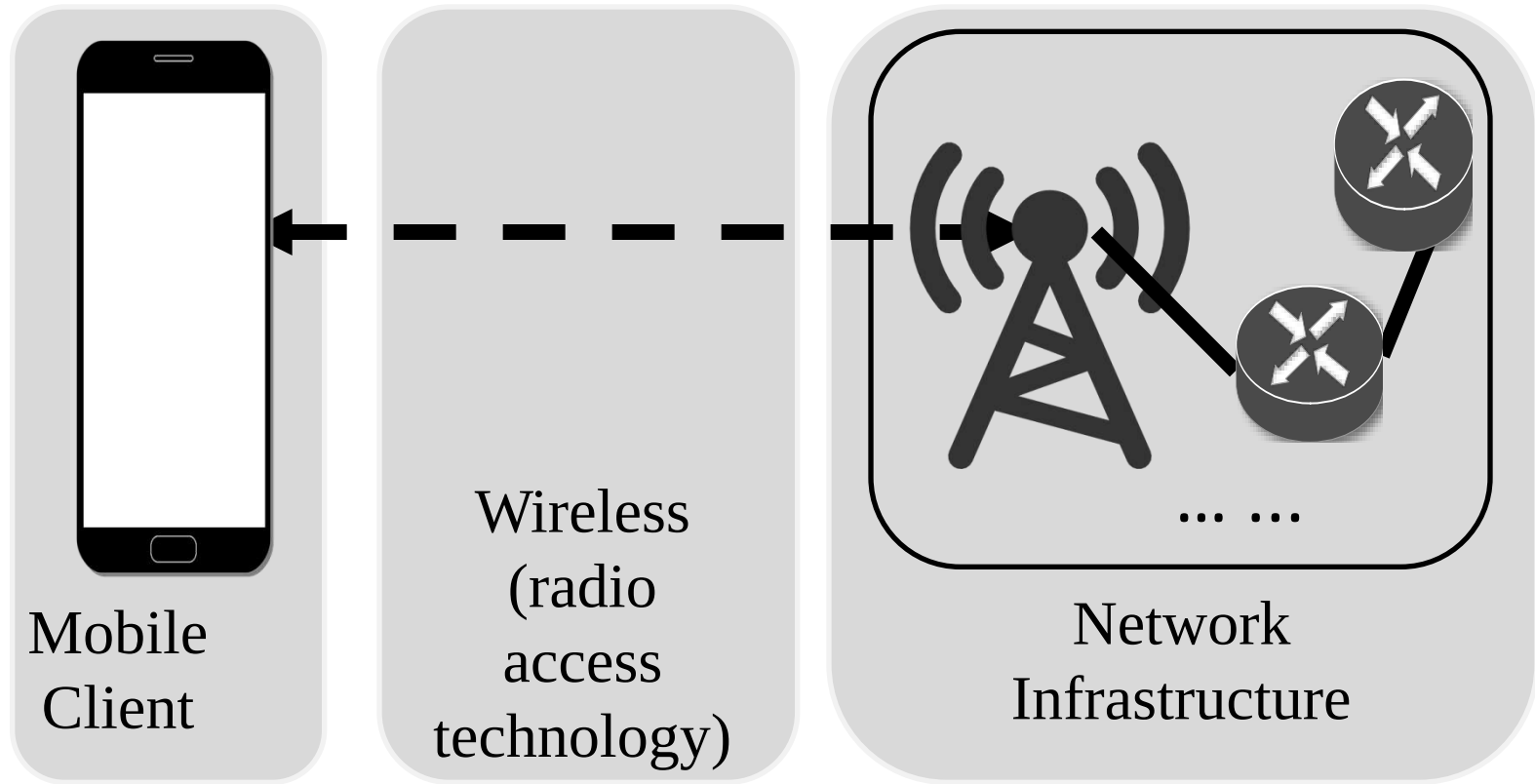
III ECE/ VI SEMESTER

Unit I -**FUNDAMENTALS OF WIRELESS COMMUNICATION**

Topic 1 : Evolution of cellular systems: 2G - 3G- 4G cellular networks



Wireless Communication





Wireless Communication

- Wireless communication is the transfer of information over a distance without the use of electrical conductors or "wires".
- The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications).
- When the context is clear, the term is often shortened to "wireless".
- Wireless communication is generally considered to be a branch of telecommunications.



Ubiquitous Mobile Network Services



In-building



Outdoor



Walking



Driving



Subway

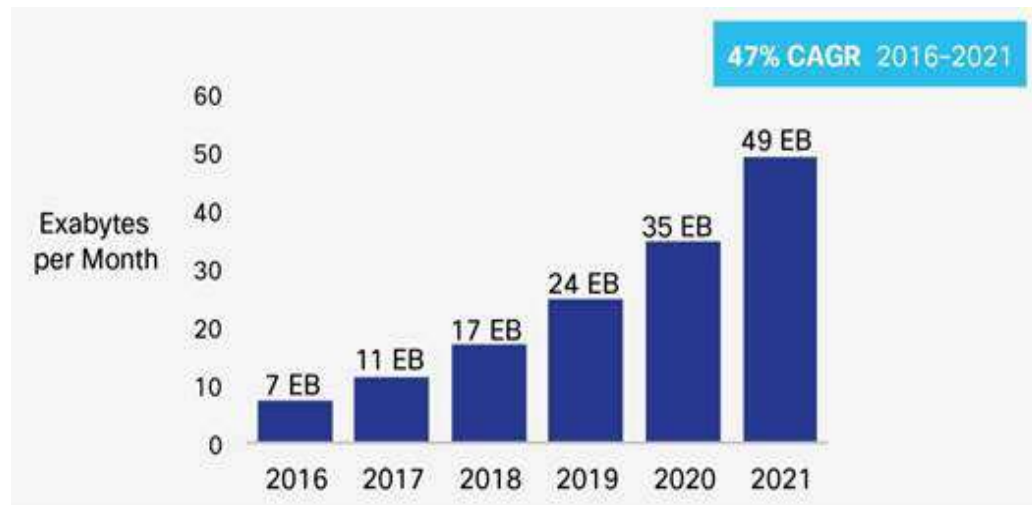


High-speed train



Ubiquitous Mobile Network Services

- Global Mobile Data Traffic
 - 7.2 exabytes/month in 2016 (63% growth)
 - 18 fold growth in the past five years
 - 7 fold growth by 2021 (49 exabytes/month)

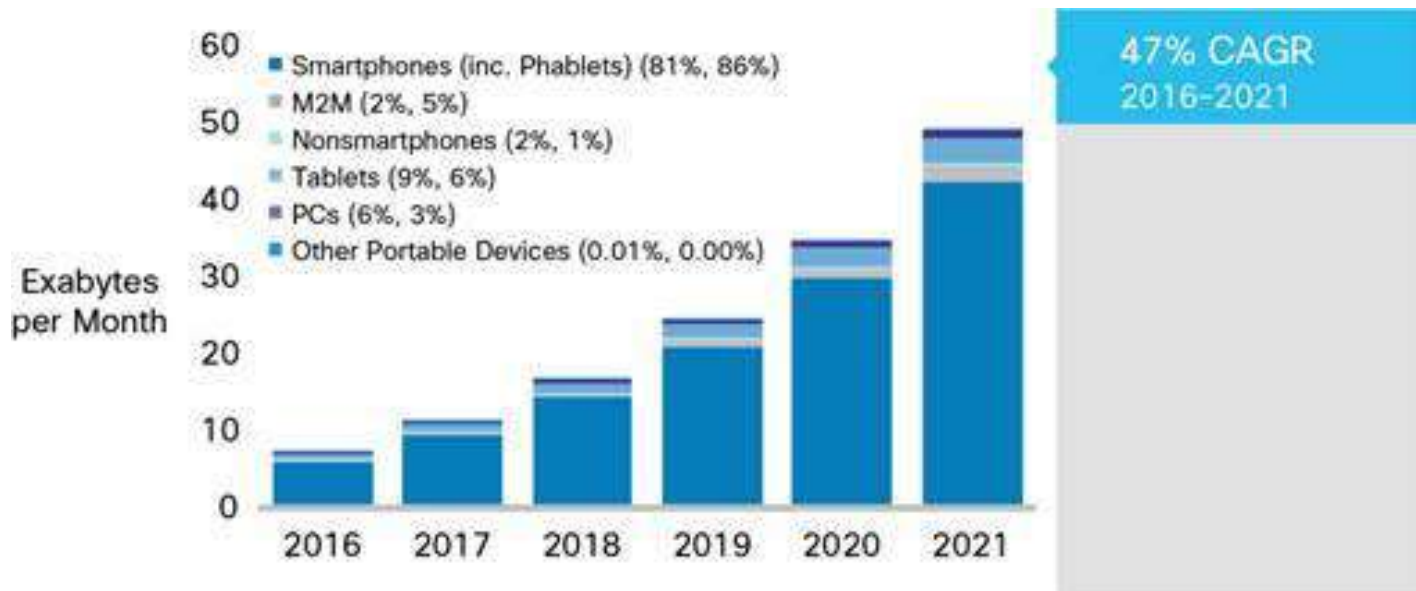


Source: Cisco Visual Networking Index, 2017: Global Mobile Data Traffic Forecast Update, 2016–2021 White Paper



Ubiquitous Mobile Network Services

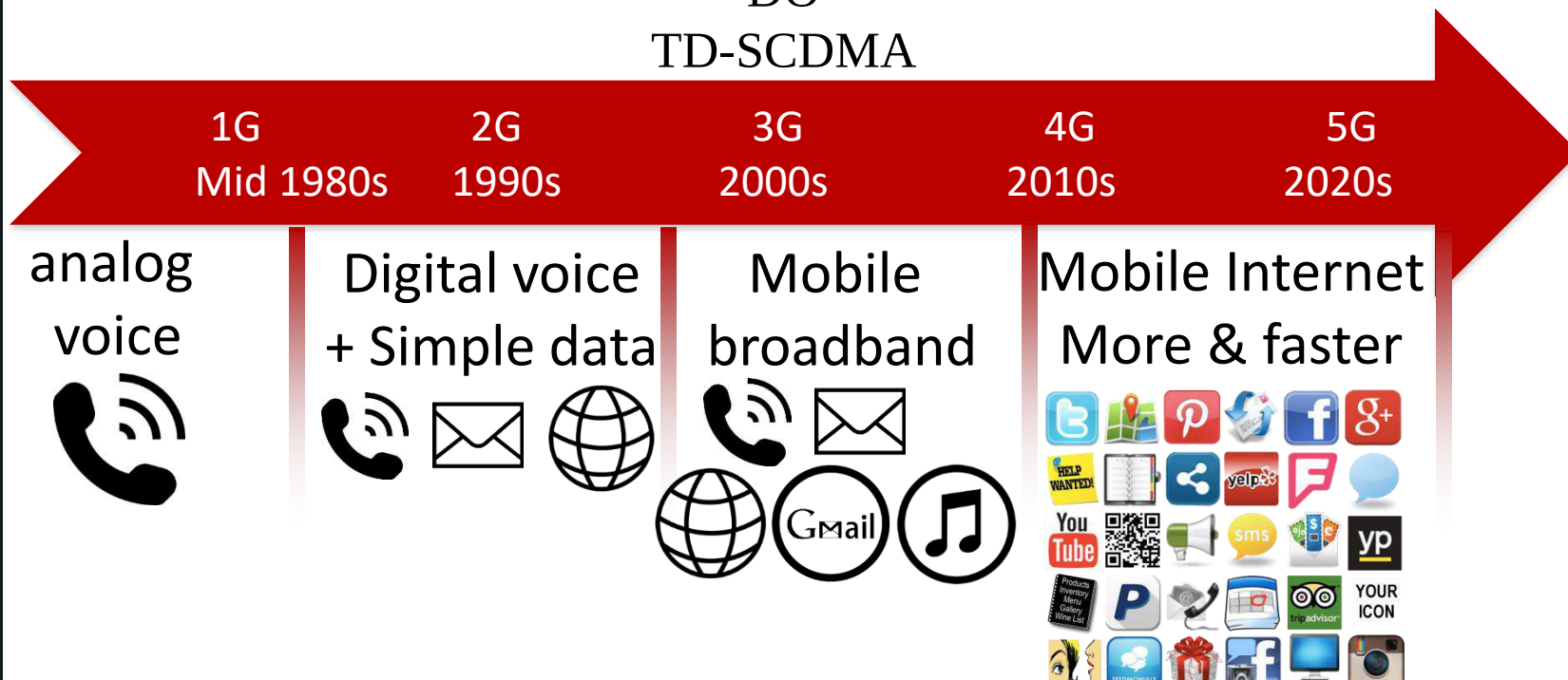
- Smartphones: primary internet access points
 - By 2021, 98% traffic and 75% connections from “smart” devices
 - 4G: 75% traffic and 53% connections
 - 5G: 1.5% traffic and 0.2% connections





Mobile Network Evolution

1G	2G	3G	4G
AMPS, NMT TACS	GSM/GPRS/ EDGE cdmaOne	WCDMA/HSPA + CDMA2000/EV DO TD-SCDMA	LTE LTE-A





Standards Body: 3GPP

- An international standards body
- Evolves and standardizes GSM, UMTS, LTE among others

The 3rd Generation Partnership Project (3GPP) unites [Six] telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TTA, TTC), known as “Organizational Partners” and provides their members with a stable environment to produce the highly successful Reports and Specifications that define 3GPP technologies

- 3GPP standards



Cellular Network Standards

Generation	3GPP Circuit Switched	3GPP Packet Switched	3GPP2	Wimax Forum
2G	GSM		cdmaOne	
2.5G		GPRS		
2.75G		EDGE		
3G	UMTS		CDMA2000	
3.5G		HSPA/+	CDMA EV-DO	
4G		LTE		WiMAX



Cellular Networks: From 1G to 4G



1G: First generation wireless cellular: Early 1980s

- Analog transmission, primarily speech: AMPS (Advanced Mobile Phone Systems) and others

2G: Second generation wireless cellular: Late 1980s

- Digital transmission
- Primarily speech and low bit-rate data (9.6 Kbps)

2.5G: 2G evolved to medium rate (< 100 kbps) data





Cellular networks: From 3G to 4G



- 3G: future Broadband multimedia
 - 144 kbps - 384 kbps for high-mobility, high coverage
 - 2 Mbps for low-mobility and low coverage



4G :Mobile broadband Internet access

- Mobile web access, IP telephony, gaming services, high-definition mobile TV
- Video conferencing, 3D television, and cloud computing



What is LTE?

- LTE is always evolving and 3GPP often has new “releases”
 - First release: Rel-8
 - Current: Rel-11, Rel-12
 - Toward LTE-Advanced (4.5G)



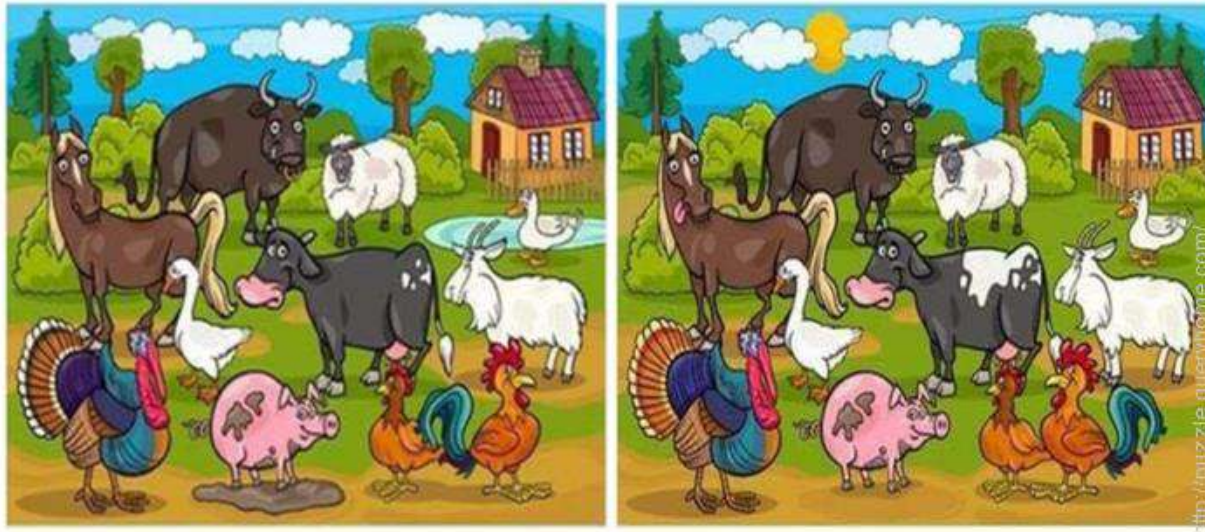
Inter-Generation Technologies

- CS networks need to be able to connect with PS networks and other distinct cellular networks
 - The internet is a good example of PS network
- GPRS (General packet radio service)
 - 2.5G packet switched technology
- EDGE (Enhanced Data Rates for GSM Evolution)
 - 2.75G packet switched technology
- HSPA (High Speed Packet Access)
 - 3.5/3.75 packet switched data technology
 - There were a few quick iterations on this technology, thus “variants”



ACTIVITY

Find the difference between two images





Network Architecture Evolution

2G

- Circuit-switching for voice

3G

- Circuit-switching for voice
- Packet-switching for data

4G

- Packet-switching for everything
- IP-based

**Telecomm
Infrastructure**

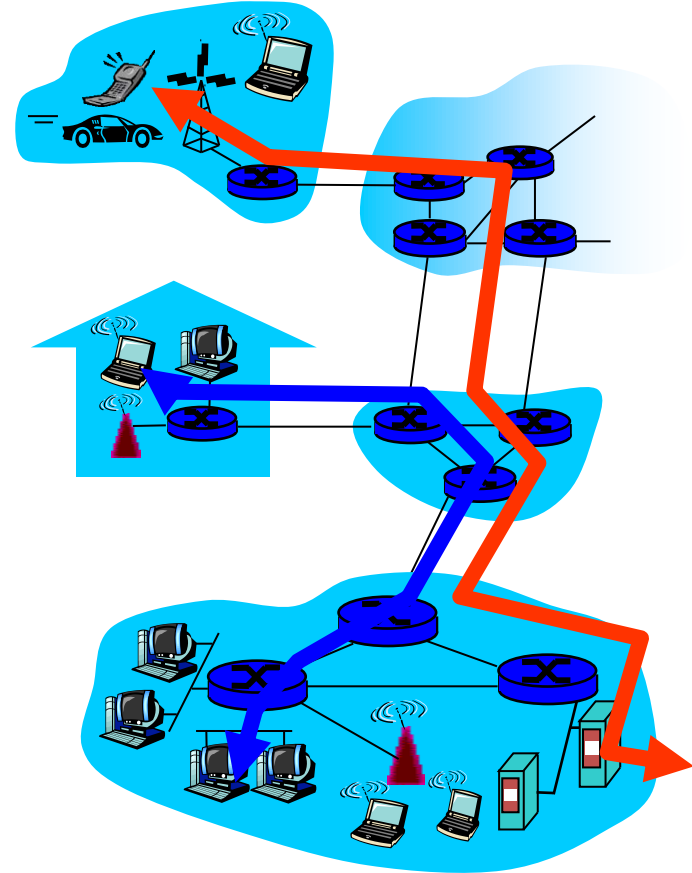
IP-based Internet



2G Based on Circuit Switching (CS)

End-end resources reserved for
“call”

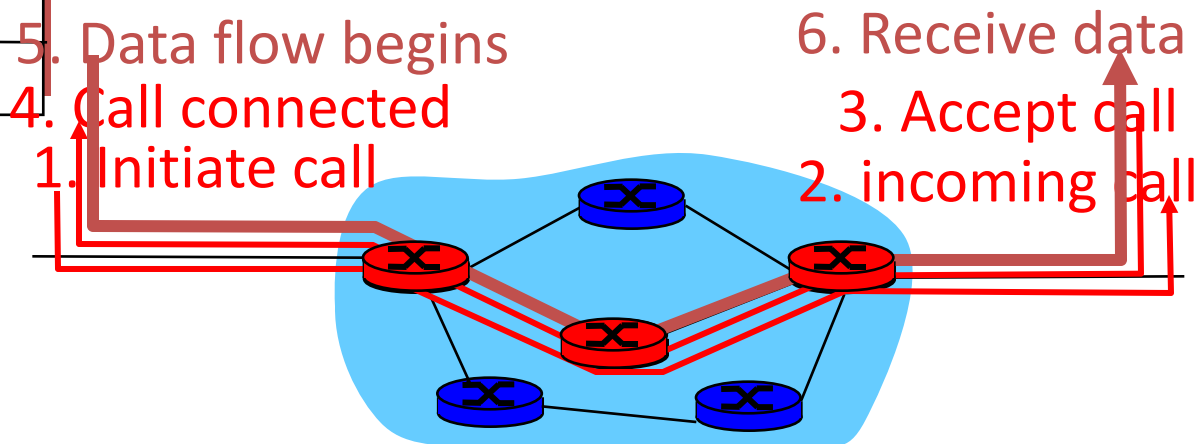
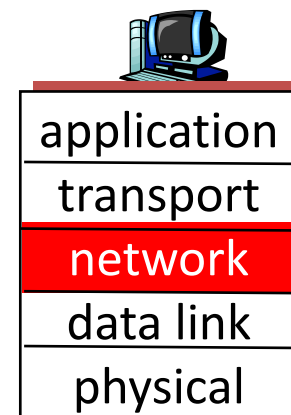
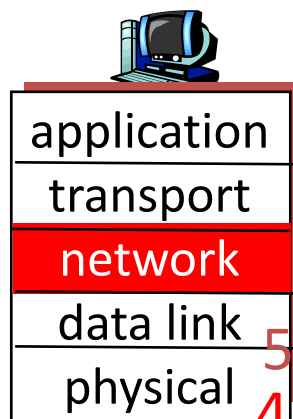
- link bandwidth, switch capacity
- dedicated resources: no sharing
- circuit-like (guaranteed) performance
- call setup required





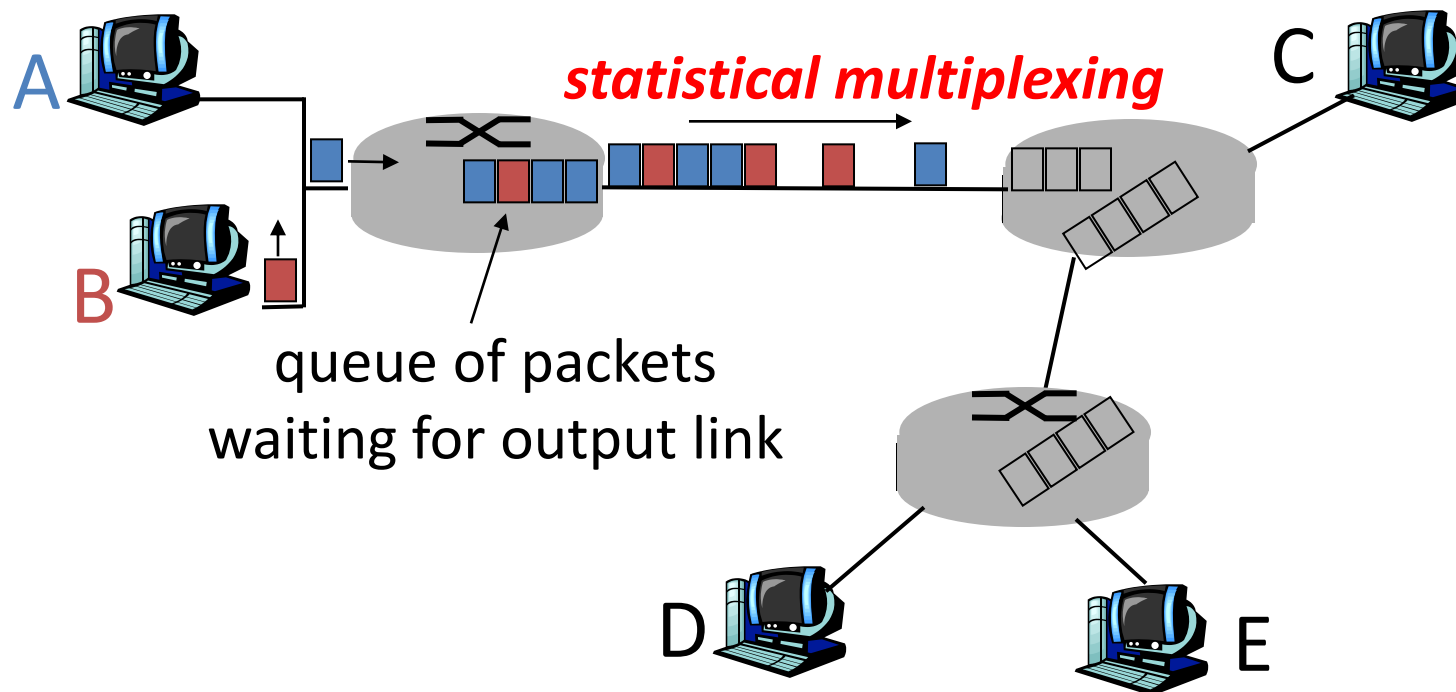
CS Signaling

- used to setup, maintain teardown VC
- used in 2G, as well as in 3G
- not used in today's Internet





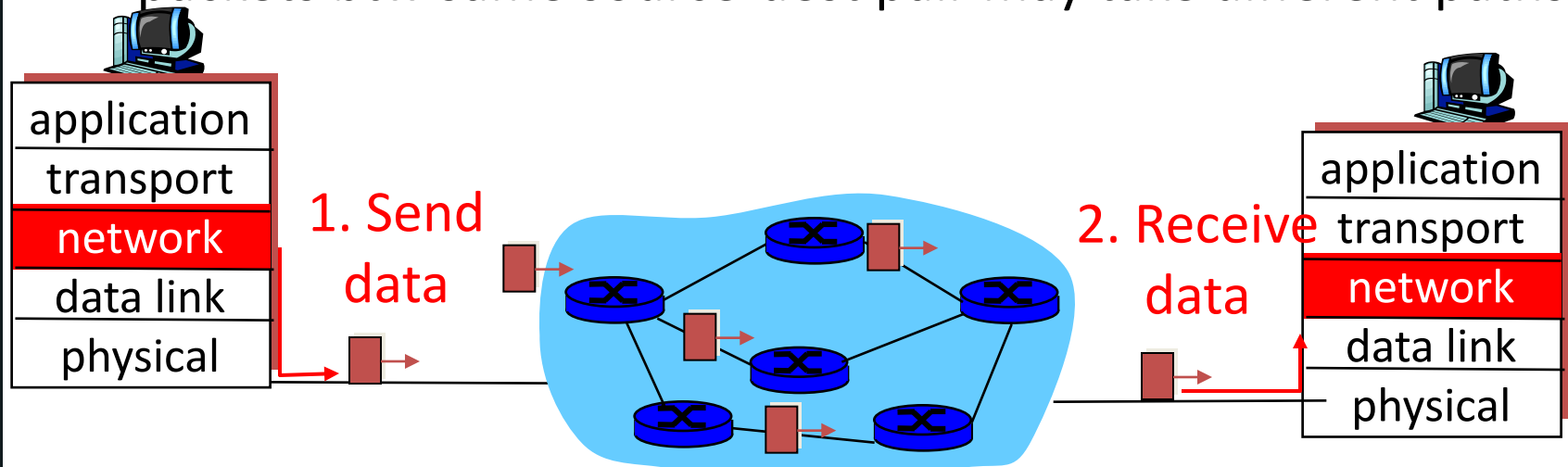
Packet Switching (PS)



- Sequence of A & B packets does not have fixed pattern, bandwidth shared on demand → statistical multiplexing
- Store-and-forward at intermediate routers
- Used by the Internet

PS Signaling

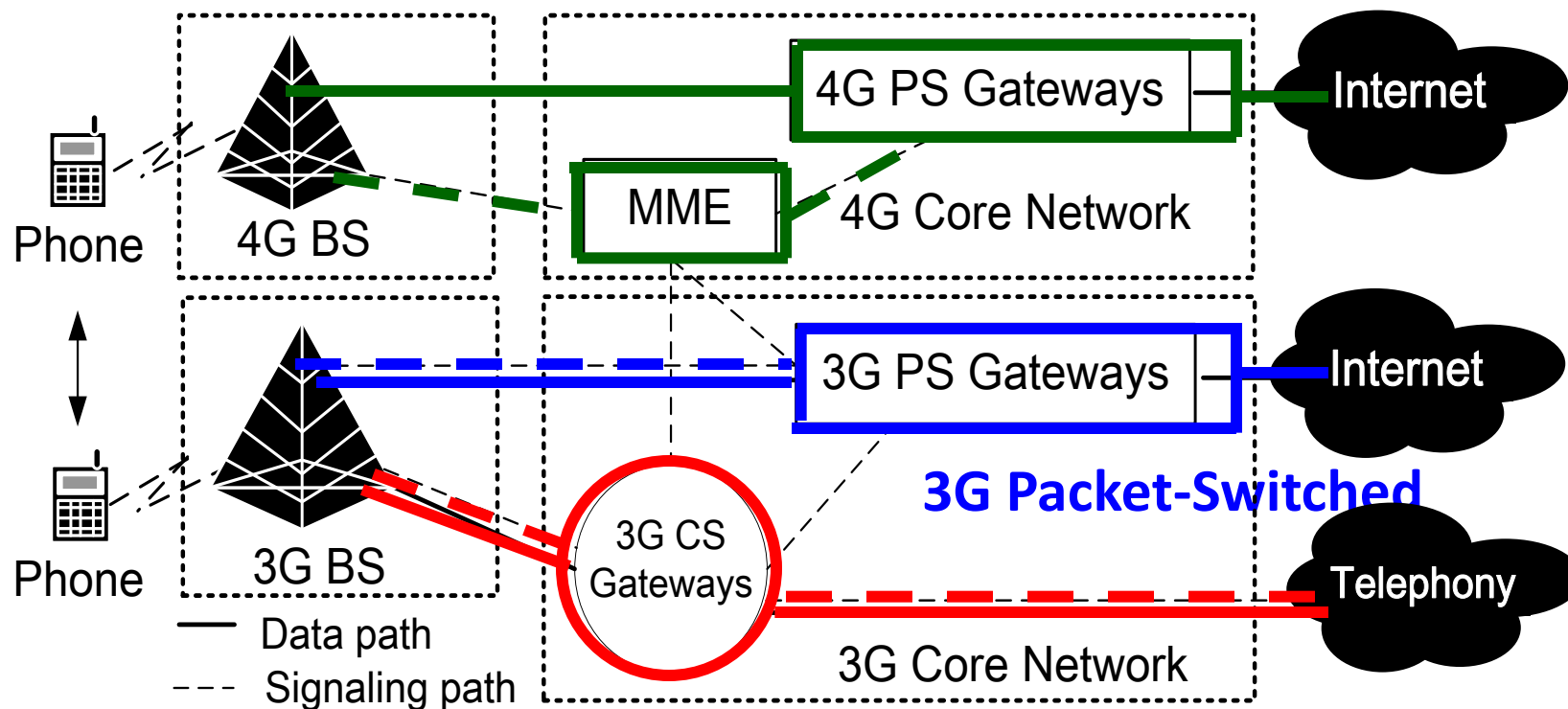
- no call setup at network layer
- routers: no state about end-to-end connections
 - no network-level concept of “connection”
- packets forwarded using destination host address
 - packets btw same source-dest pair may take different paths





3G/4G Network Architecture

4G Packet-Switched

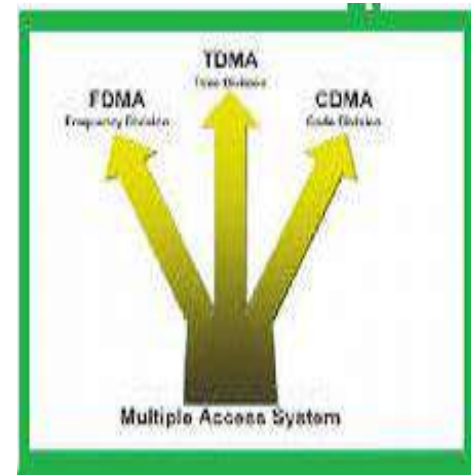


3G Circuit-Switched



Issues Vital to cellular

- Frequency allocation
 - Licensed
 - Many providers
- Multiple Access
 - Many users
 - Wide area of coverage
 - Traffic management
- Location management
 - High mobility (in cars, trains)
 - Multiple suppliers
 - Handoff management, roaming
- Handled differently by different generations





Assessment

1. Differentiate 3G from 4G.
2. What is packet switching?
3. Discuss about 3GPP

