SNS COLLEGE OF ENGINEERING

Coimbatore – 35

An Autonomous Institution

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

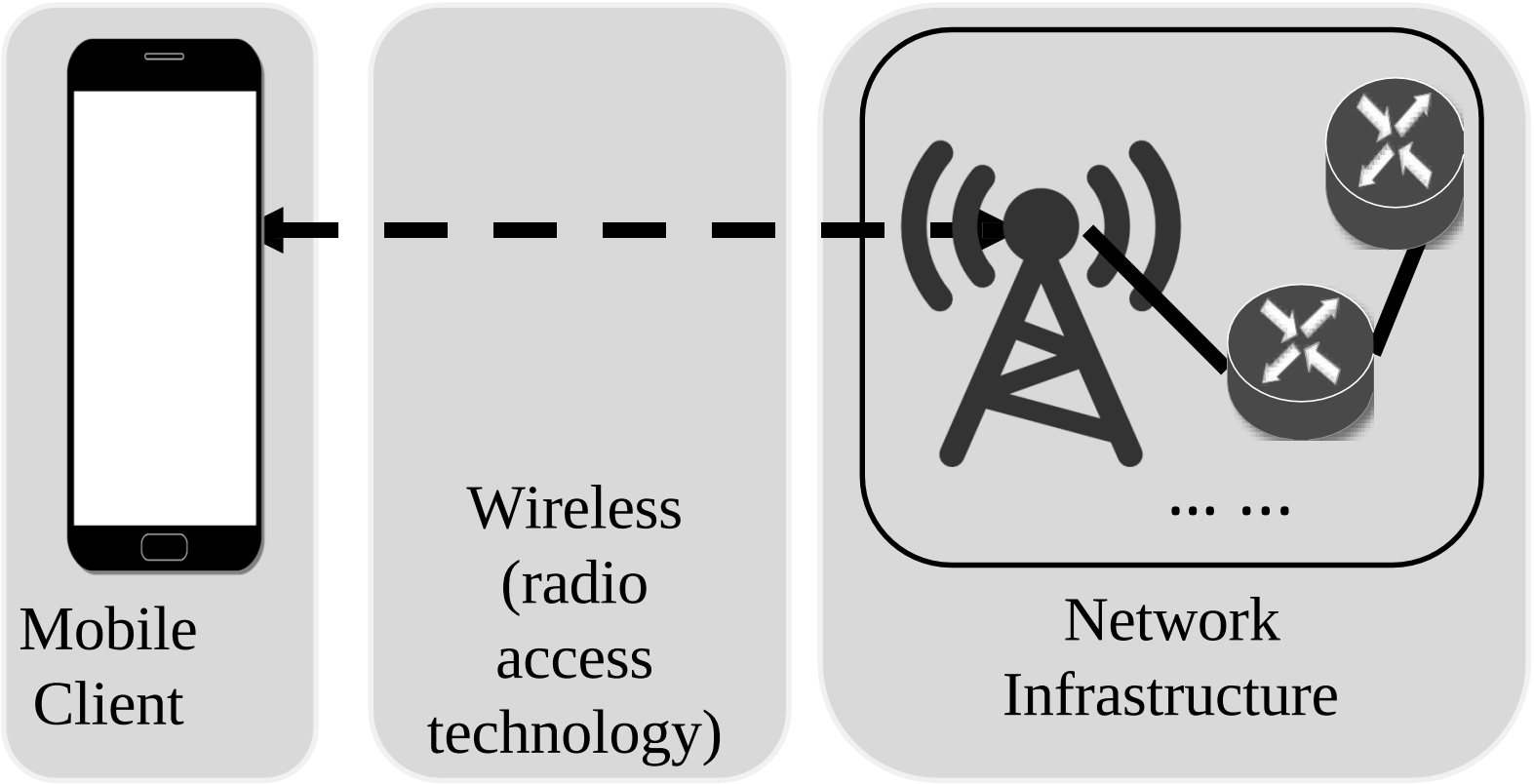
19EC601 / Wireless Communication

III ECE/ VI SEMESTER

Unit I -**FUNDAMENTALS OF WIRELESS COMMUNICATION**

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

Wireless Communication

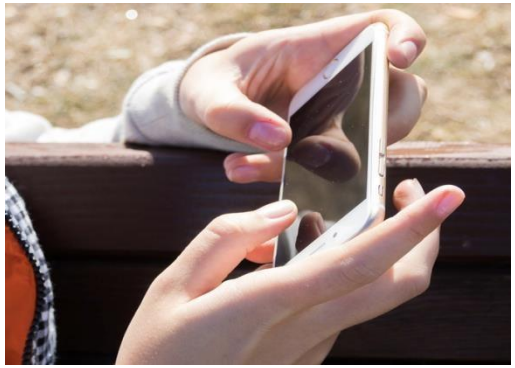


Wireless Communication

- 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

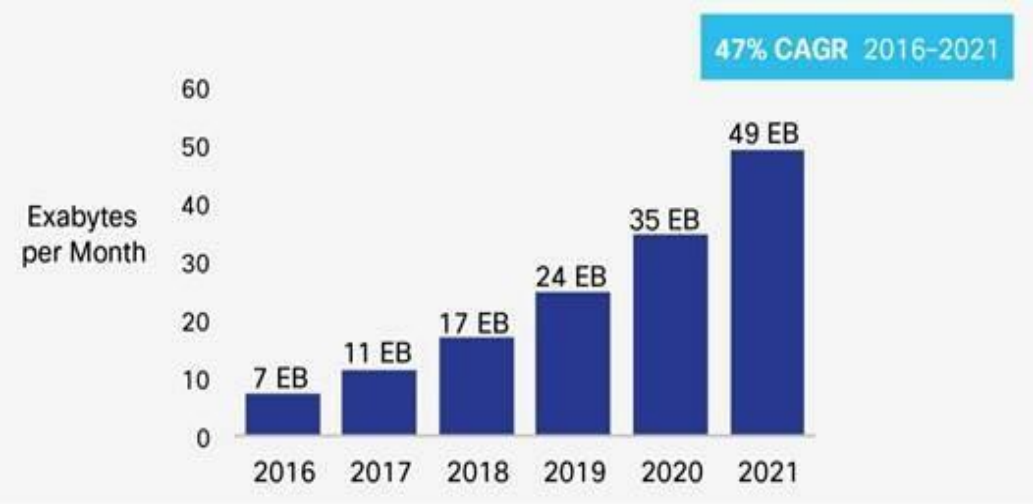
Driving

Subway

High-speed train

Ubiquitous Mobile Network Services

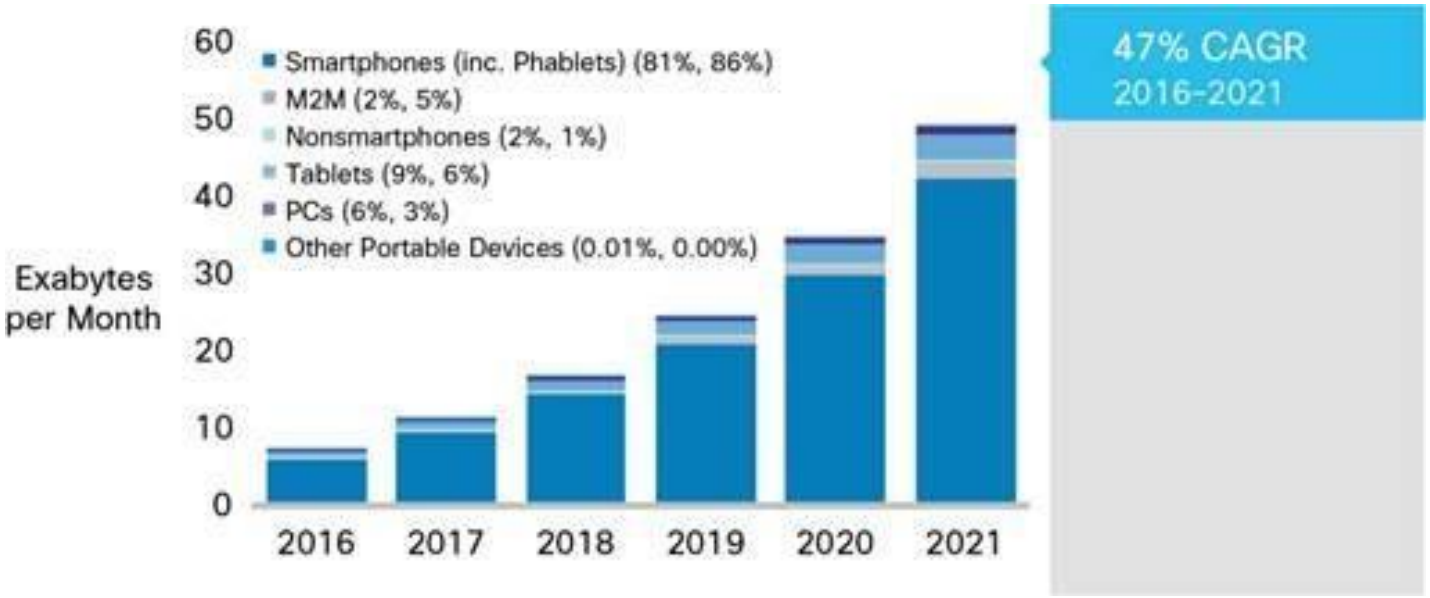
- Global Mobile Data Traffic
  - 7.2 exabytes/month in 2016 (63% growth)
  - 18 fold growth in the past five years
  - 7 fold growth by 2021 (49 exabytes/month)



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

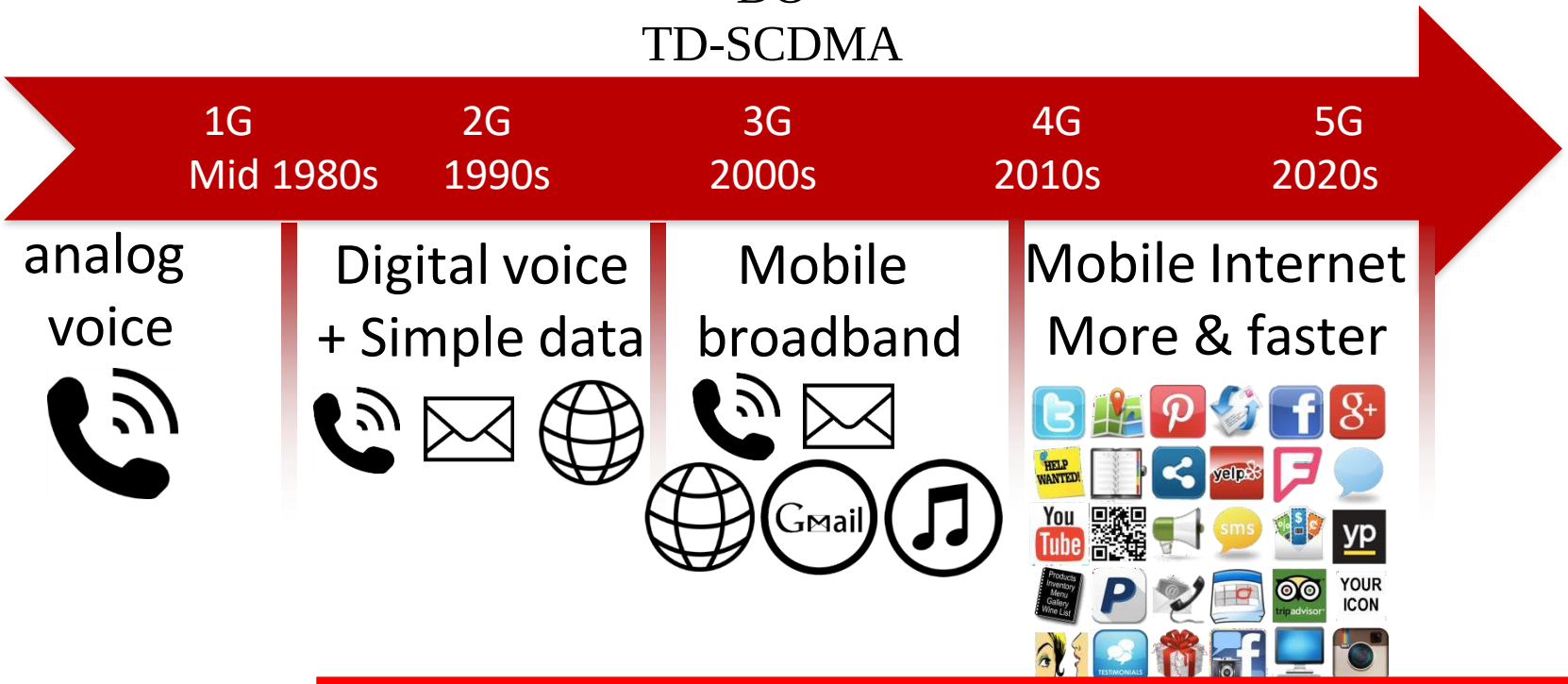
Ubiquitous Mobile Network Services

- 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	GPRS	cdmaOne	
2.5G				
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 (< 100kbps) 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?

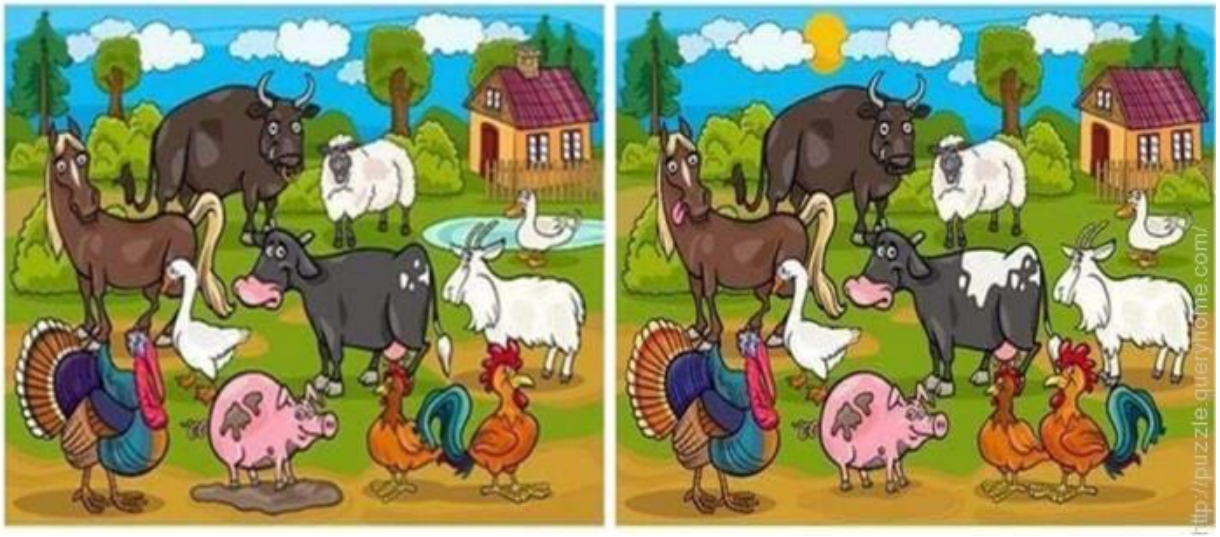
- LTE is always evolving and 3GPP often has new “releases”
  - First release: Rel-8
  - Current: Rel-11, Rel-12
  - Toward LTE-Advanced (4.5G)

Inter-Generation Technologies

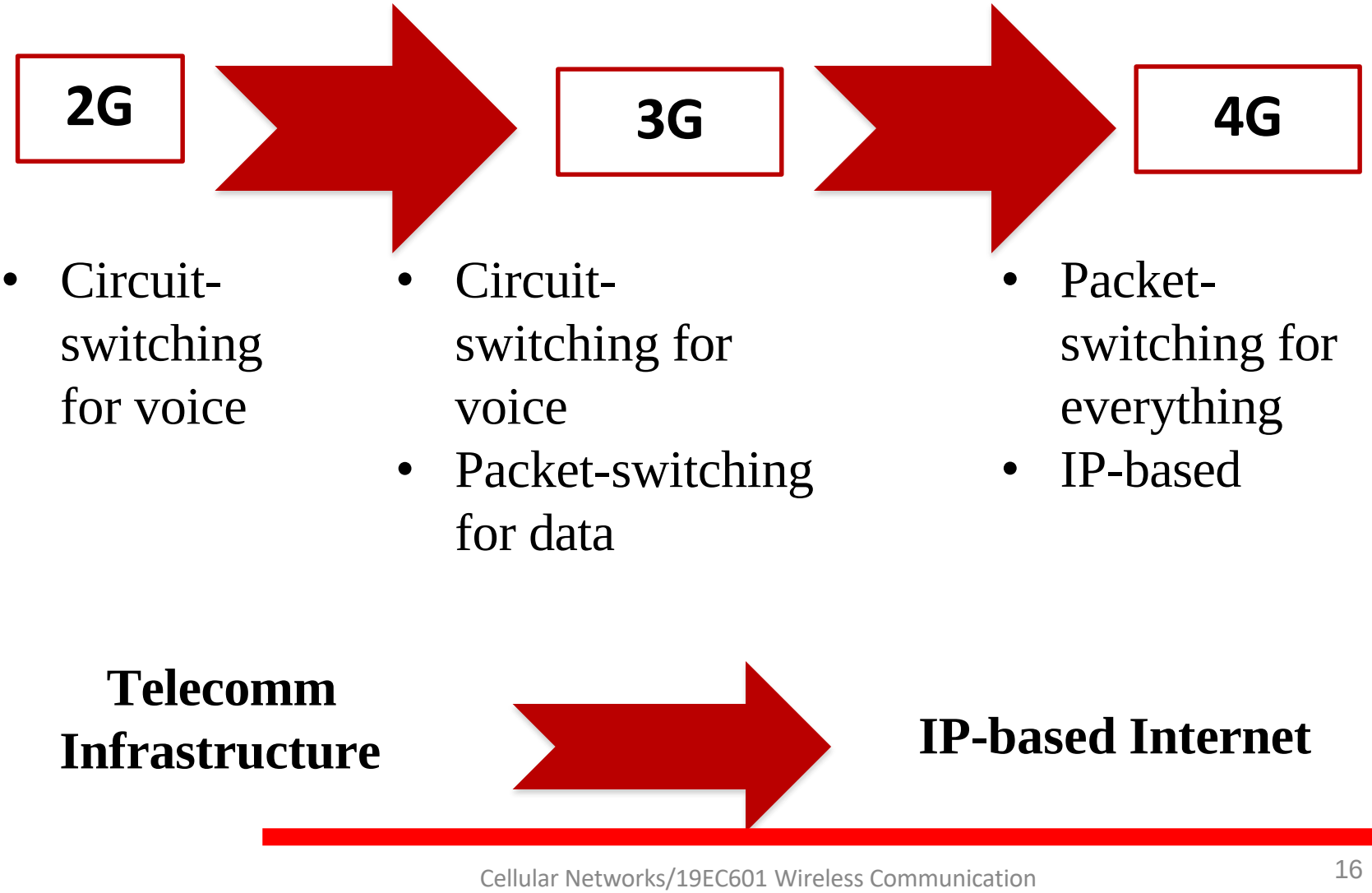
- CS networks need to be able to connect with PS networks and other distinct cellular networks
  - The internet is a good example of PS network
- GPRS (General packet radio service)
  - 2.5G packet switched technology
- EDGE (Enhanced Data Rates for GSM Evolution)
  - 2.75G packet switched technology
- 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



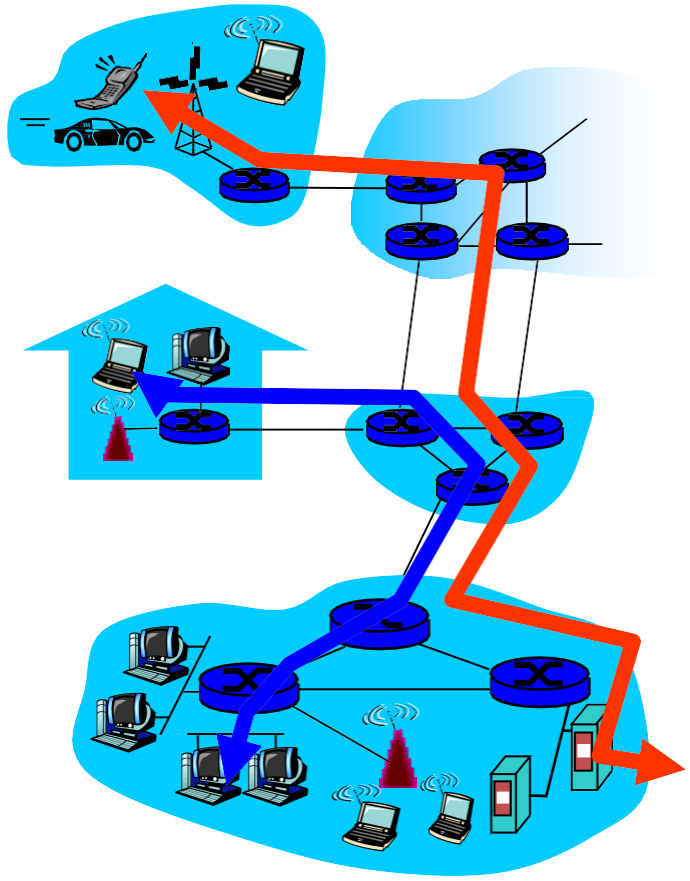
Network Architecture Evolution



2G Based on Circuit Switching (CS)

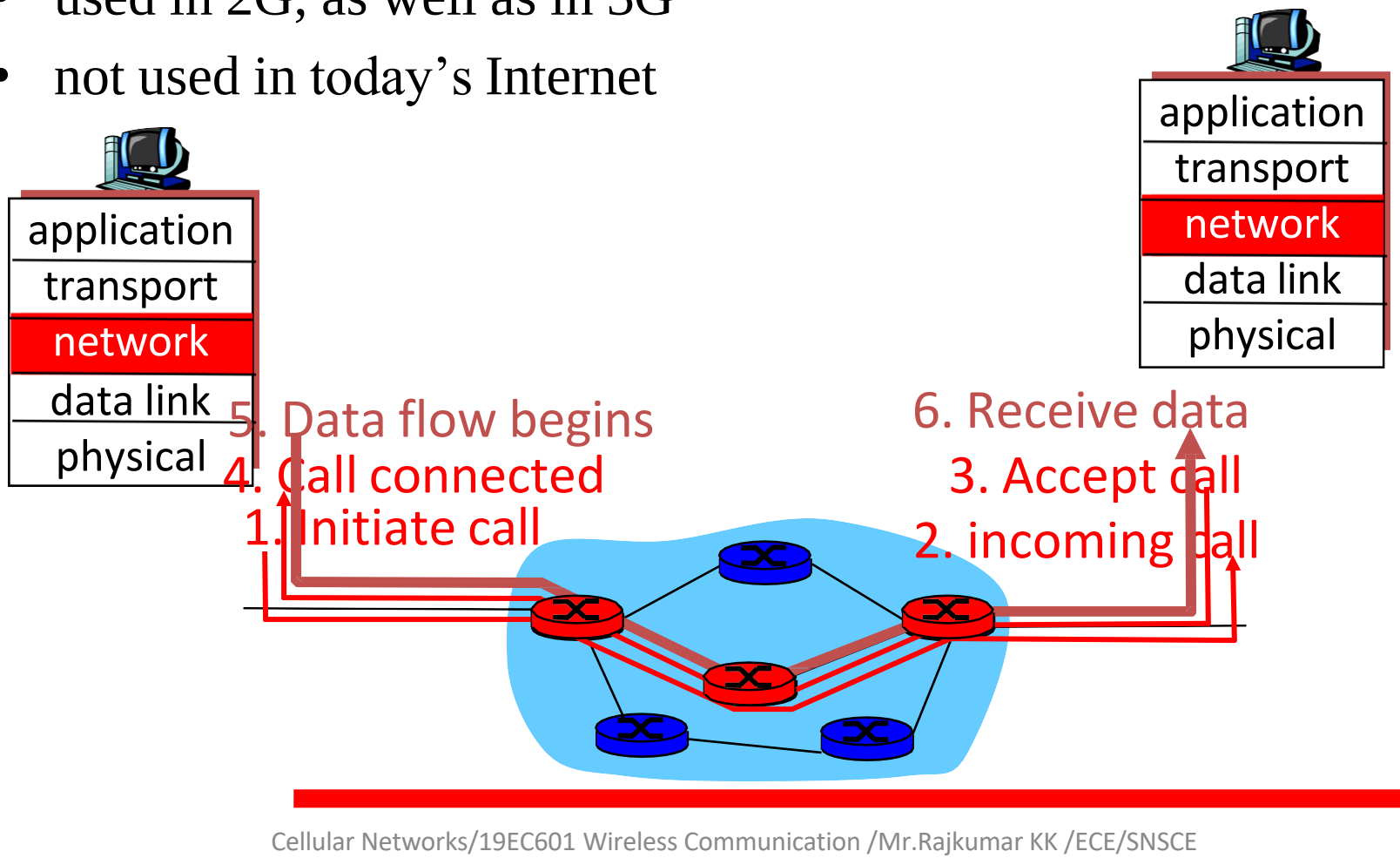
End-end resources reserved for "call"

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

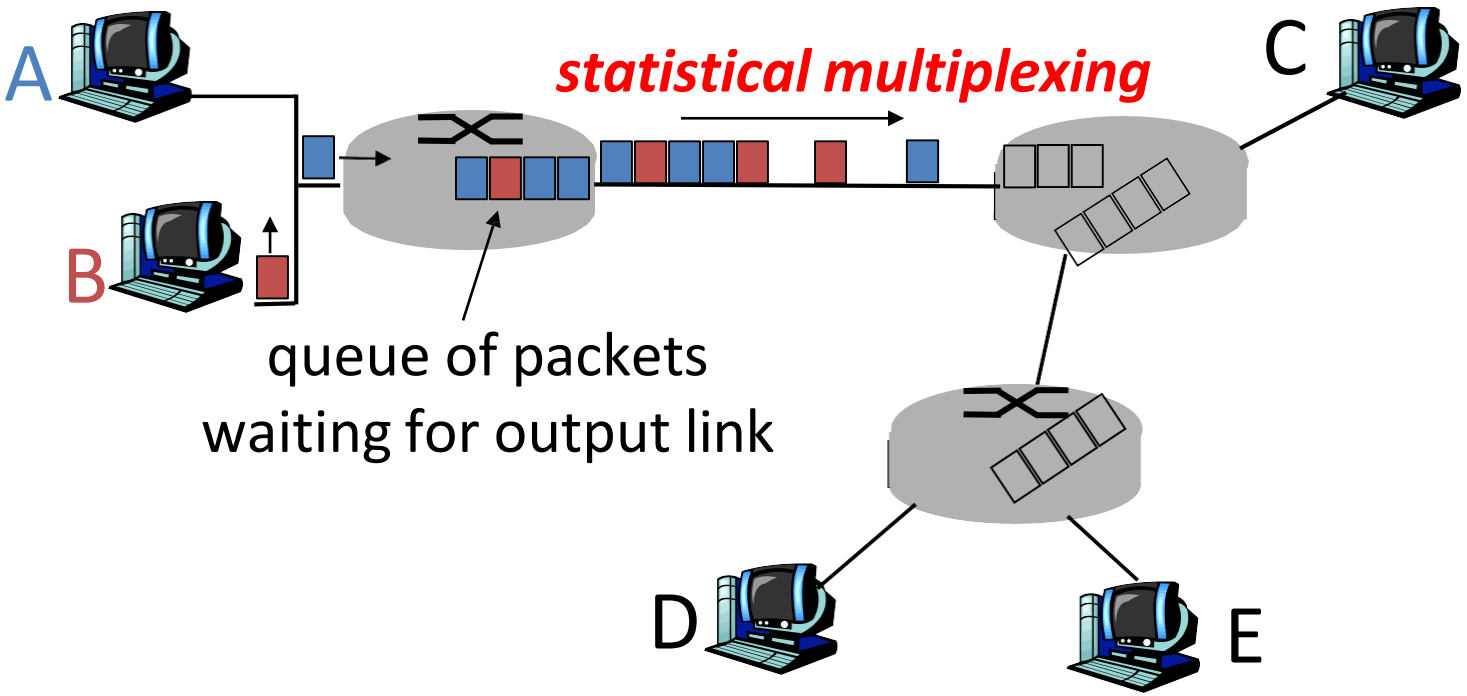


CS Signaling

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



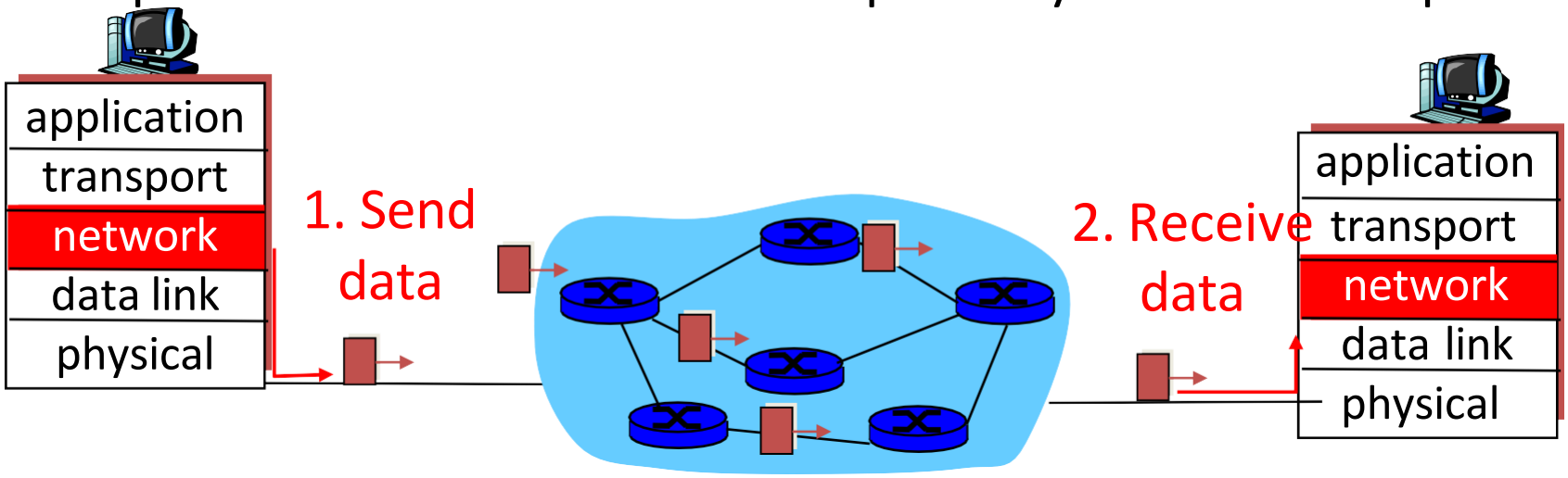
Packet Switching (PS)



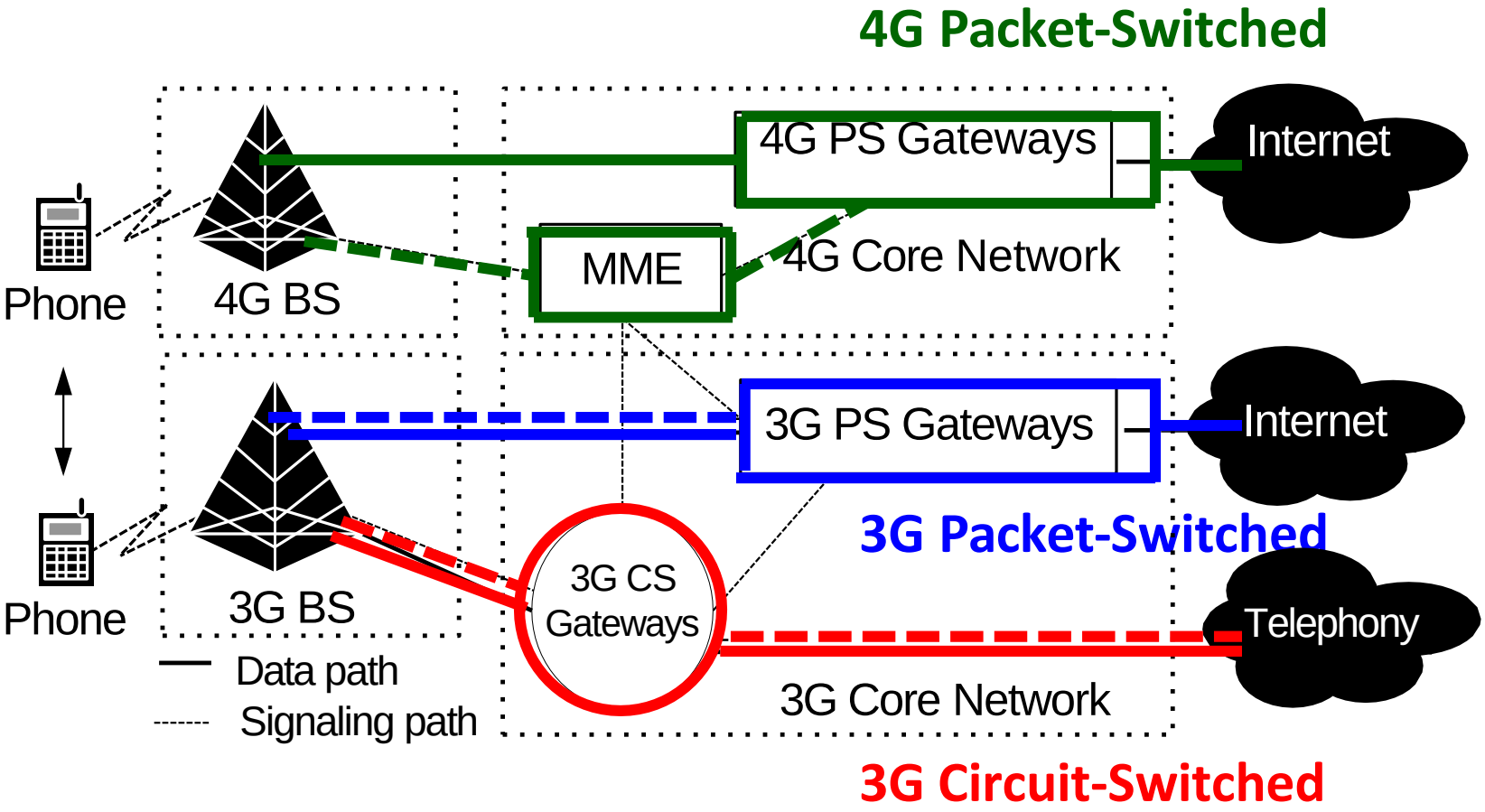
- Sequence of A & B packets does not have fixed pattern, bandwidth shared on demand → statistical multiplexing
- Store-and-forward at intermediate routers
- Used by the Internet

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

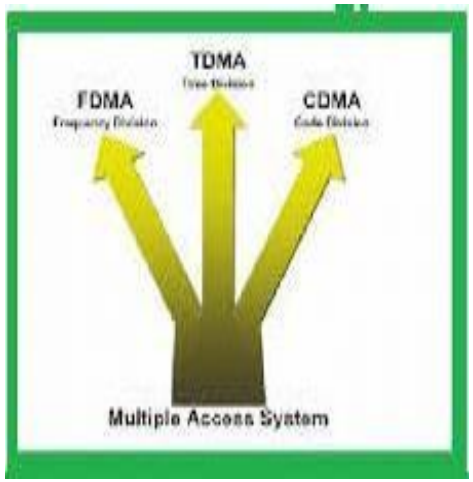


3G/4G Network Architecture



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