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Enriching Life Through Communication !

Telecom Network Introduction

HUAWEI TECHNOLOGIES CO., LTD.



Content

1-Evolution of Mobile Network

2-Differences between GUL Technologies

3-Site Equipments

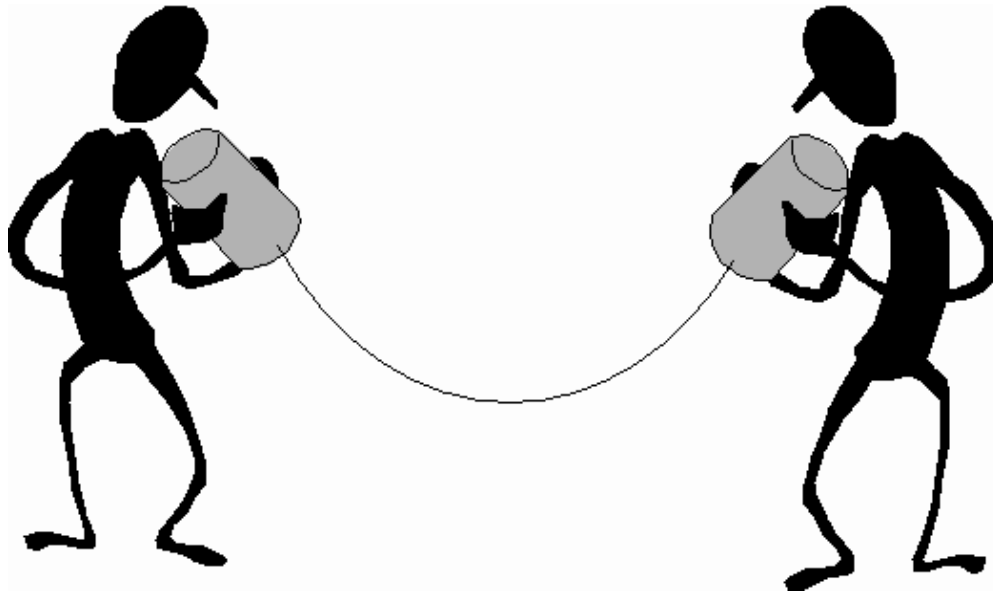
Objective

- The objective of this training is provide the basic knowledge to identify the principles of telecommunications and the kinds of network access.

Comunication

Human communication is a process between two or more persons involving exchange of information using a symbolic system for that.

This process involves several ways to communicate, such as two people talking or through sign language, by phone, mail, instant messages and so on.



Mobile Technologies need better experience

Mobile 1G

AMPS, NMT, TACS



Mobile 2G

D-AMPS, GSM/GPRS, cdmaOne



Mobile 3G

CDMA2000/EV-DO, WCDMA/HSPA+, TD-SCDMA



Mobile 4G LTE

LTE, LTE Advanced



N/A

Analog Voice



<0.5 Mbps¹

Digital Voice + Simple Data



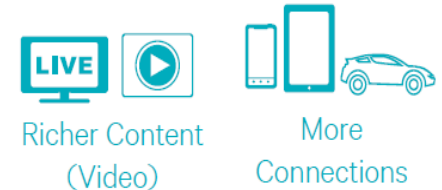
63+ Mbps²

Mobile Broadband

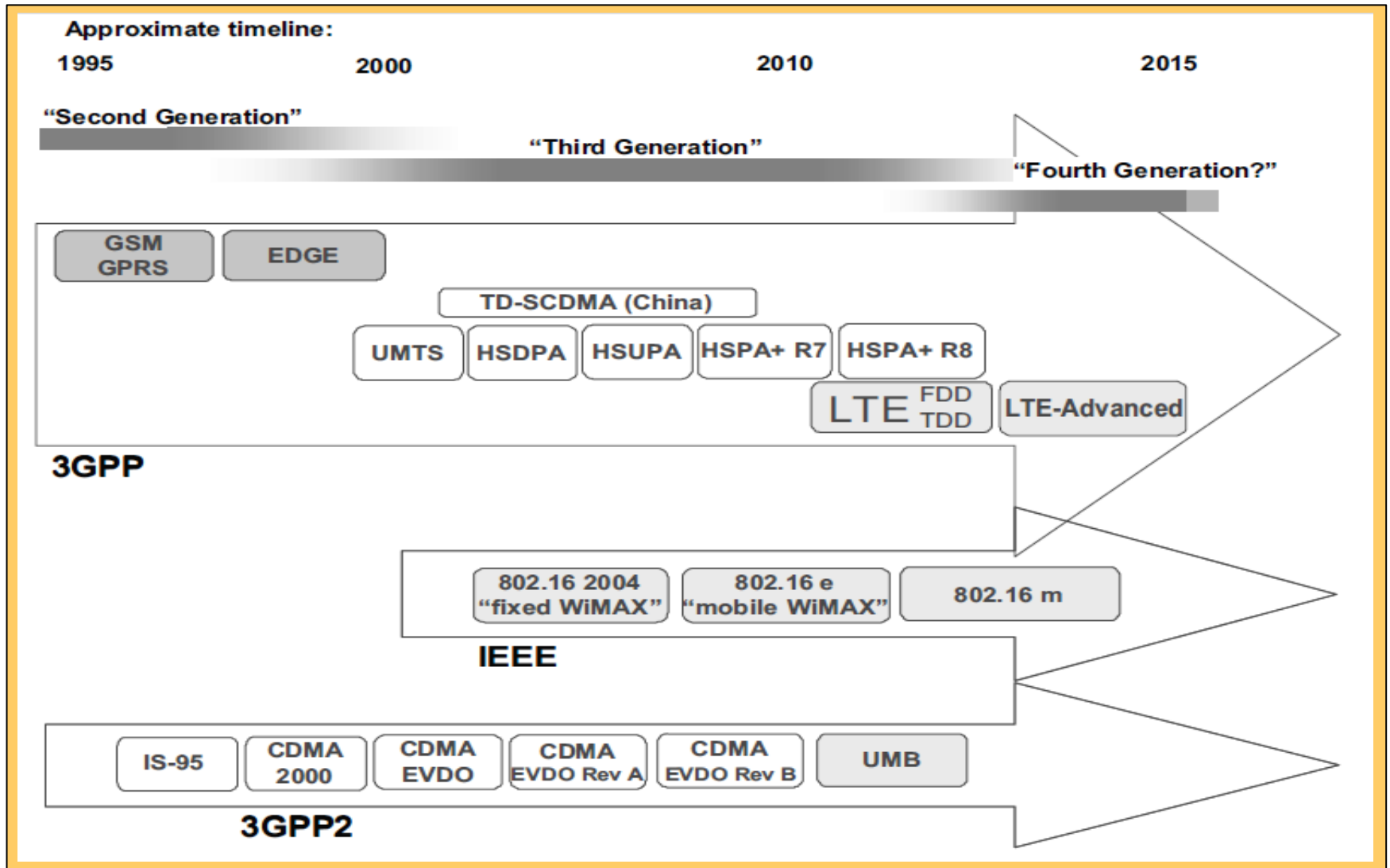


300+ Mbps³

Faster and Better

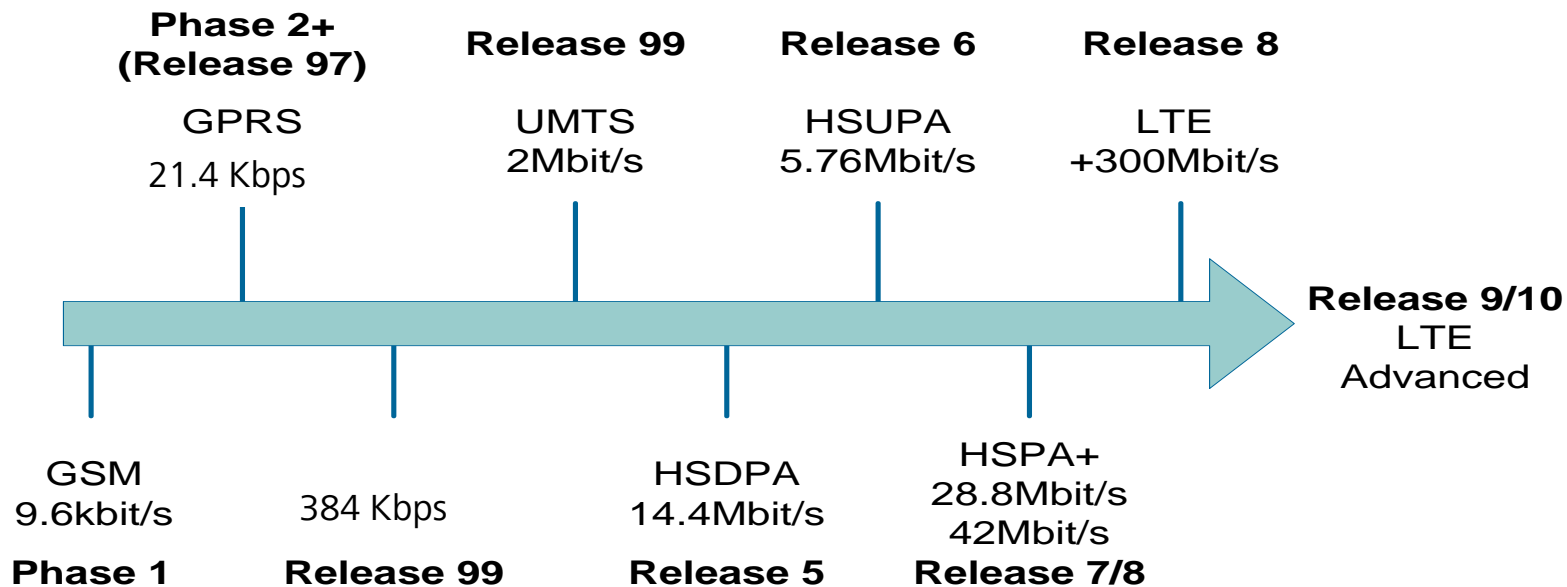


Mobile communications standards landscape

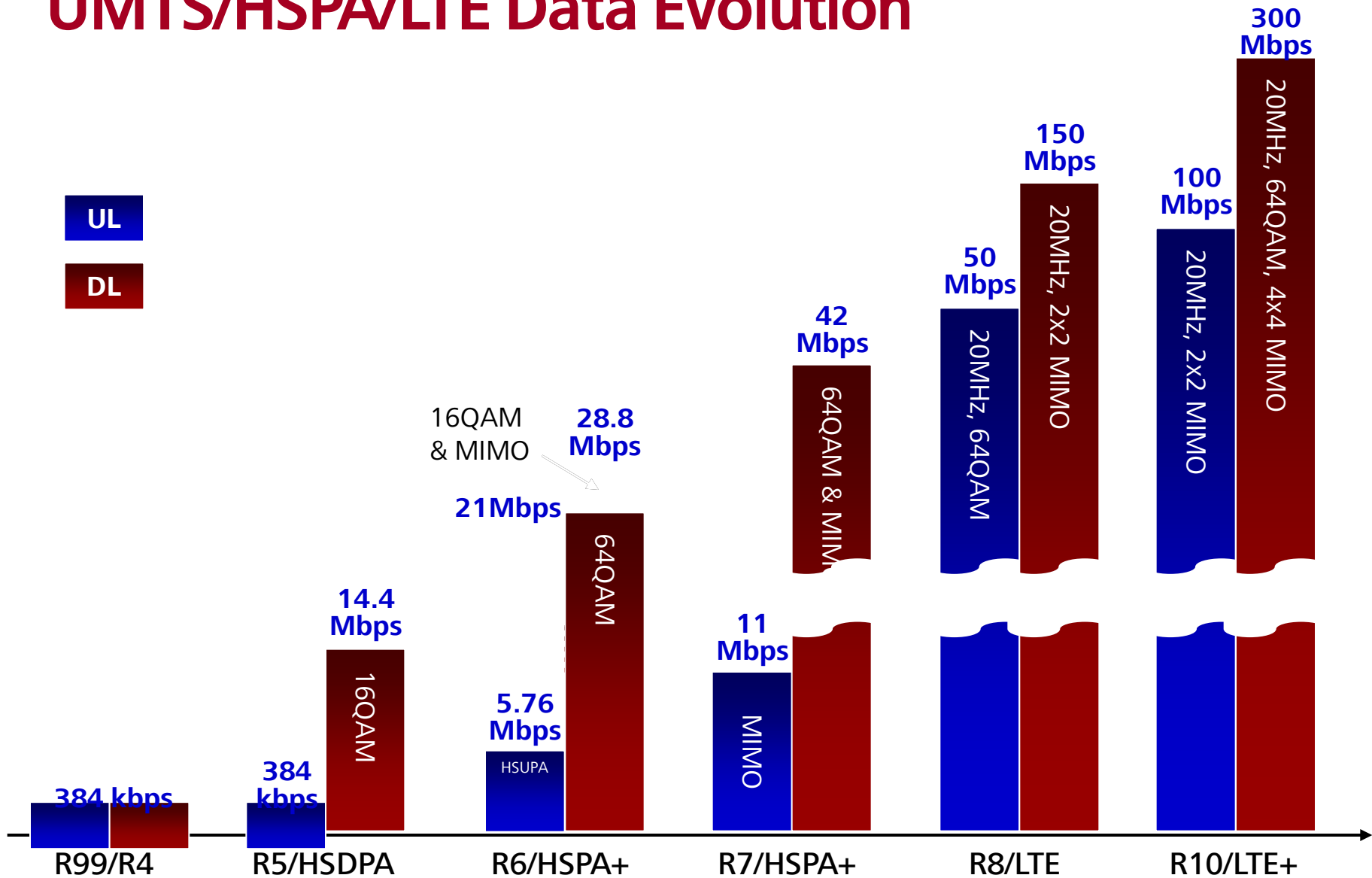


3GPP Releases (1)

- 3GPP is working on two approaches for 3G evolution: the LTE and the HSPA Evolution
 - HSPA Evolution is aimed to be backward compatible while LTE do not need to be backward compatible with WCDMA and HSPA
 - By the end of 2007, 3GPP R8 is released as the first specs of LTE



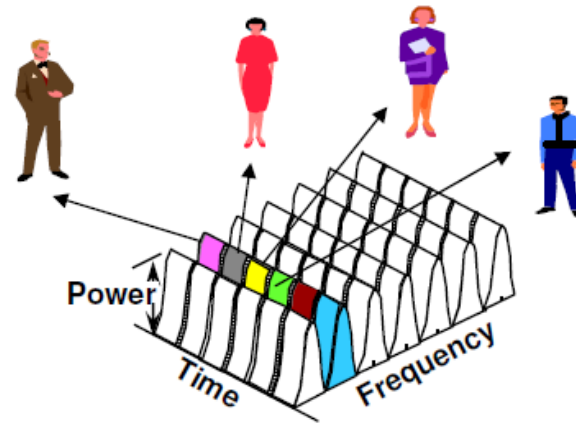
UMTS/HSPA/LTE Data Evolution



What is GSM?

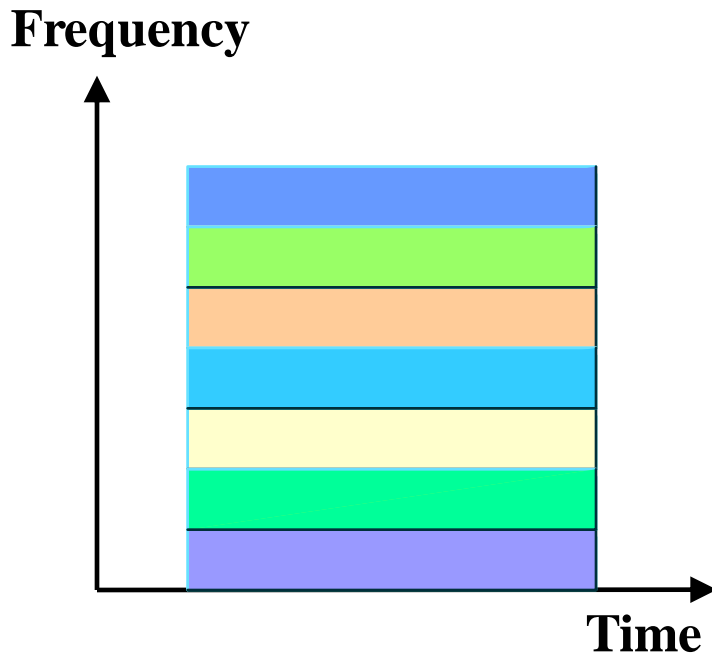
- **GSM** - **G**lobal **S**ystem for **M**obile Communication.
 - The GSM system is a frequency- and time-division cellular system, each physical channel is characterized by a carrier frequency and a time slot number

GSM



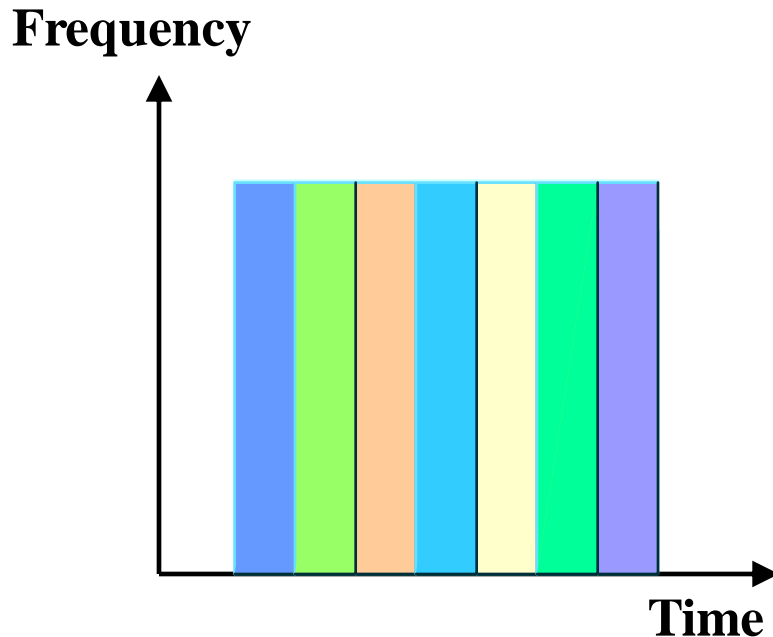
- **GPRS** - **G**eneral **P**acket **R**adio **S**ervice.
 - GPRS is an end-to-end packet switching technology providing data services up to 21.4 Kbps
- **EDGE** - **E**nhanced **D**ata Rates for **G**SM **E**volution
 - EGPRS (**E**nhanced **G**PRS) supports wireless access rate of up to 59.2 Kbps.

FDMA



- **FDMA uses different frequency channels to accomplish communication.**
- **The whole frequency spectrum available is divided into many individual channels (for transmitting and receiving), every channel can support the traffic for one subscriber or some control information.**

TDMA

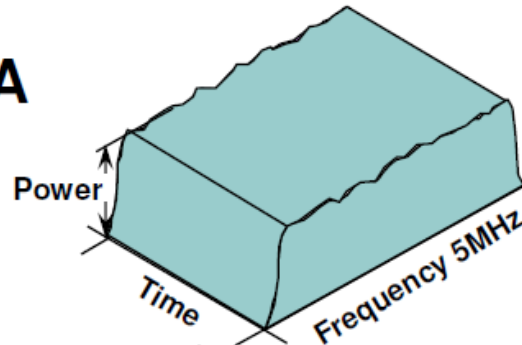


- TDMA accomplishes the communication in different timeslot.
- A carrier is divided into channels based on time. Different signals occupy different timeslots in certain sequence , that is , many signals are transmitted on the same frequency in different time.

What is WCDMA?

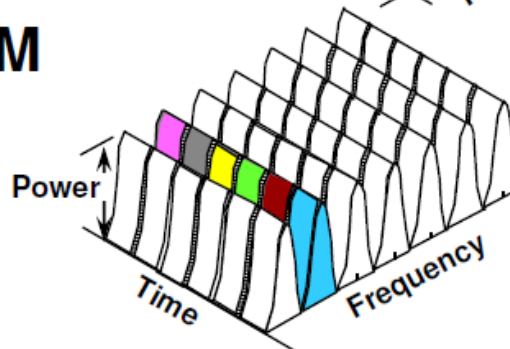
- **W**ideband **C**ode **D**ivision **M**ultiple **A**ccess
- The WCDMA system is a code-division cellular system, each physical channel is characterized by a unique code.

WCDMA



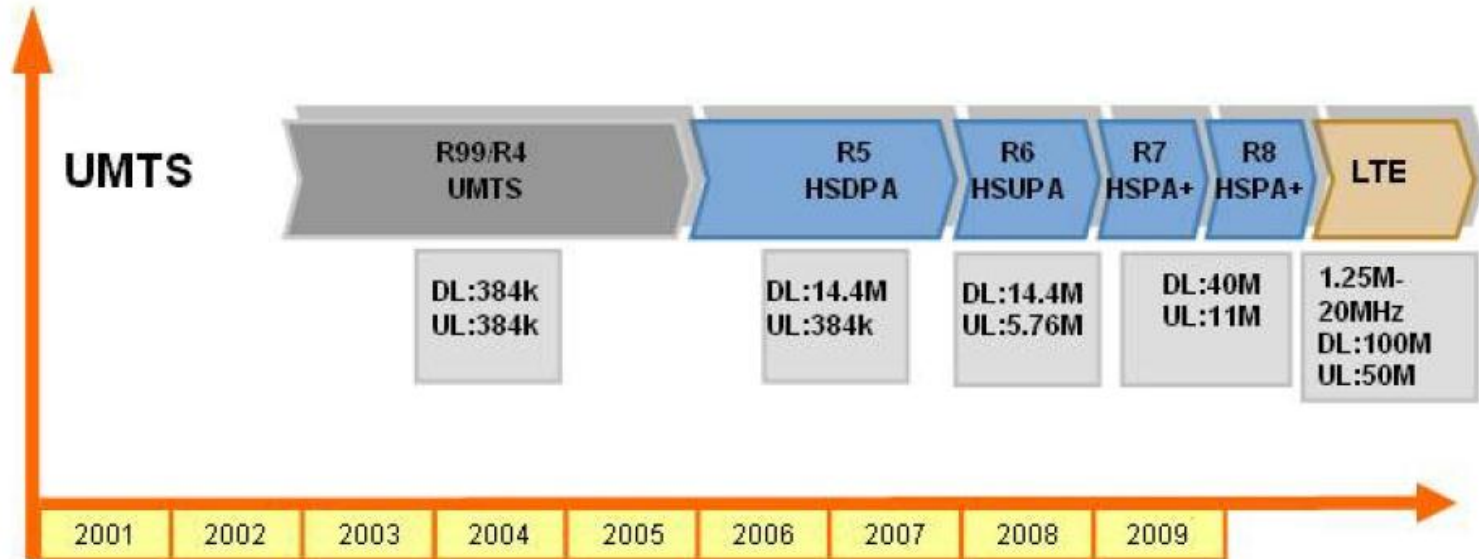
Traffic channels: different users are assigned unique code and transmitted over the same frequency band: WCDMA and CDMA2000

GSM

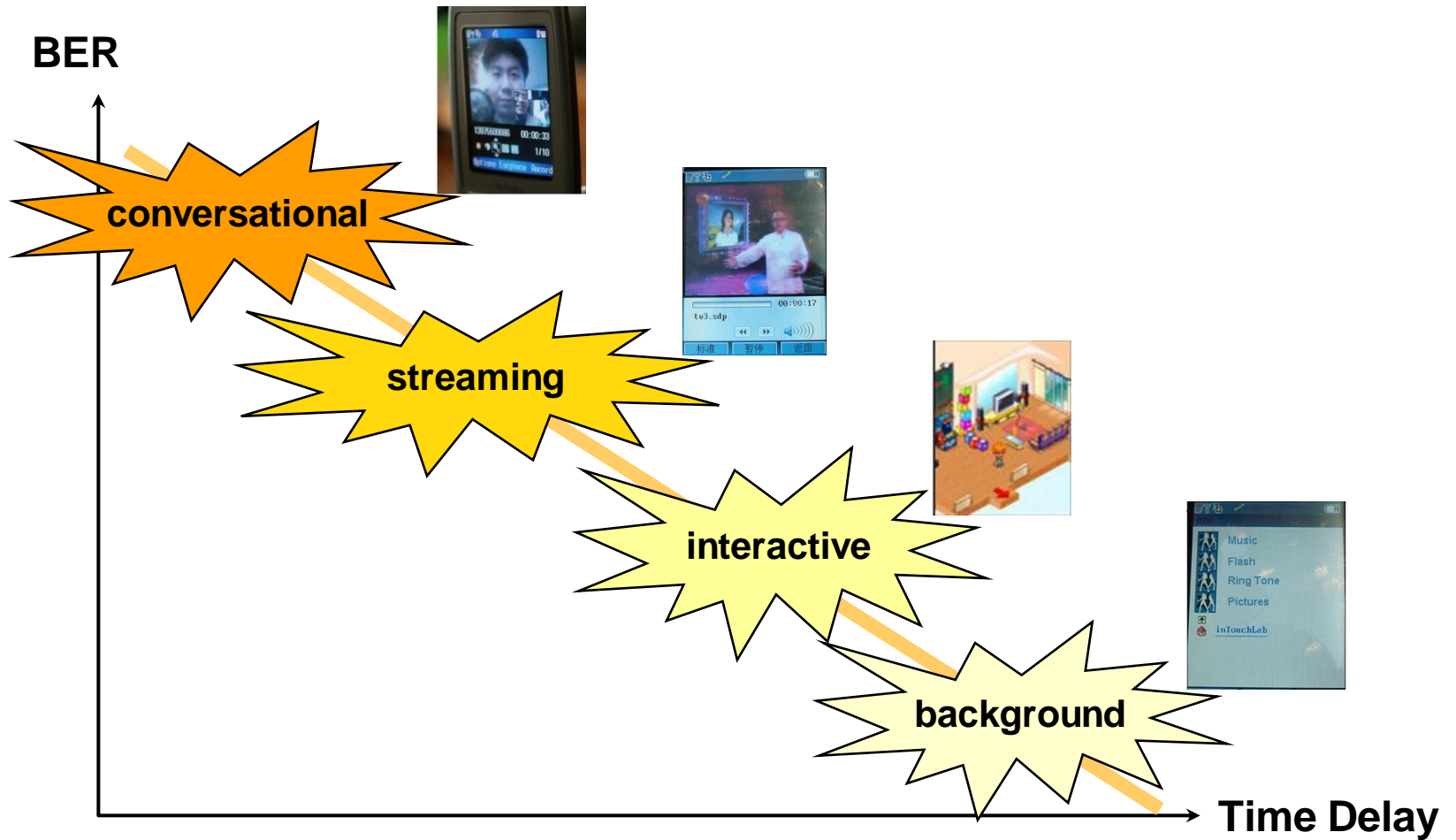


Traffic channels: different time slots are allocated to different users

WCDMA Development Evolution

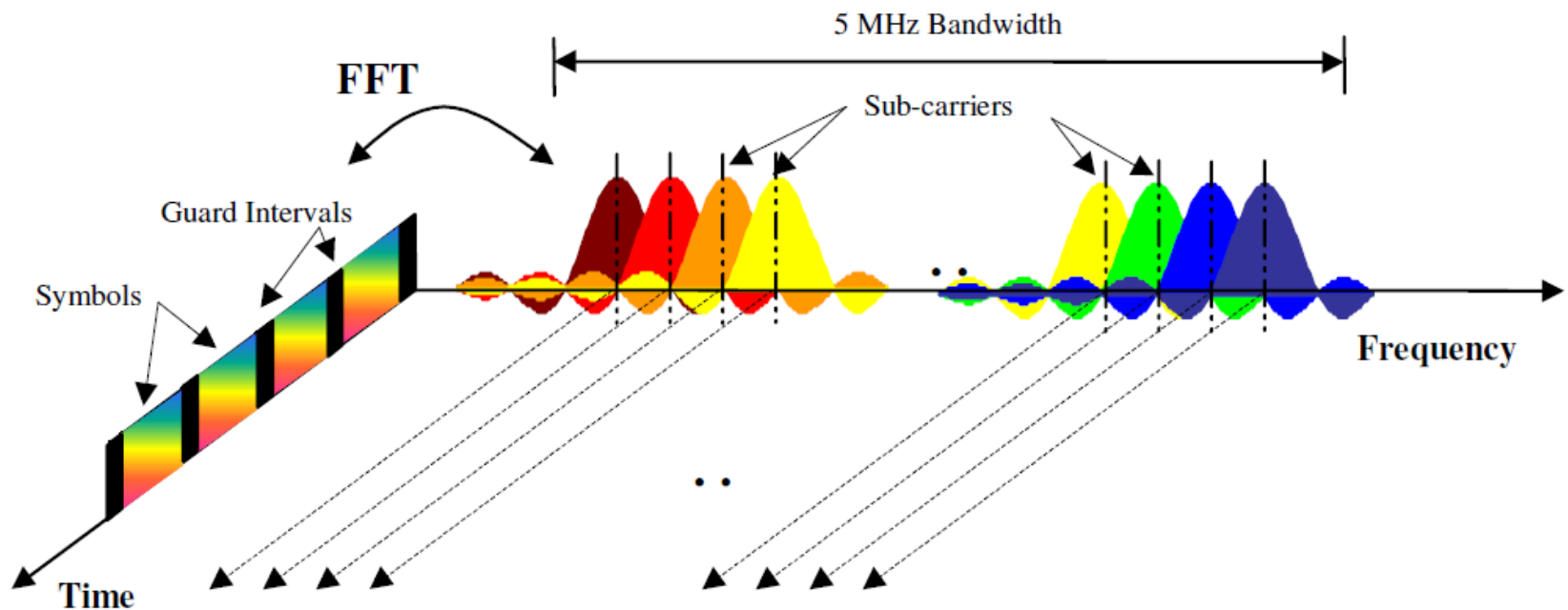


WCDMA Application Services



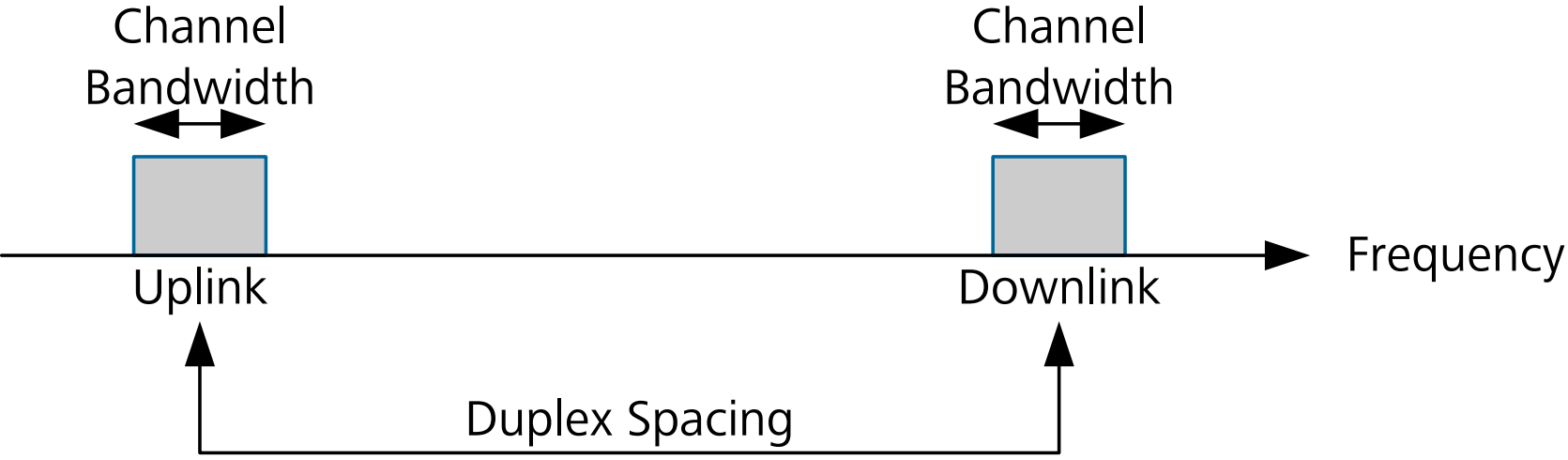
What is LTE?

- (Long Term Evolution) is known as the evolution of radio access technology conducted by 3GPP.
- OFDMA is used as multiple access technology in downlink.

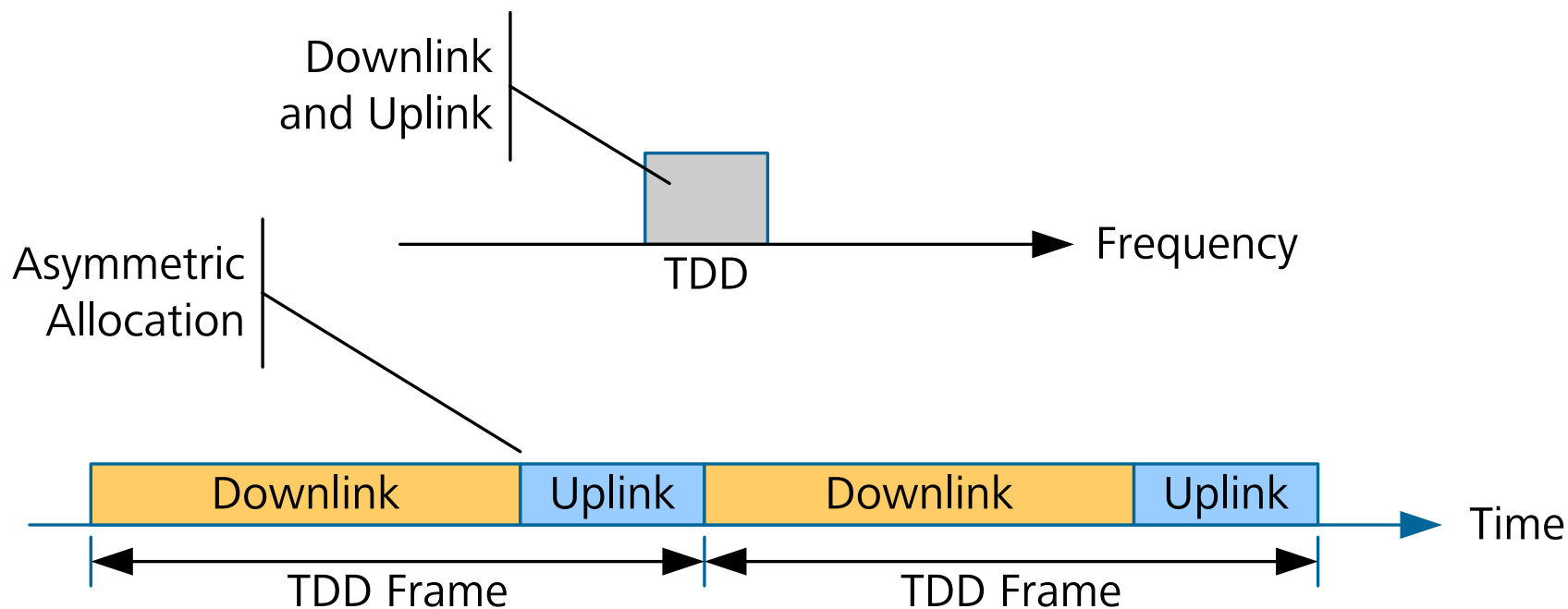


OFDM signal represented in frequency and time

Transmission Modes: Frequency Division Duplex



Transmission Modes: Time Division Duplex



Content

1-Evolution of Mobile Network

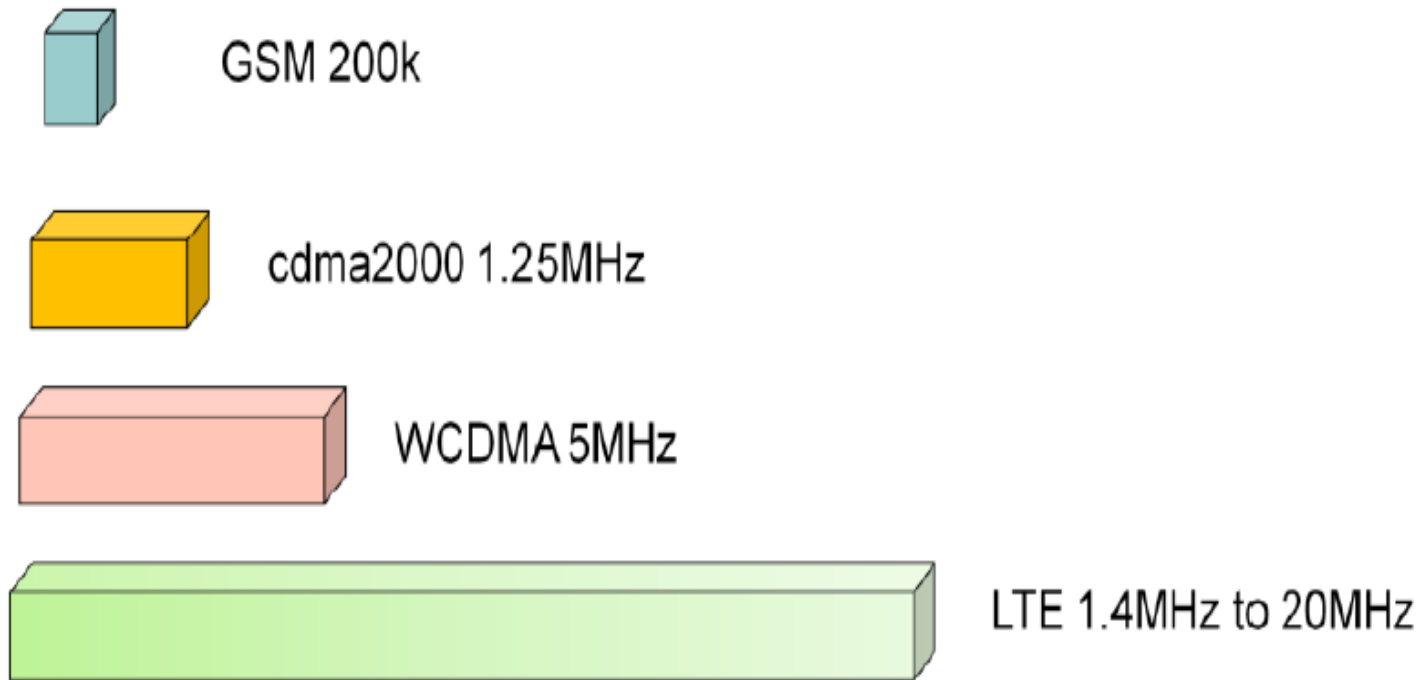
2-Differences between GUL Technologies

3-Site Equipments

Technique Differences between GUL

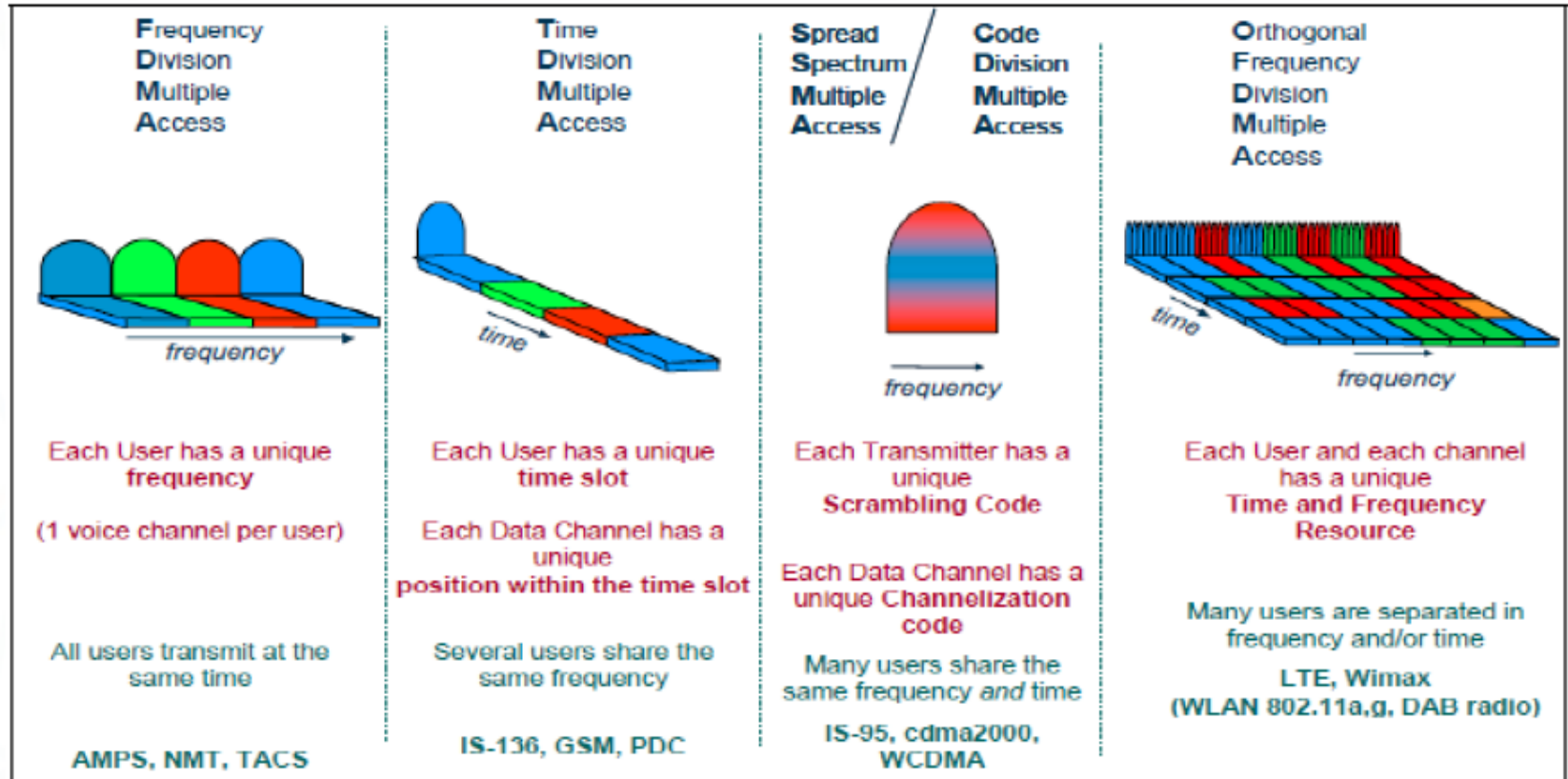
Items	GSM	UMTS	LTE
Channel Spacing	200KHz	5MHz	1.4...20MHz
Radio Transmission	TDMA	CDMA	OFDMA
Frequency Plan?	Yes	No	SFR
Handover	Hard HO	Soft HO	Hard HO
Power Control	Yes (Slow PC)	Yes (Fast PC)	Yes (Slow PC)
Support MIMO?	No	No (HSPA+, Yes)	Yes
Pilot Channel	BCCH	CPICH	RS(RSRP/RS SINR)
Capacity Resource	# of TRX	# of Carriers	# of RBs
Support AMC?	No (EDGE, Yes)	No (HSPA, Yes)	Yes
UE max Power	33dBm	24dBm	23dBm

Variable Band Deployment



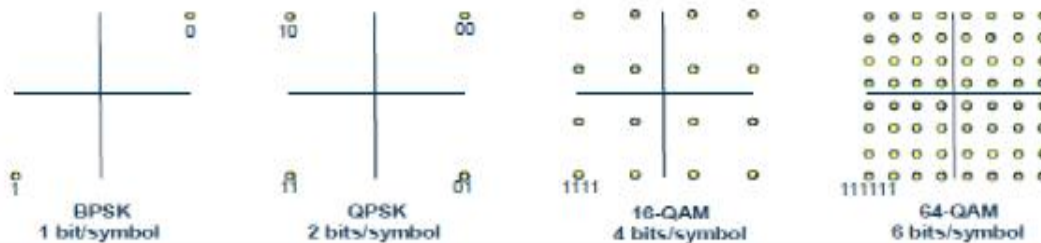
■ LTE has the flexible Bandwidth, so that the operator can choose different networking solution with certain frequency band.

Multiple Access Methods



UMTS & LTE Modulation

- The sub-carriers are modulated with a certain modulation scheme
 - maps the data bits into a carrier phase and amplitude (symbols)
- E-UTRAN user data channels supports QPSK, 16QAM and 64QAM
- 16QAM allows for twice the peak data rate compared to QPSK
- 64QAM allows for three times the data rate compared to QPSK
- Higher order modulation more sensitive to interference
 - Useful mainly in good radio channel conditions (high C/I, Little or no dispersion, Low speed)
e.g. Close to cell site & Micro/Indoor cells
- BPSK is used for some signaling (PHICH)

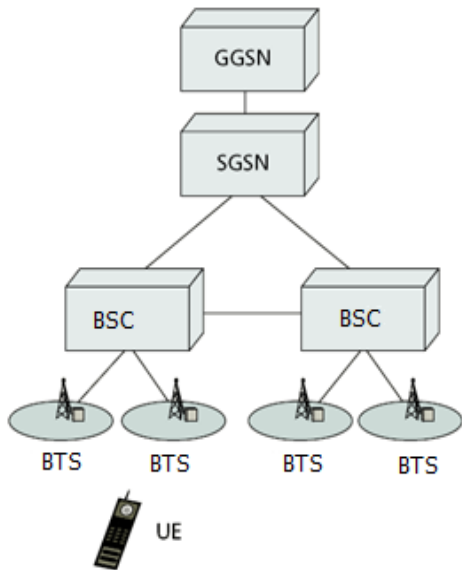


■ Three different modulation schemes are supported in LTE:

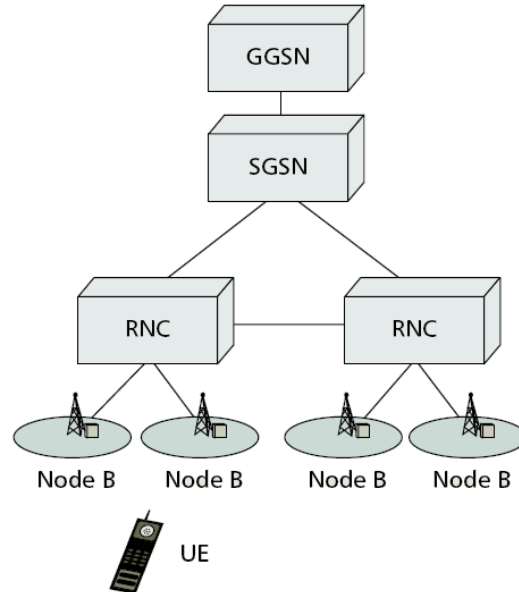
- QPSK (Quadrature Phase shift keying)
- 16-QAM (16 Quadrature Amplitude Modulation)
- 64-QAM (64 Quadrature Amplitude Modulation)

System PS Architecture

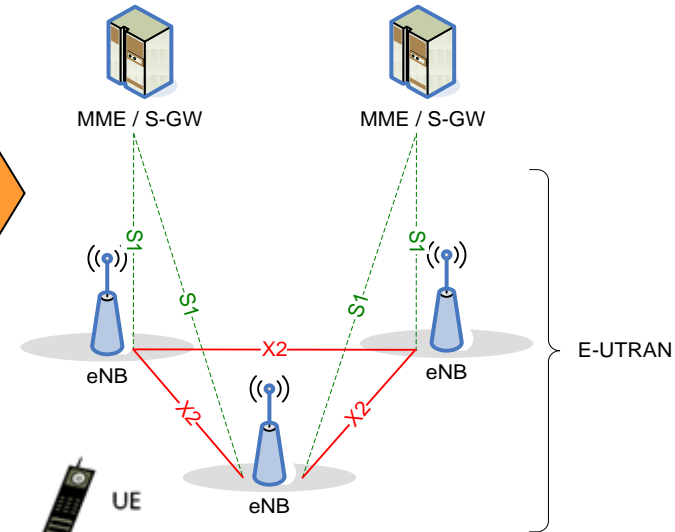
GSM



UMTS



LTE



- **LTE: simplified IP flat architecture**

- Less equipment node and easier deployment
- Less transmission delay and easier O&M
- S1 and X2 interfaces are based on a full IP transport stack

System Main Services

Data application	GPRS/EDGE	UMTS	LTE
SMS	★	★	★
Ring back Tone	★	★	★
MMS	★	★	★
WAP browsing	★	★	★
Email	★	★	★
“Classic” WEB browsing	★	★	★
Video Ring Back Tone		★	★
High-end Gaming		★	★
High quality online video		★	★
Video telephony		★	★
“Super-fast” WEB browsing		★	★
Broadcast Mobile TV (MBMS)		★	★
Corporate VPN, intranet		★	★
true on-demand television			★
Video-based mobile advertising			★
Wireless DSL			★
Mobile WEB2.0 (social community, P2P)			★
High quality online gaming (consistent experience with fix network)			★
.....			★

Different Experience for End Users

	EDGE	UMTS	HSPA	HSPA+	LTE
	59.2kbps	256kbps	2Mbps	5Mbps	40Mbps
Web Visit	36 Seconds	8 Seconds	1 Second	immediately	immediately
Download 5MB Music	12 Minutes	3 Minute	20 Seconds	8 Seconds	1 Second
Download 25MB Video	1 Hour	15 Minutes	1.5 Minute	40 Seconds	5 Seconds
Download 750MB movie	30 Hours	6.5 Hours	50 Minutes	20 Minutes	2.5 Minutes
Download HD-Video	10+ Days	2~3 Day	~6 Hours	~2 Hours	~15 Minutes

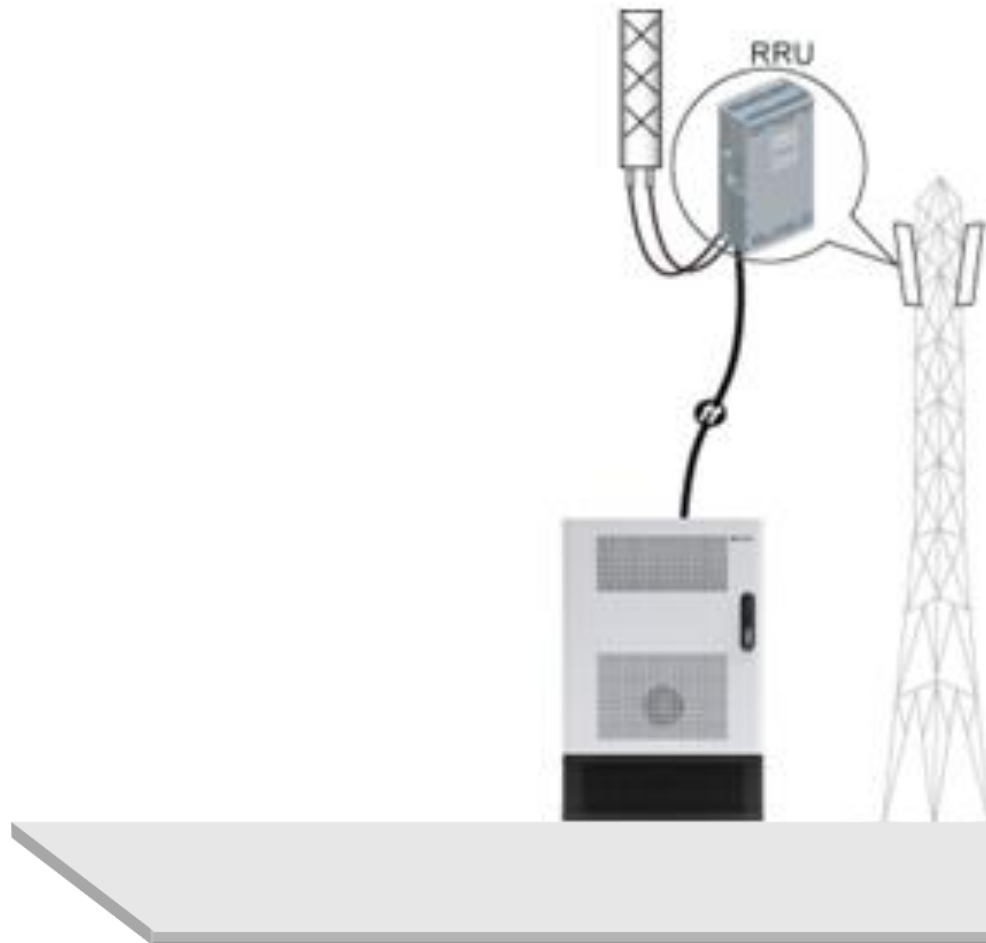
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Site Equipments

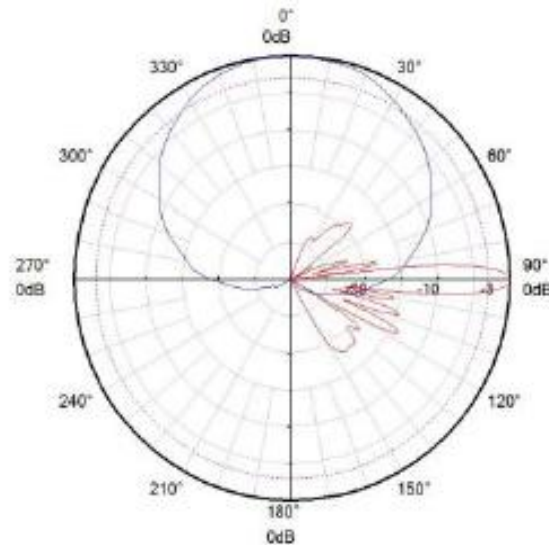


Antenna Specifications

Antenna Specifications

Electrical Properties

Frequency range (MHz)		4 x (1710 - 2690)			
		1710 - 1990	1920 - 2200	2200 - 2490	2490 - 2690
Polarization		+45°, -45°			
Electrical downtilt (°)		0 - 12, continuously adjustable, each band separately			
Gain (dBi)	at mid Tilt	17.4	17.7	17.9	18.3
	over all Tilts	17.2 ±0.5	17.5 ±0.5	17.7 ±0.5	18.0 ±0.5
Horizontal 3dB beam width (°)		68 ±5	64 ±5	61 ±5	60 ±5
Vertical 3dB beam width (°)		6.8 ±0.5	6.1 ±0.4	5.4 ±0.4	5.0 ±0.3



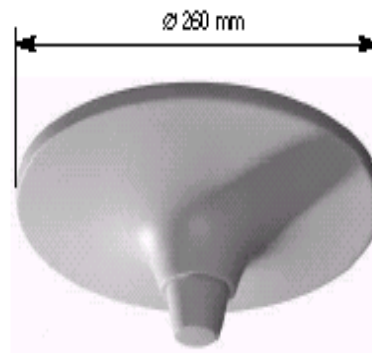
Antenna Classification



Directional antenna



plate antenna



741 572

cap antenna



paraboloid antenna

Basic Site Layouts

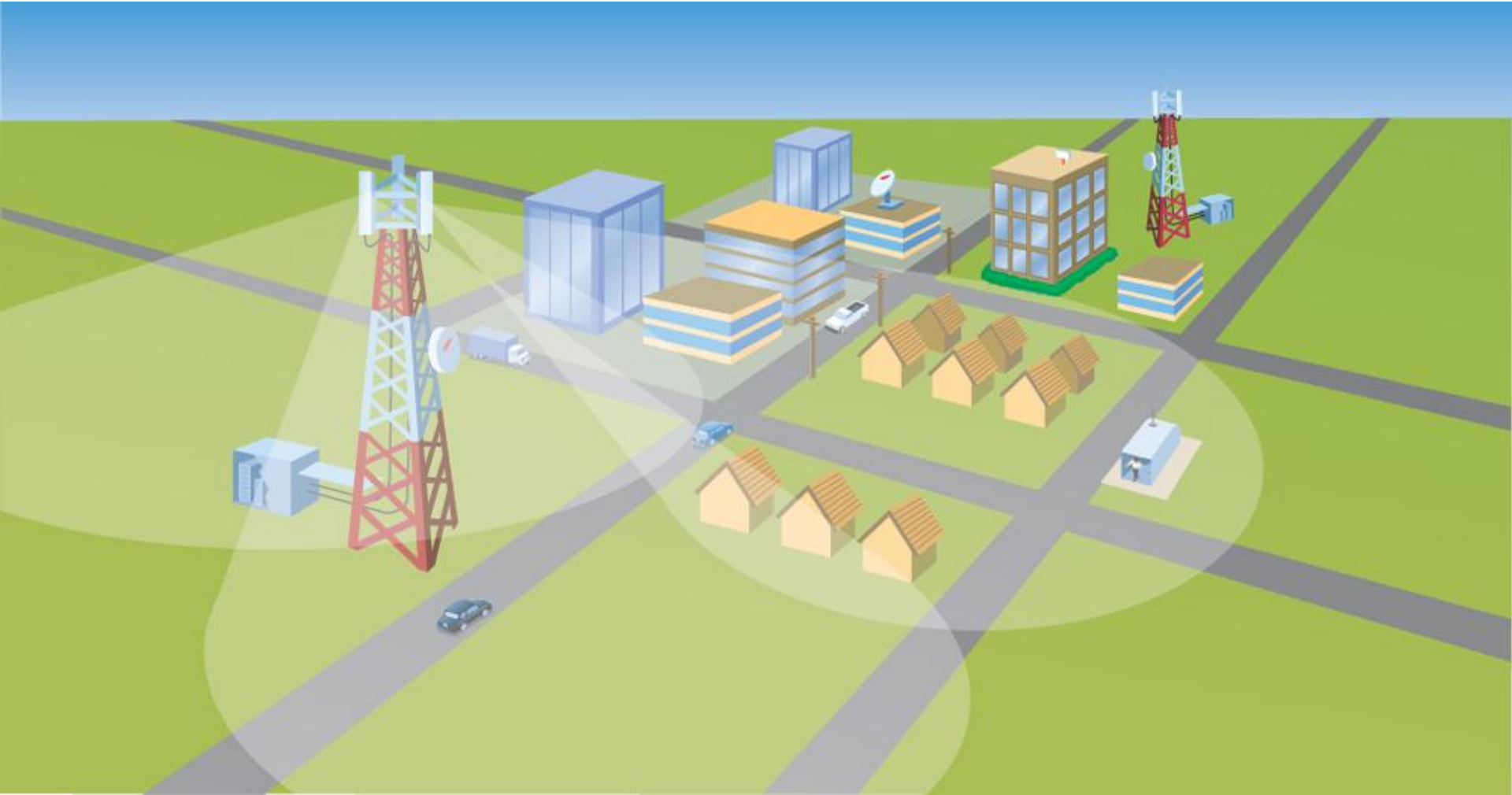
- Elevation Tilt

- Boresite Correction

- Azimuth Fanning



Signals From Tower A



Coverage Tower A



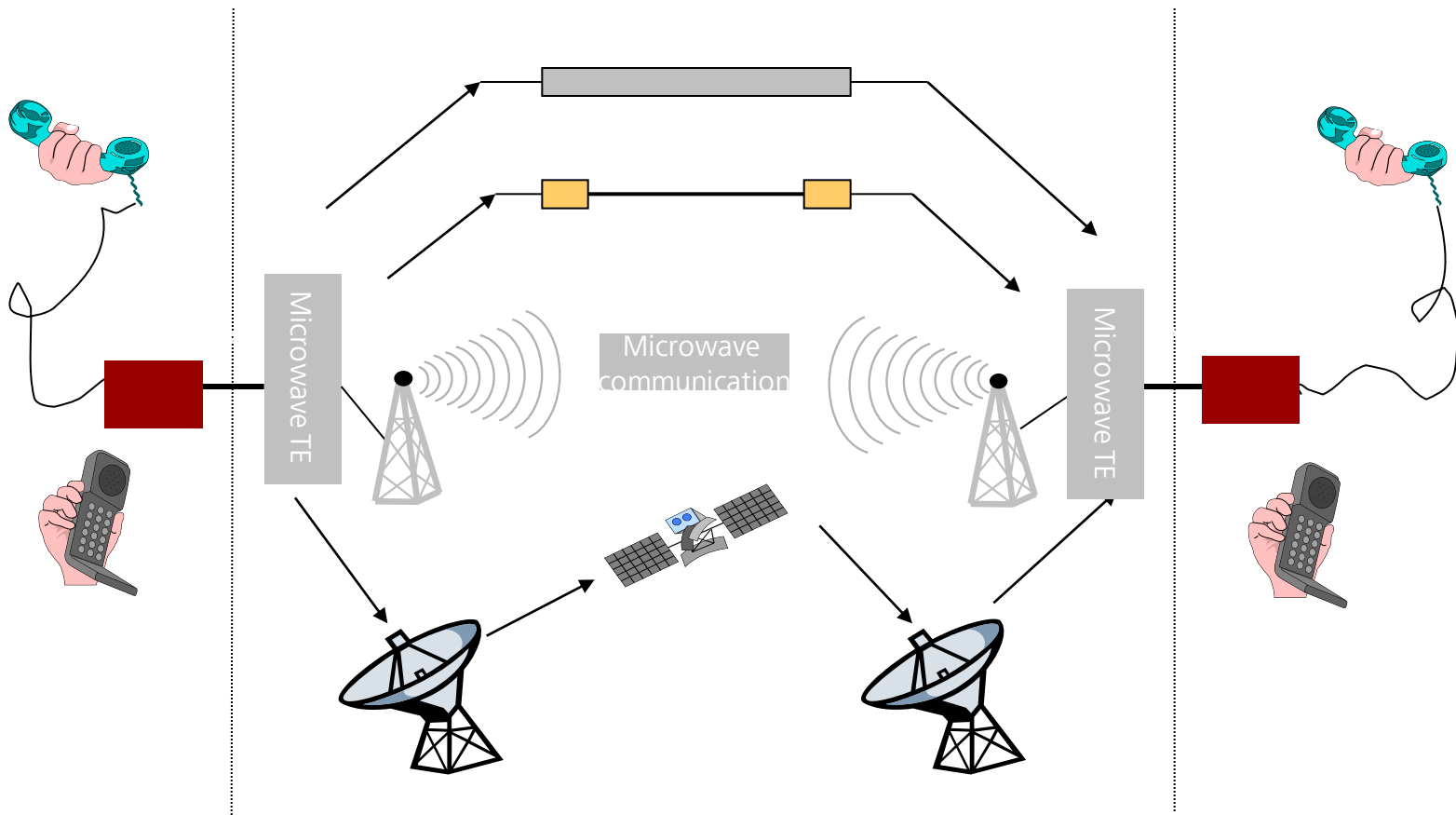
Signals From Tower B



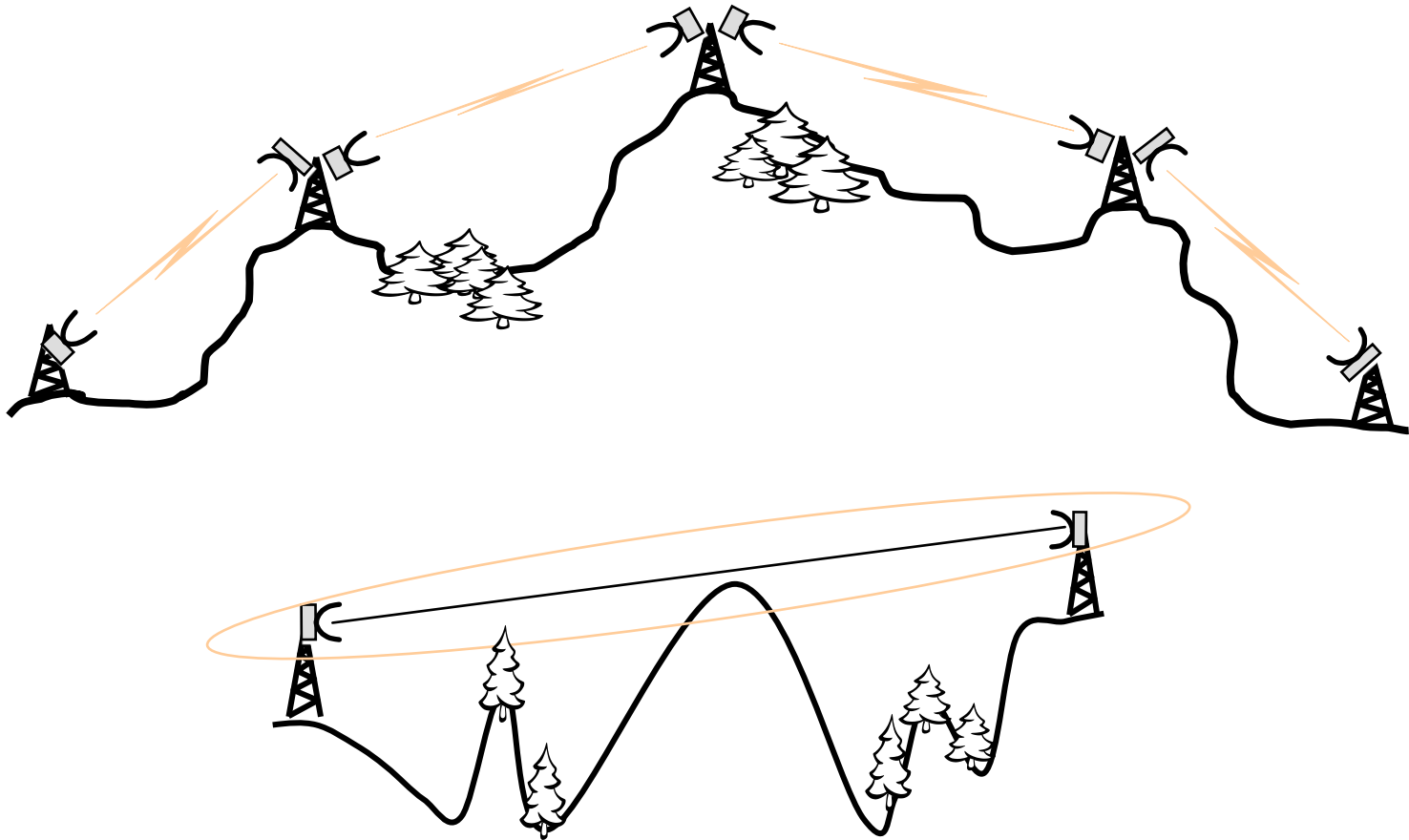
Coverage From Tower B



Transmission Methods in Current Communications Networks



Active Relay Station



- The first Fresnel zone is the region where the microwave transmission energy is the most concentrated. The **obstruction in the Fresnel zone should be as little as possible.**

Thank you

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