

CDMA PRINCIPLES

ECE 525E-MOBILE COMMUNICATION

Thursday, 04 April 2019



Who We Are

Leadership

History

Awards

Billions, maybe trillions of times a day...

That's how often people around the world touch something made better by Qualcomm. It could be the smartphone in your pocket, the tablet on your coffee table, that wireless modem in your briefcase... it could even be that navigation system in your car or that action camera strapped to your chest.

“We often do what many thought was impossible.”



Who We Are

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Seven people, one big idea.

In July 1985, seven industry veterans came together in the den of Dr. Irwin Jacobs' San Diego home to discuss an idea. Those visionaries—Franklin Antonio, Adelia Coffman, Andrew Cohen, Klein Gilhousen, Irwin Jacobs, Andrew Viterbi and Harvey White—decided they wanted to build “Quality Communications” and outlined a plan that has evolved into one of the telecommunications industry’s greatest start-up success stories: Qualcomm Incorporated.

SAMSUNG DUOS SPECIFICATIONS

NETWORK	Technology	GSM / HSPA
	Announced	2012, July
LAUNCH	Status	Available. Released 2012, September
	Dimensions	121.5 x 63.1 x 10.5 mm (4.78 x 2.48 x 0.41 in)
BODY	Weight	120 g (4.23 oz)
	SIM	Dual SIM (Mini-SIM, dual stand-by)
DISPLAY	Type	TFT capacitive touchscreen, 16M colors
	Size	4.0 inches (~59.4% screen-to-body ratio)
	Resolution	480 x 800 pixels (~233 ppi pixel density)
	Multitouch	Yes
PLATFORM	OS	Android 4.0 (Ice Cream Sandwich)
	Chipset	Qualcomm MSM7227A Snapdragon S1
	CPU	1.0 GHz Cortex-A5
	GPU	Adreno 200
MEMORY	Card slot	microSD, up to 32 GB (dedicated slot)
	Internal	4 GB (1.8 GB user available), 768 MB RAM

SECOND GENERATION TECHNOLOGIES

1ST GENERATION

FDMA – BASED SYSTEMS

1. AMPS (US Standard)
2. ETACS (UK Standard)
3. NMT (Nordic Countries)

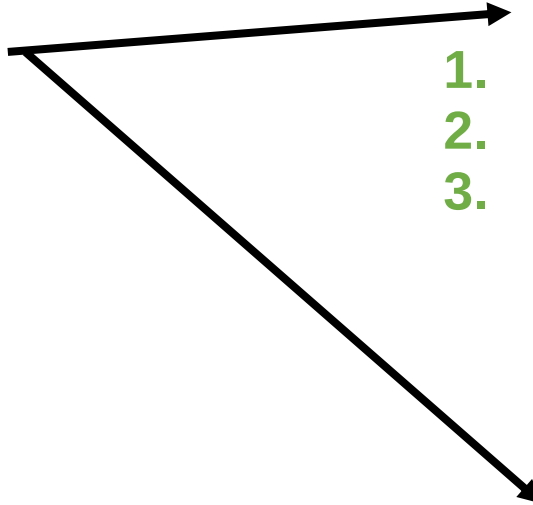
2ND GENERATION

FDMA/TDM-BASED SYSTEMS

1. GSM (European Standard)
2. DAMPS/IS 136 - US Standard)
3. PDC – Personal Digital Service (Japanese Standard)

CDMA

1. IS-95 - US Standard)



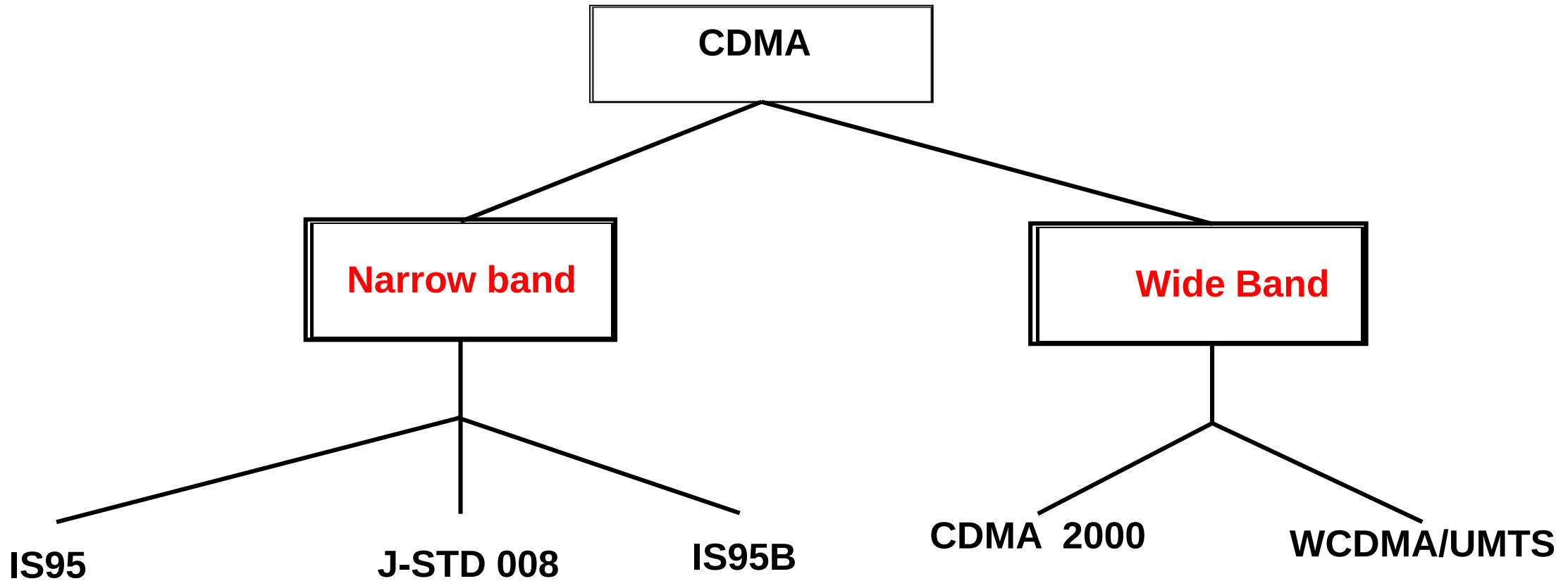
CODE DIVISION MULTIPLE ACCESS (CDMA)

1. **Code Division Multiple Access (CDMA)** also known as IS-95 is a spread spectrum technology platform that enables multiple users to occupy the same radio channel or frequency spectrum at the same time.
2. Each CDMA Mobile Station (MS) employs its own unique code to distinguish it from other MSs.
3. CDMA Offers users all features associated with spread spectrum communication which include:
 - a) Ability to thwart interference
 - b) Improved immunity to multipath effects
 - c) Anti-jam

HISTORY OF CDMA

- Motivation – Intended as a new system (greenfield) or replacement for AMPS (not an upgrade) to
 - a) Increase system capacity
 - b) Increase security
 - c) Add new features/services
- **History:**
 - **1990:** Qualcomm proposed a code division multiple access (CDMA) digital cellular system claimed to increase capacity by factor 20 or more – Started debate about how CDMA should be implemented and the advantages vs. TDMA (religious tones to debate)
 - **1992:** Telecommunication Industry Association (TIA) starts a study of spread spectrum cellular
 - **1995:** First CDMA system (named CDMA-one) launched in Hongkong

TYPES OF CDMA SYSTEMS

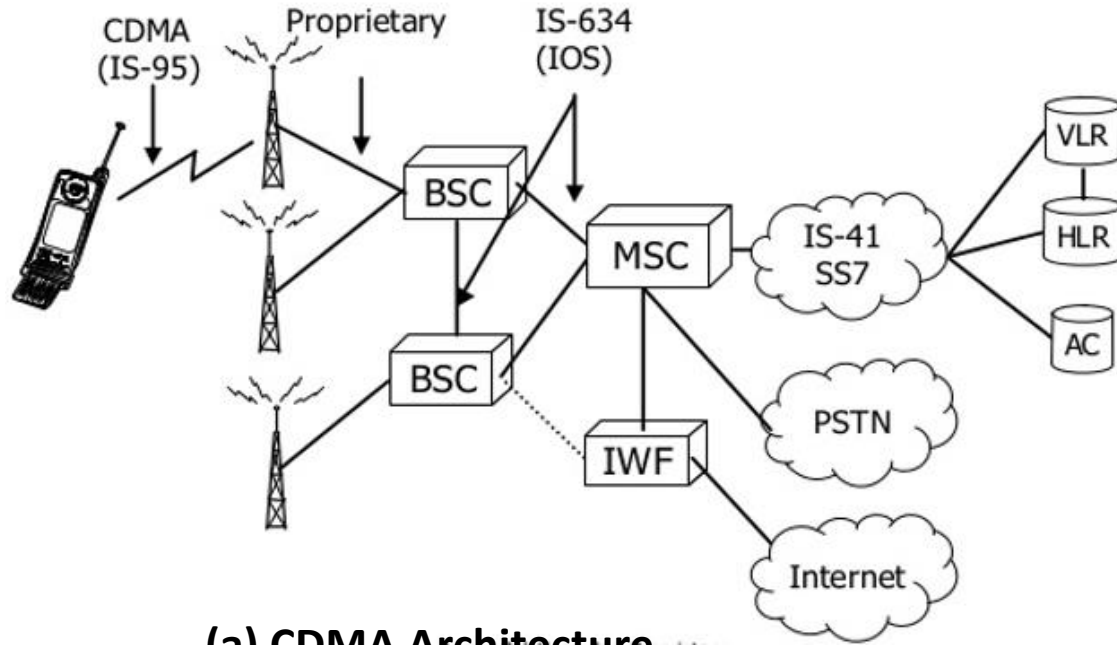


Launch date: 1995
Frequency Band: 800 MHz
Chip rate: 1,228,800 bits/s
Data rate: 14.4 Kbps

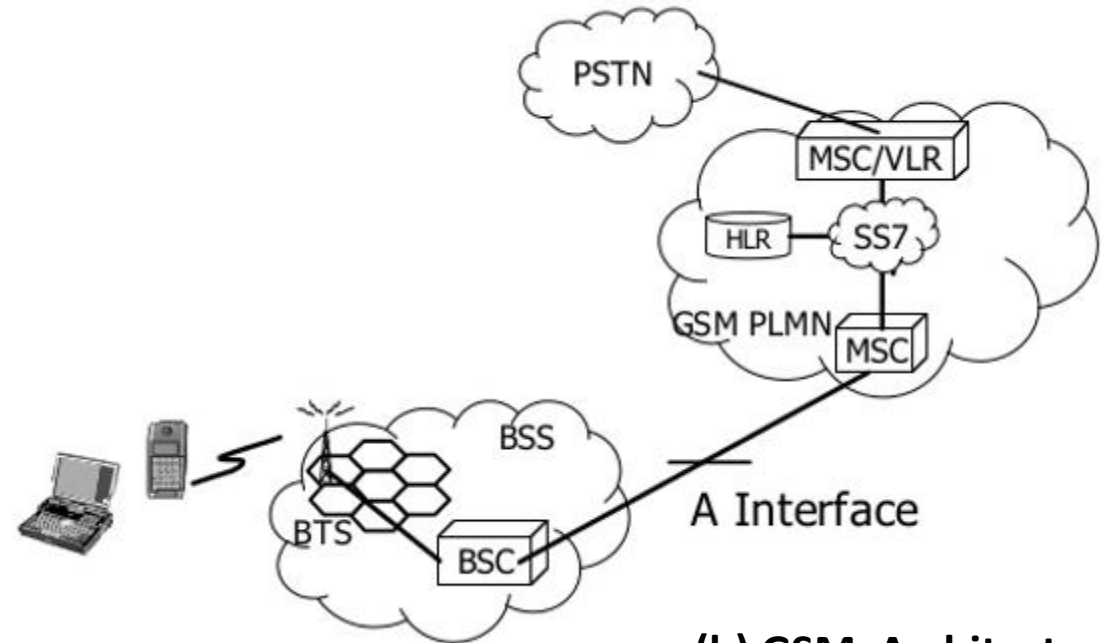
ANSI Standard
Published – 1996
Frequency Band:
800 & 1900 MHz

Launch date: 1999
Frequency Band: 800
& 1900 MHz
Data rate: 115 Kbps

CDMA(IS-95) ARCHITECTURE



(a) CDMA Architecture



(b) GSM Architecture

CDMA MOBILE STATION

Mobile Station Contains:

1. Mobile Equipment (ME)
2. Subscribers Identity Module (SIM)

FUNCTIONS OF THE CDMA BTS

- It defines the cell .
- It handles the radio link protocol with the mobile station

FUNCTIONS OF THE CDMA MSC

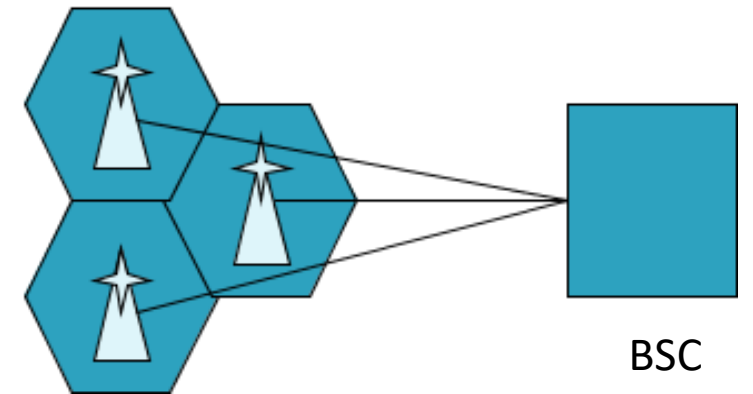
1. Call set up/supervision/release
2. Call routing
3. Billing information collection
4. Mobility management
5. Paging, connection to BSC, other MSC and other local exchange networks
6. Access to HLR and VLR

PROPERTIES/FUNCTIONS OF THE CDMA HLR

1. One HLR per CDMA operator
2. Contains permanent database of all the subscribers in the network
3. Contains MSRN(mobile station routing no.)

FUNCTIONS OF THE CDMA BSC

1. It manages radio resources for one or more BTS.
2. Allocation and Deallocation of channels.
3. Transmitter power control.
4. Handoff control



COMPARISON OF FDM/TDM SYSTEMS & CDMA

1. In TDMA Bandwidth available per channel is small which leads to compromise in quality of transmission. Whereas in CDMA systems entire bandwidth is used which enhances voice quality.
2. In TDMA/FDMA, cell design requires more frequency planning which is tough job. Whereas in CDMA frequency planning is minimal.
3. TDMA is band-limited system while CDMA is power-limited system

FEATURES OF CDMA

1. Frequency reuse of one
2. Tight power control
3. Longer battery life
4. Support for soft handoff

ADVANTAGES OF CDMA

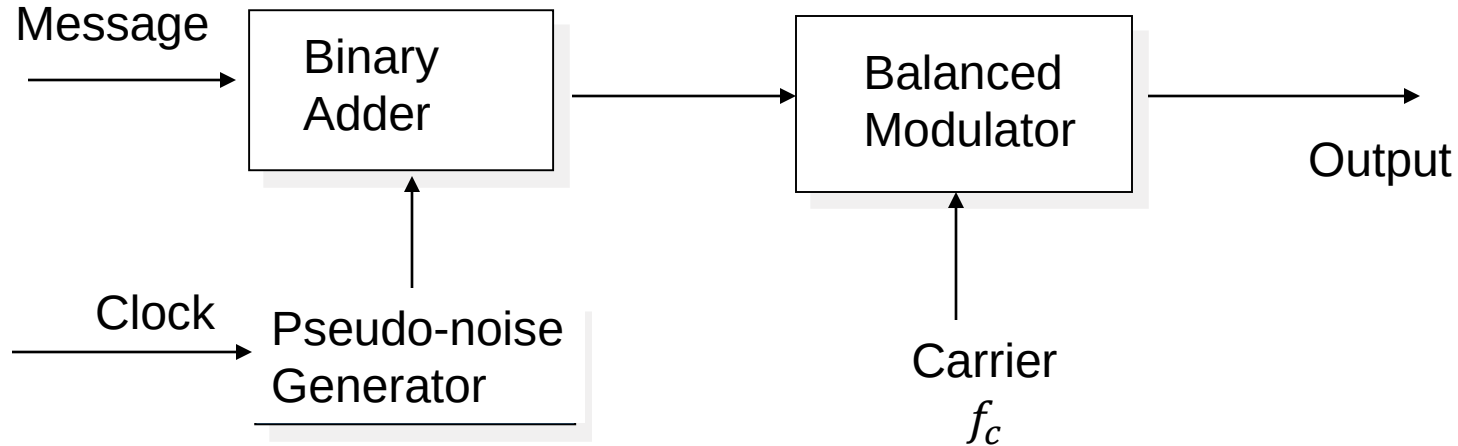
1. High capacity without hard blocking limits
2. Easy frequency planning
3. Greater coverage with fewer cells
4. Technology platform extendable to new services
5. Excellent call quality
6. Inherent privacy
7. Lower power/Longer battery life

DISADVANTAGES OF CDMA

- **Near far problem.**
- **CDMA can not offer international roaming, a large GSM advantage**

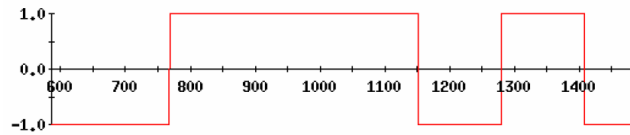
DIRECT SEQUENCE/PSEUDO NOISE TRANSMITTER – FROM REVIOUS CLASS

- In **Direct Sequence**(also called a Pseudo-noise), the signal is generated by adding a binary message with the output of a pseudo-noise generator as shown below:



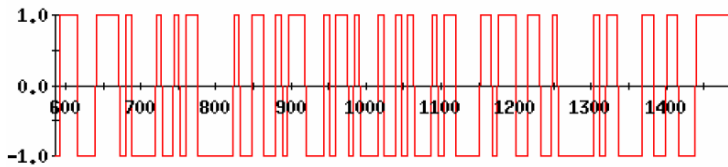
CDMA PRINCIPLE

Rate of Change Known as bitrate



Message signal

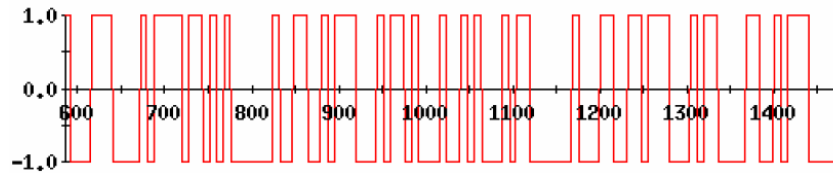
Rate of Change Known as chiprate



Pseudo Code



Each bit of sequence 1 is replaced by the code sequence

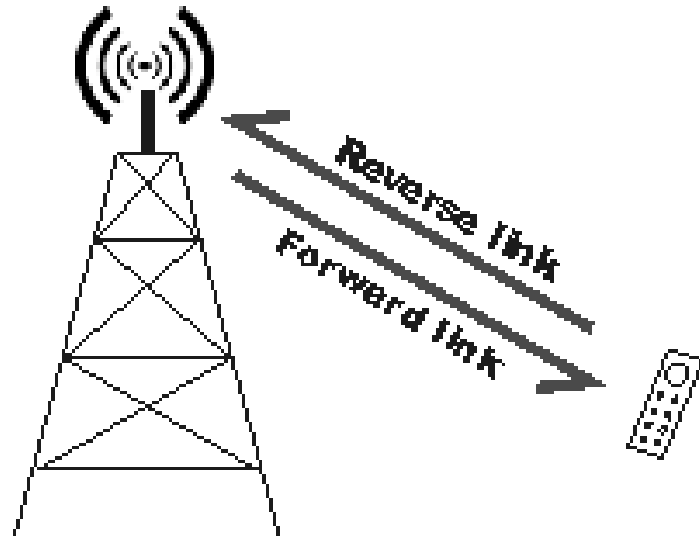


Output

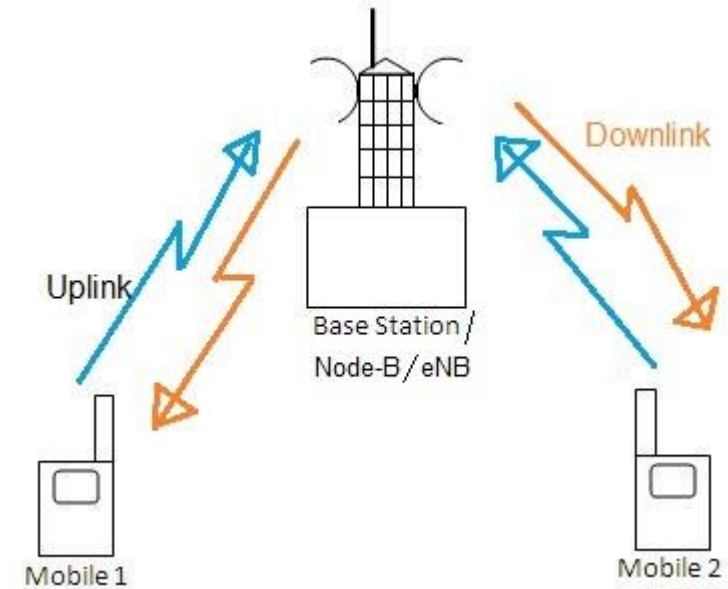
BASE STATIONS – PN SEQUENCIES, TIMING

- All base stations use same PN sequence
- Each base station selects from 512 different PN off-sets
- Mobile station synchronizes to a pilot channel
- Each base station has GPS receiver to synchronize self with other bases stations
- Timing accuracy is vital to CDMA system functionality

GSM AND CDMA LINK DESIGNATION



(a) CDMA Um interface link designation

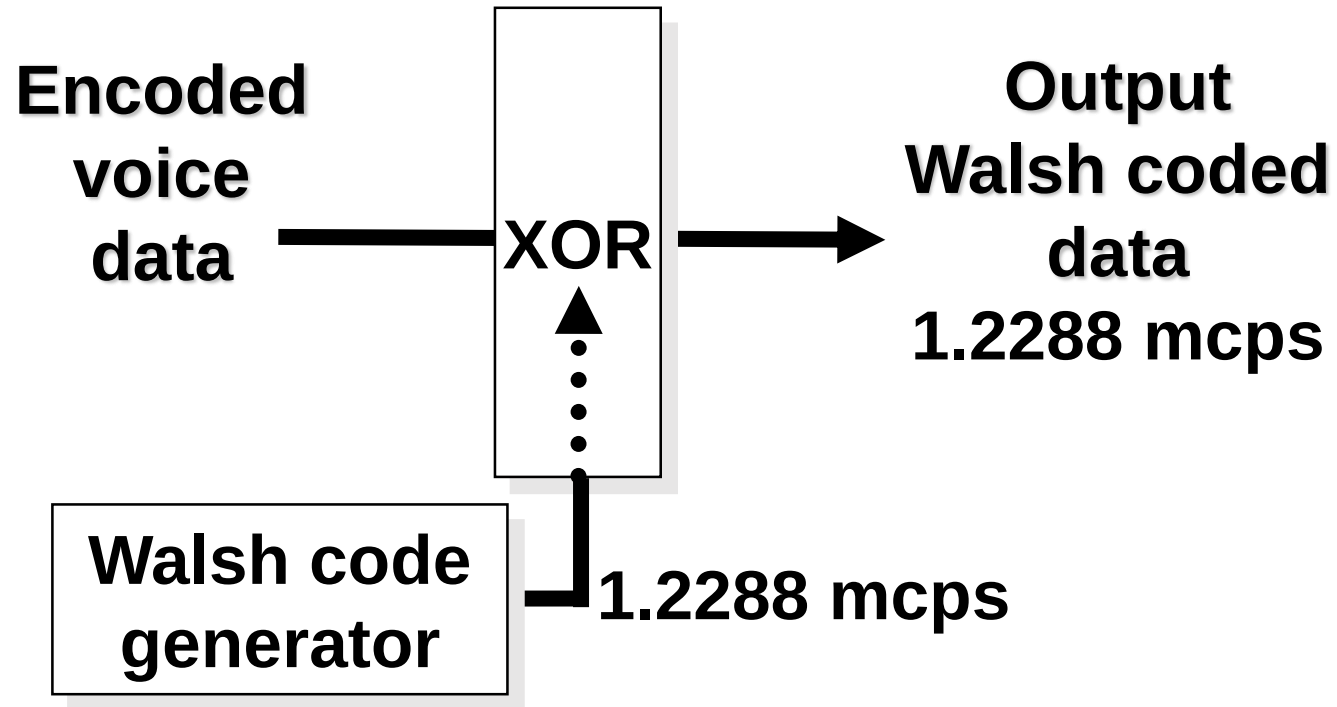


(b) GSM um Interface Link designation

MOBILE STATION CODES

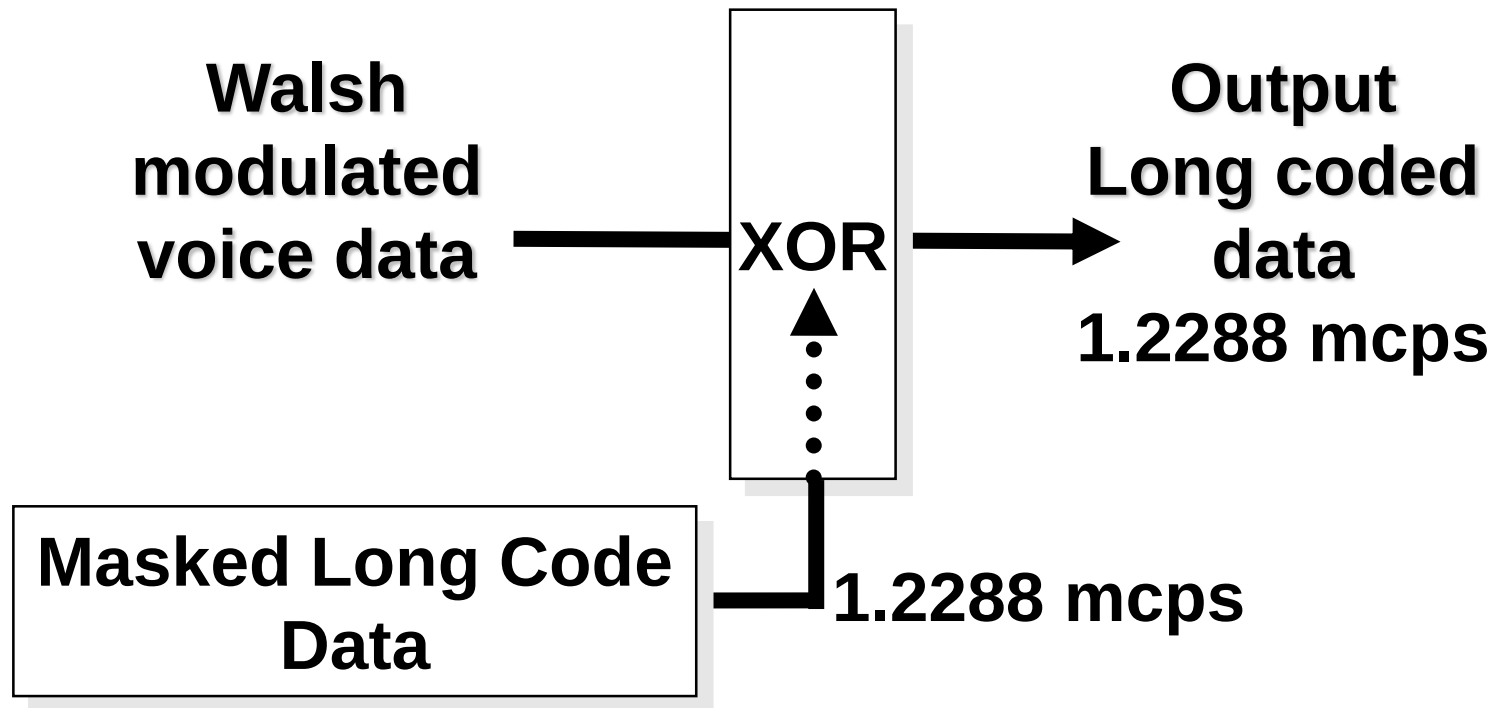
1. Channelized by digital codes called long codes masked by a unique user long code mask
2. Long code is a 42 bit number - 2^{42} billion combinations
3. Each mobile has a different long code mask
4. Two types of reverse channels:
 - a) Traffic channels
 - b) Control/access channels

FORWARD CHANNELIZATION



Each bit of voice data is 'spread' by a factor of 64

REVERSE CHANNELIZATION



Telkom Kenya plans shutdown of CDMA network by end of April

SHARE BOOKMARK PRINT RATING ☆☆☆☆☆



Telkom Kenya Orange staff displays a CDMA/GSM dual sim phone. The telco will at the end of April switch off its CDMA network that has served as a wireless version of its regular landline service. PHOTO | FILE

By JAMES KARIUKI

Posted Tuesday, April 7 2015 at 20:17

IN SUMMARY

- The move will lead to losses for CDMA phone users since their gadgets will become obsolete given that they are not compatible with the GSM network.
- CDMA network was introduced to counter the Global System for Mobile Communications (GSM) technology with its key market being homes and in offices.

COMPARISON OF 2G TECHNOLOGIES

Feature	AMPS	D-AMPS	GSM	CDMA
Frequency Band	800 MHz	800 & 1900 MHz	900 & 1800 MHz	800 & 1900 MHz
Channel Width	30 KHz	30 KHz	200 KHz	1.25 MHz
Users per Channel	1	3	8	About 20
Multiplex Scheme	FDMA	FDMA & TDMA	FDMA & TDMA	CDMA
Network Architecture	IS-41	IS-41	GSM-MAP (MAP-Mobile Application Part)	IS-41

HOME WORK

- Study the Interim Standard 41 (IS 41) and make a comparison with the GSM architecture.