1G to 4G Overview

Presentation
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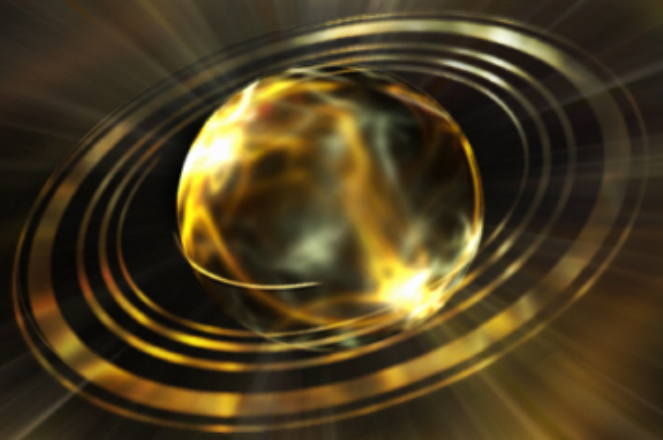
Mobile Networks

differentiated from each other by the word

‘Generation’

1G, 2G, 2.5G, 2.75G, 3G…

milestones…



1G

1981

World’s first cellular system launched in Saudi Arabia based on the Analog – NMT 450

milestones…

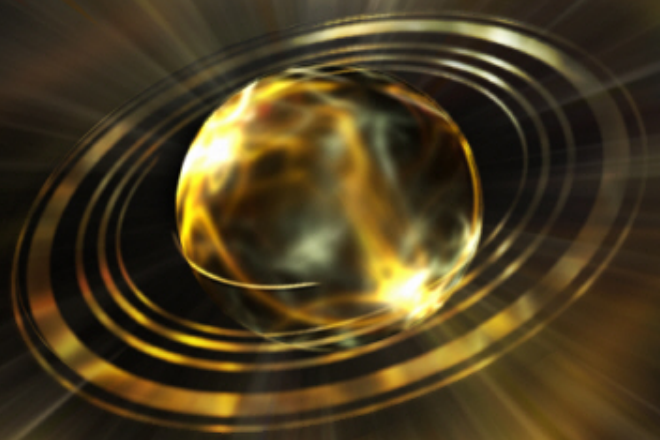
2G

1991

Digital Cellular Standard GSM Service launched

milestones…

2.5G

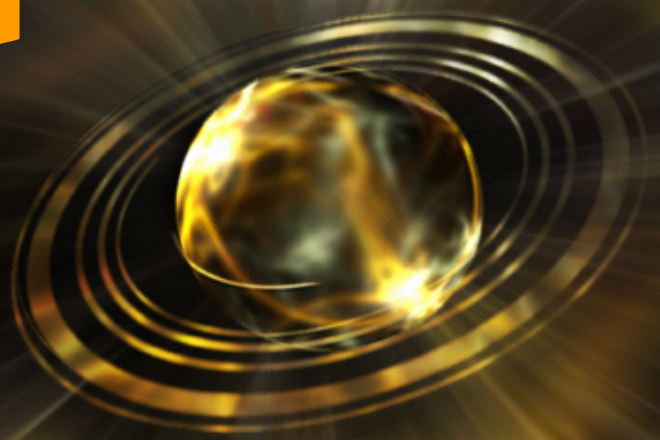


1997

Under GSM environment GPRS Service launched

milestones…

2.75G



1999

Under GSM environment EDGE Service launched

milestones…

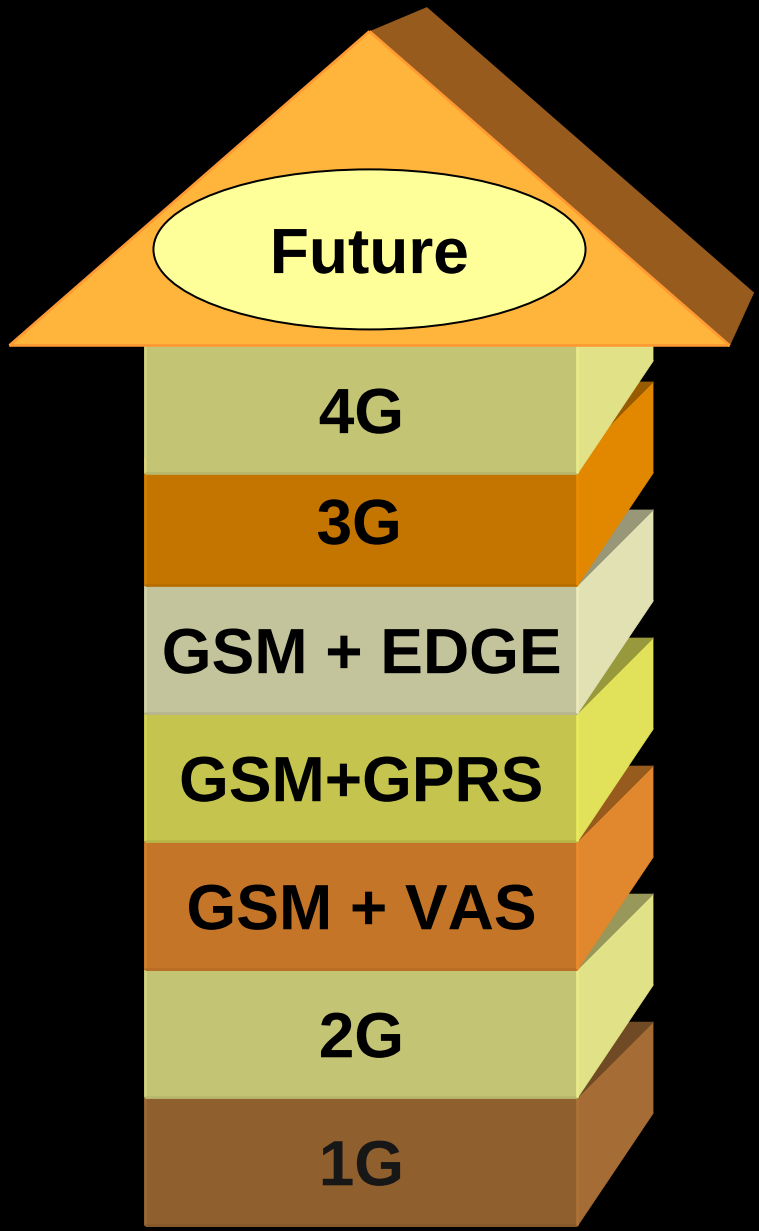
UMTS Service launched

Future …

under evolution …

Evolution of

3G Networks


Future
4G
3G
GSM + EDGE
GSM+GPRS
GSM + VAS
2G
1G


W-CDMA
3G
3GPP
UMTS
3G.co.uk
ANALOG DEVICES
Othello-W RX
ANALOG DEVICES
Othello-W TX
ANALOG DEVICES
SoftFone-J CSP
ANALOG DEVICES
SoftFone-J CSP

Evolution Path of 3G

IMT-2000
Capable Systems

GSM → GPRS → EDGE → UMTS

Existing Spectrum

New Spectrum

GSM 900 & GSM 1800

IMT 2000

2G	2.5G	2.75G	3G
9.6 kbps	64–115 kbps	115–384 kbps	0.384–2 mbps

3G Networks…

UMTS Universal Terrestrial Mobile System

(Developed in Europe)

IMT-2000 International Mobile Telecom

(ITU-T)

CDMA 2000 Code Division Multiple Access 2000

(American 3G variant)

IMT 2000 Vision

- Common Spectrum Worldwide (1.8 – 2.2 GHz band)
- Multiple Radio Environments (Cellular, cordless, satellite)
- Wide Range of Telecommunication Services (Voice, Data, Multi-media, Internet)

IMT 2000 Vision

- Data Rates up-to 2 Mbps – for Indoor Environment
- Global Seamless Roaming
- Enhanced Security Performance
- Integration of Satellite and Terrestrial Systems

IMT Technology

ITU has finally narrowed down technology options to the following five :

- **IMT -DS (Direct Spread) : WCDMA UTRA FDD**
- **IMT -MC (Multi Carrier) : CDMA 2000**
- **IMT-TC (Time Code) : TD -SCDMA UTRA TDD**
- **IMT -SC (Single Carrier) : UWC - 136**
- **IMT-FT (Frequency Time) : DECT**

IMT-2000 Data Rate Requirements…

High Speed Data requirements 3G system must support:

- 144 kbps Data for High Speed Vehicular Environment.
- 384 kbps Data for Low Speed Vehicular Environment.
- 2 Mbps Data for Stationary Environment

IMT 2000 Spectrum

- **IMT 2000 Core Band (FDD Mode – Paired Frequencies) :**
  - **Mobile to BTS (UP-LINK) - 1920 to 1980 MHz**
  - **BTS to Mobile (DOWN -LINK) - 2110 to 2170 MHz**

- **IMT 2000 TDD Mode unpaired band :**
  1885 to 1920 MHz
  2010 to 2025 MHz

Key Requirements of 3G Services

- Improved system capacity
- Backward compatibility with 2G Systems
- Multimedia Support

Key Requirements of 3G Services

- High speed Packet Data Services
- Data Rates
  - up-to 2 Mbps – for Fixed or Indoor Environments
  - up-to 384 kbps – for pedestrian or urban environments
  - up-to 144 kbps – for wide area mobile environments

3G Standard : The choice is CDMA

In 1999 ITU narrowed down on 5 technologies for IMT-2000, 3 of which are based on CDMA technology :

- **CDMA 2000 1x,**
- **WCDMA (UMTS)**
- **TD-SCDMA**

What 3G mean to Customers

Access to the mobile Internet and Messaging in all forms Email, MMS, Instant Messaging

- Always-on connectivity receive voice calls in data mode
- Fast data speeds Meaningful access to corporate data
- Powerful, easy to use devices

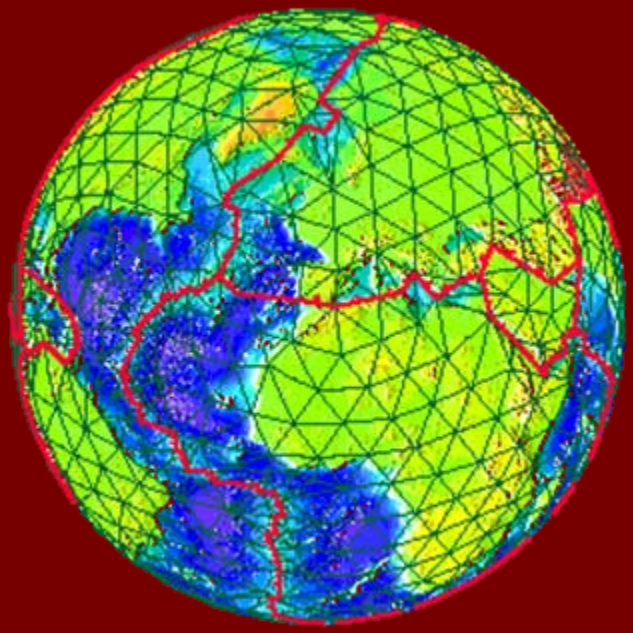
WCDMA

(Wide Band – Code Division Multiple Access)

It is the **air –interface** technology for the **UMTS** systems

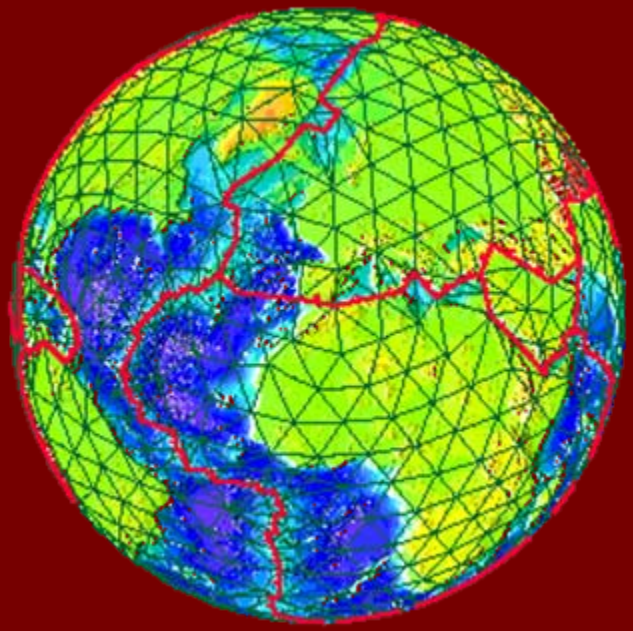
Why WCDMA ….

- WCDMA for high speed data access up to 384 Kbps - 2 Mbps
- Demand for high Speed Data Access
    - Streaming
    - Video on Demand
    - Video Telephony
  - Data Revenue is becoming significant
- Operators World wide have shown inclination to introduce WCDMA



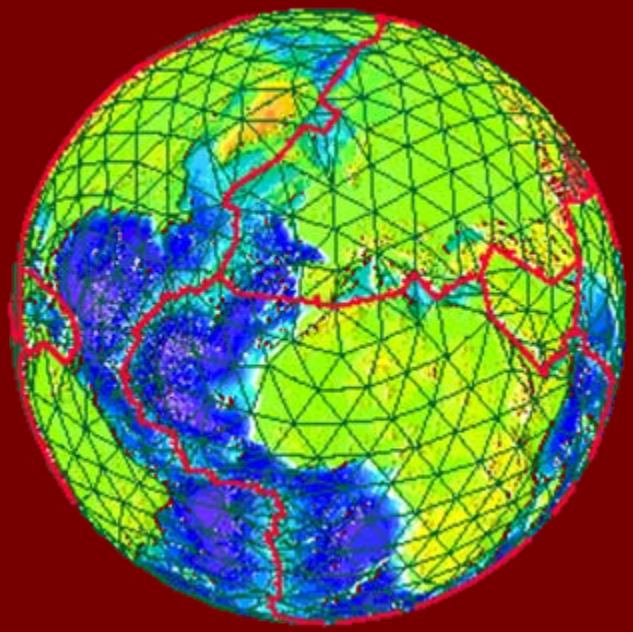
Main Network Elements….

- Circuit Switched-Core Network consisting of MSC Server and MGW and is common for both GSM & UMTS.
- Packet Core Network consisting of SGSN & GGSN is common for both GSM & UMTS networks.
- Radio Network shall be separate for both GSM & UMTS



Main Network Elements….

- Radio Network-
  - GSM: BSC, BTS and
  - UMTS: RNC, Node B
- RNC - Radio Network Controller
- Node B- BS (Base Station) is referred to as Node B



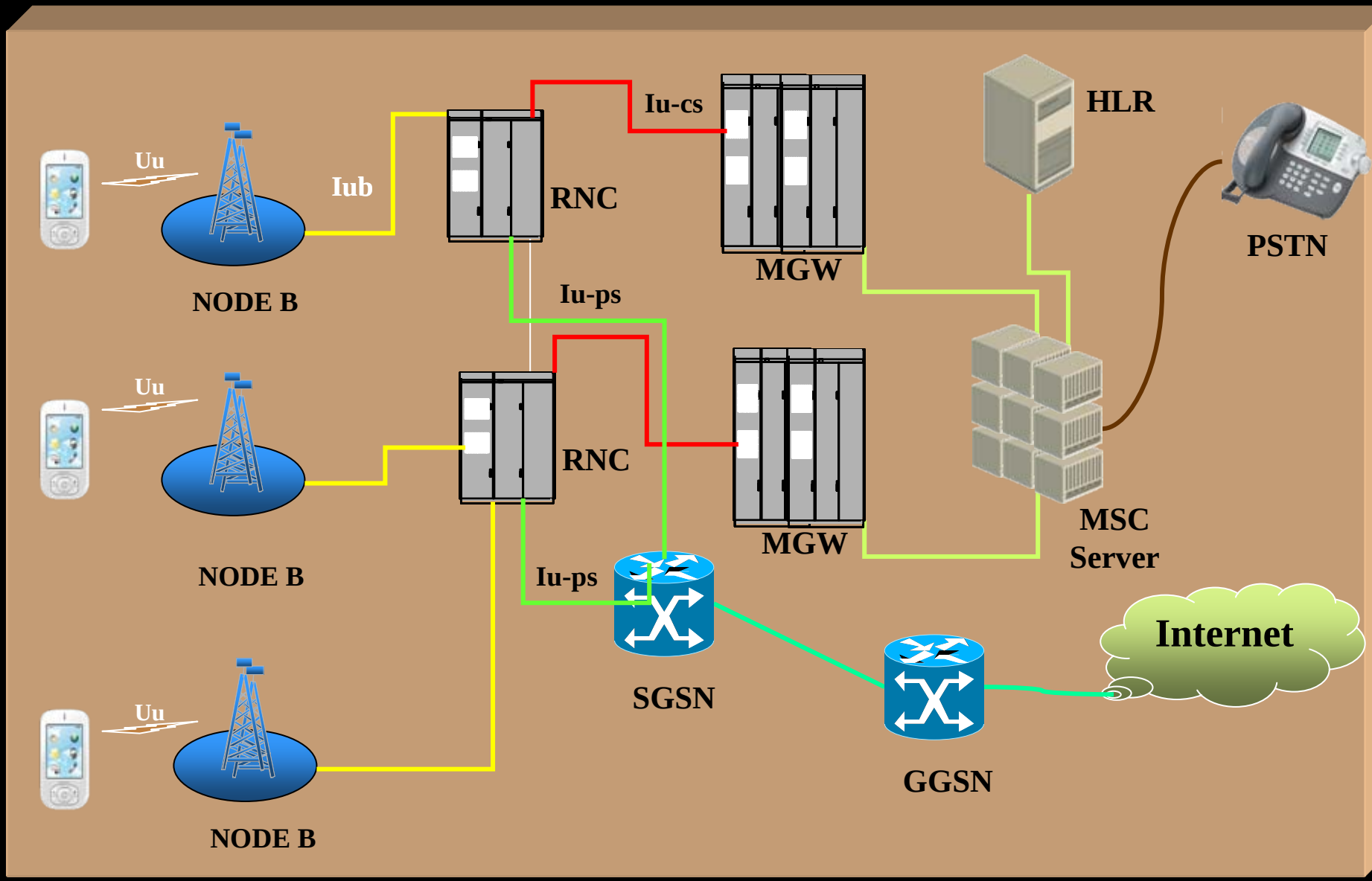
RNC : Main Functionalities

- Manage and secure an optimal usage of the radio resources of the radio access network.
- Control the mobility and handover within the radio access network.
- RNC provide Handover functions between WCDMA RAN and GSM, and Cell Change between WCDMA RAN and GSM/GPRS.
- Support radio access bearer (RAB) services with: Circuit Switched and Packet Switched data

Node B : Main Functionalities

- Provides radio interface to the UE
- Transceiver Units and Dedicated Power Amplifiers for every sector
- Executes power control to minimize interference

UMTS Architecture



Critical Issues in 3G Deployment

- Seamless migration of existing network
- Nature and quantum of license fee
- Inter operatability of equipments
- Allocation of spectrum
- Pricing of spectrum

UMTS - Roll-out Options

WCDMA

EDGE

EDGE

EDGE

Sub-urban

Urban

Rural

- Reasons to have 4G
  - Support for interactive multi-media services: video teleconferencing etc.
  - Scalability of mobile networks.
- What is new in 4G
  - Entirely packet-switched network
  - Higher bandwidth – up-to 100 Mbps
- The earliest expected time of initial 4G standards to be ready is around 2011


Let us
Join Hands
Together…

UMTS - Roll-out Options

WCDMA

EDGE

EDGE

EDGE

Sub-urban

Urban

Rural