Table of Contents

ABOUT

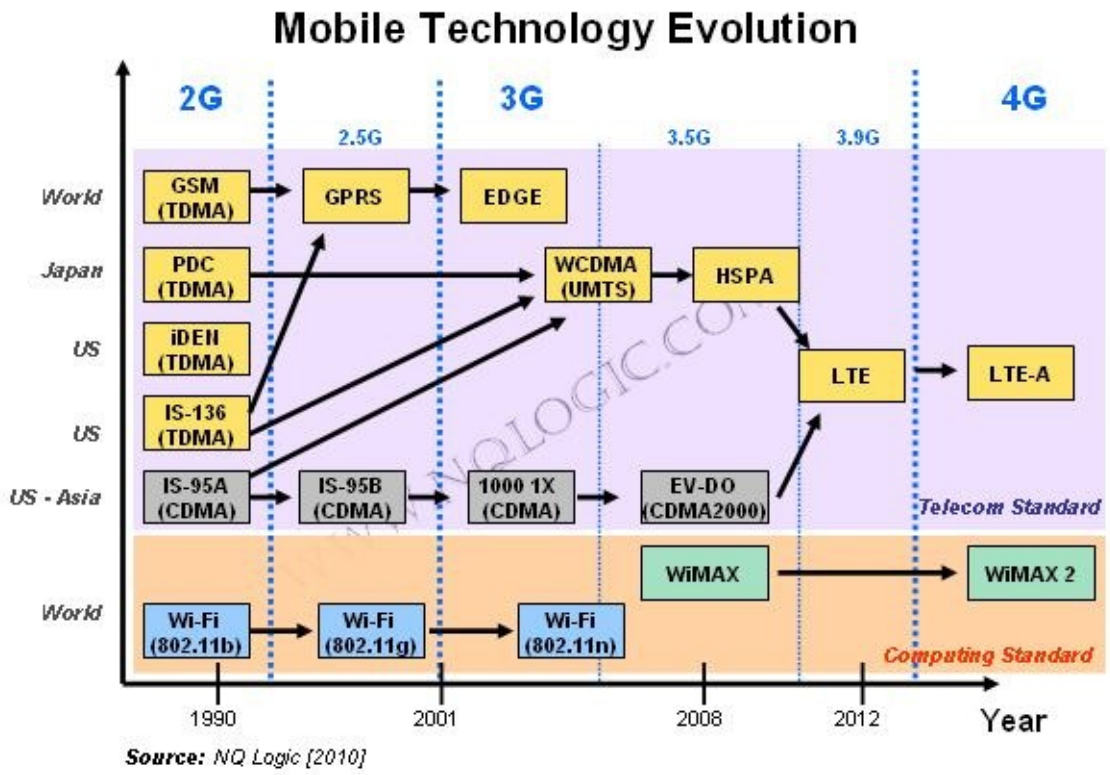
General Cellular staff

Standardization

- ITU
- IMT2000
- 3GPP (1&2)

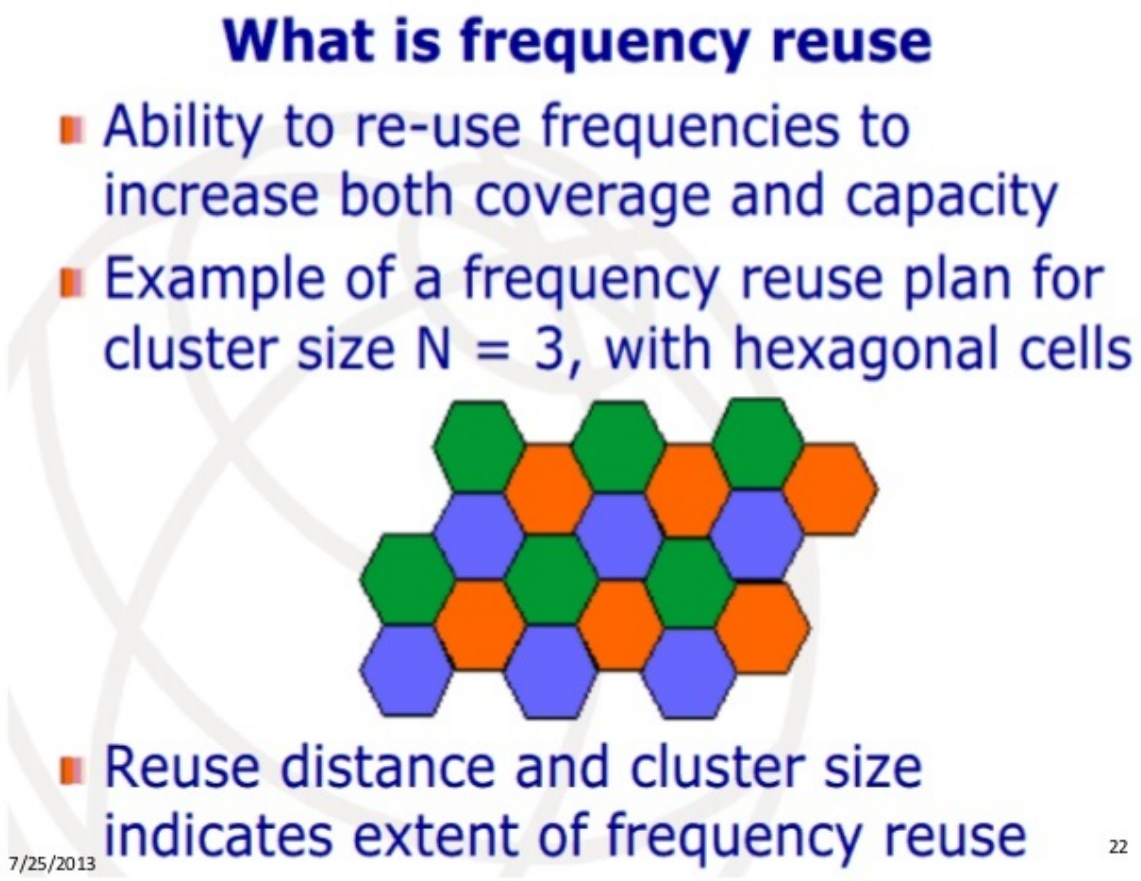
migration

- 1G - analog voice
- 2G - Digital Voice ; GSM / CDMA
- 2.5G - Packet data ; GPRS / CDMA-1xRTT
- 2.75 - inetrmidiata multimedia ;
- 3G - multimedia ; UMTS-HSPA / CDMA2000-EVDO
- 4G - ; LTE / NR
- 5G - ALl ip

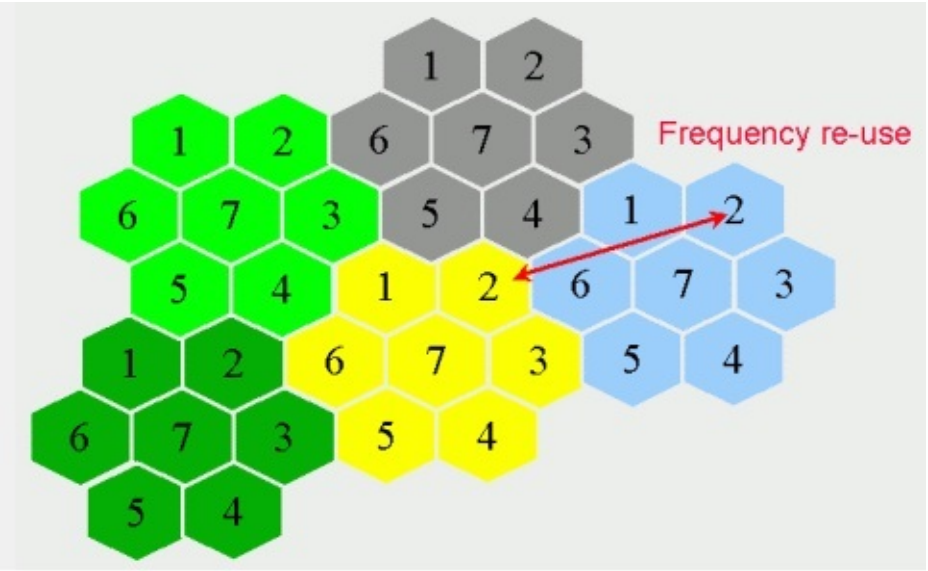


Frequency Reuse

reuse 3



reuse 7



Cell UNIT

TBD

method to increse capacity

Frequency borrowing

- assign freq dynamically

Cell Splitting

- smaller cell in high density aread

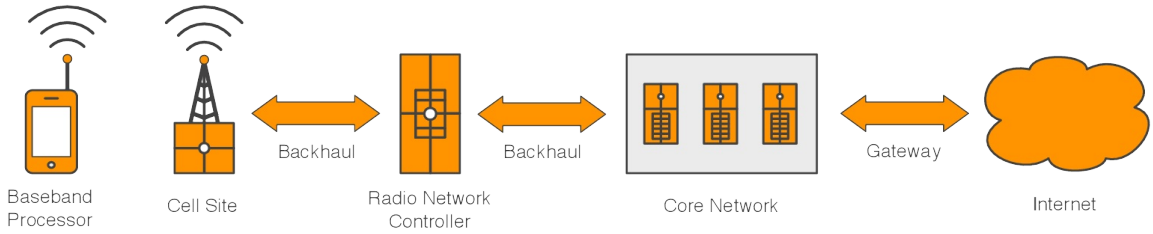
Cell Sectoring

- divide cell into sectors

Small Cells

- move cells from hills to buildings

Cellular network segments



Mobile station equipment

- portabel
- iniquely identified by IMEI
- voice and data transmission
- monitor power and signal of surrounding cells
- sms

Handovers

TBD

Radio Concepts

Propagation

- direct radiation
- reflection
- diffraction
- scattering

Attenuation

pass loss

- loss in large scope of the spread

slow fading

- loss due to buillding and hills

fast fading

- decline rapidly in a few dozens wavelength path
- rayleigh distribution - non line pf sight
- Rice distirbuition - line of sight

Dopler

SNR -Signal to Noise Ratio

Multi path propagation

Inter Symbil Interference

Transmission Procedure

Channel Coding

purpose

- adding redundant information - detect and correct error signal
- error correction

principle

- convolutional coding
- turbo coding
- increase redundancy and transmission time

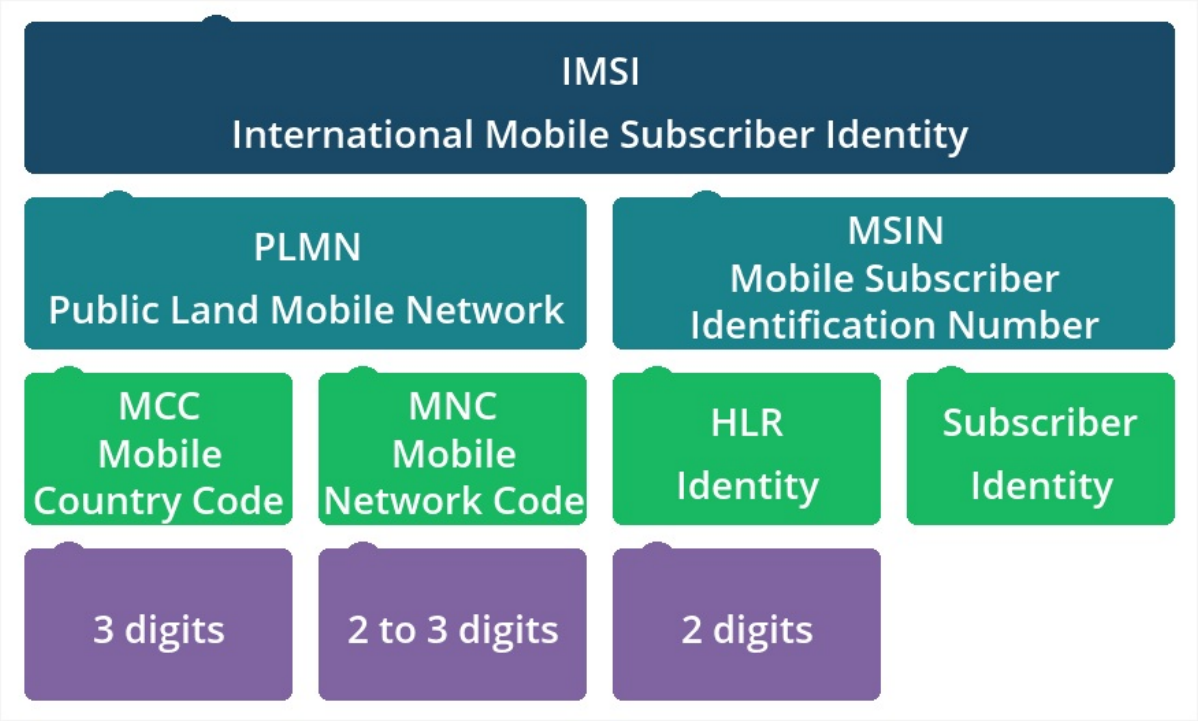
Interleaving

SIM - Subscripber Identity Module

Sim Content

- IMSI - International Mobile Subscriber Identify
- Encryption keys
- TMSI - Temporary Mobile Subscriber Identify
- MSISDN - phone number
- card protection pin (4-8 digits)
- Roaming Data
- SMS msgs
- personal data like phone bumbers and settings

IMSI


IMSI
International Mobile Subscriber Identity
PLMN
Public Land Mobile Network
MSIN
Mobile Subscriber
Identification Number
MCC
Mobile
Country Code
MNC
Mobile
Network Code
HLR
Identity
Subscriber
Identity
3 digits
2 to 3 digits
2 digits

TMSI

- The TIMSI (Temporary IMSI) is a pseudo-random number generated from the IMSI (International Mobile Subscriber Identity) number.
- The TIMSI is utilized in order to remove the need to transmit the IMSI over-the-air. This helps to keep the IMSI more secure.
- To track a GSM user via the IMSI/TIMSI, an eavesdropper must intercept the GSM network communication where the TIMSI is initially negotiated. In addition, because the TIMSI is periodically renegotiated, the eavesdropper must intercept each additional TIMSI re-negotiation session.
- used in CS domain allocated by VLR
- timsi has only local significane withing a VLR and the area controlled by a VLR

PTMSI

- used on PS domain , allocated by SGSN
- has only local significance

UICC - universal intergrated circuit card

- platform to store multi applications (like usim)
- NAA (Network Access Application) defined for UICC:
  - USIM
  - ISIM

USIM

- Universal subscriber identity module

ISIM

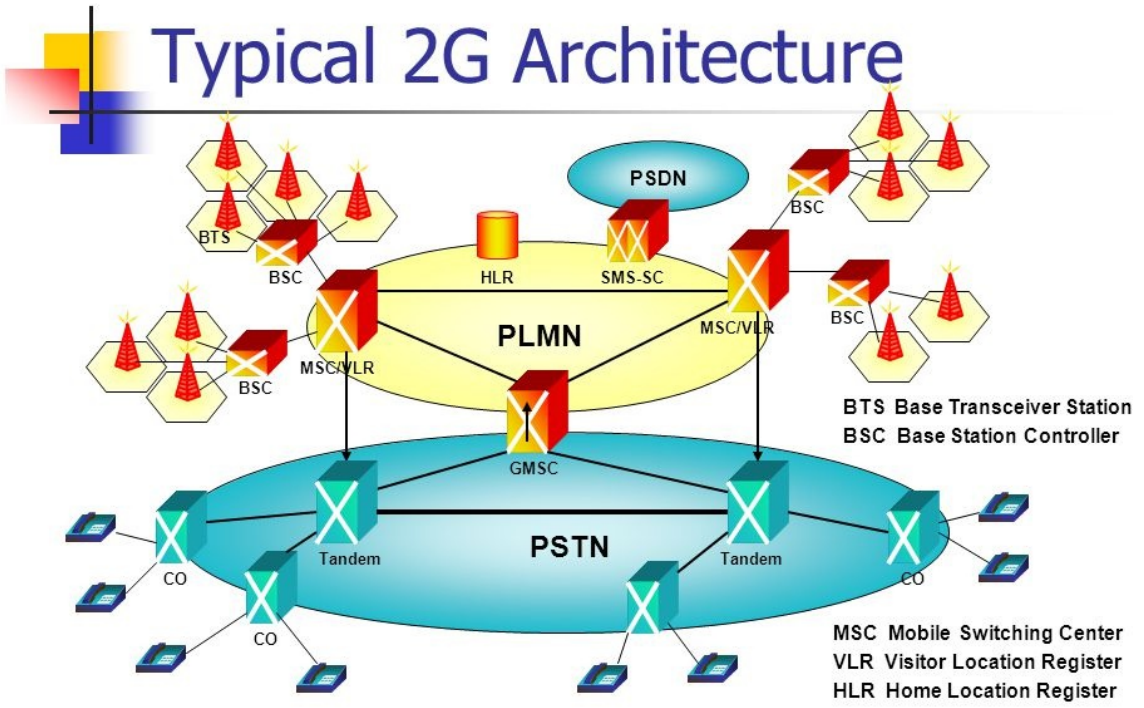
- IP-multimedia subsystem subscriber identity module

Embedded SIM

- alowing over the air provisioning
- change sybscription from one operator to another

2g

2G Architecture



LTE PROTOCOL

UE category

- https://www.sharetechnote.com/html/LTE_Advanced_UE_Category.html#RRC_Message
- https://www.sharetechnote.com/html/Handbook_LTE_RRC_IE_UE_Capability.html

```
ueCapabilityInformation-r8

    ue-CapabilityRAT-ContainerList: 2 items

        Item 0

            UE-CapabilityRAT-Container

                rat-Type: eutra (0)

                ueCapabilityRAT-Container:

                UE-EUTRA-Capability

                    accessStratumRelease:

                    ue-Category: X           //!!!!!!!!!!!!!!!!!!!!!!!!//
```