
hello!

5G Overview → 5G System architecture overview → RAN → O-RAN → Multiple access method → Channel → Identifiers

5G common

5G System architecture (5GS)

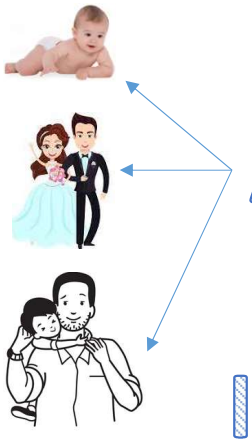
UE

5G Access Network(NG-RAN)

5G Core Network (5GC)

Human in the different contexts

Different IDs are used to identify a human depending on their relationship



At Work

At Home

In Việt Nam

At Pagoda

At Church

In the world

Creation Time

- Provision
- On-Demand

Attritube Type

- Permanent
- Temporary

Range

- World
- Country
- Organization

5G NR Identifiers

TrungLNA

May-2021

NOTE

- This slide is made based on the webpage as below with updates on 5G

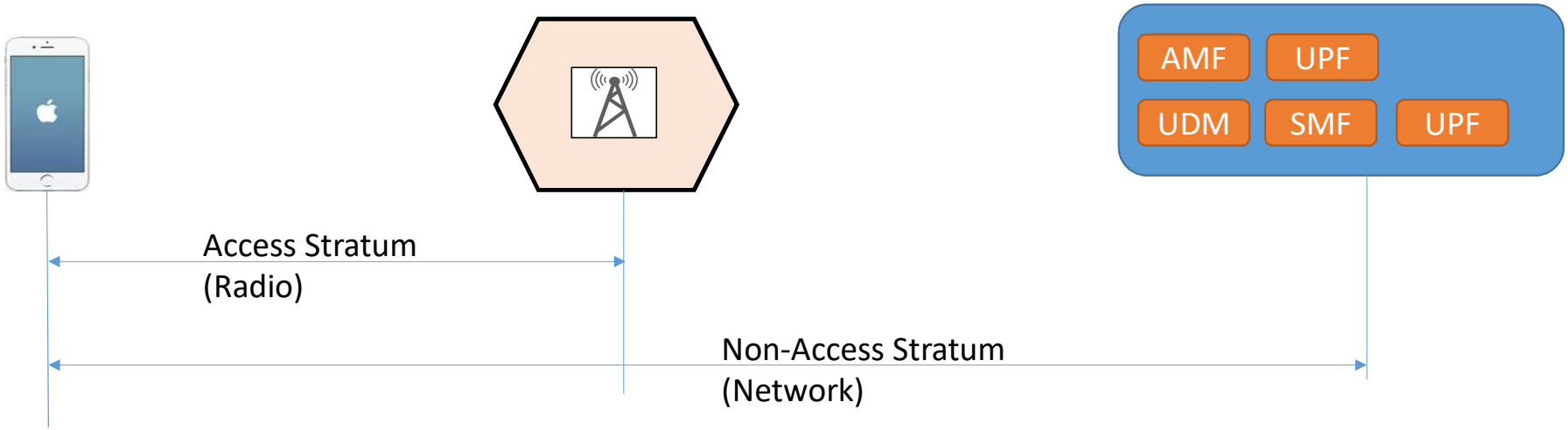
https://www.netmanias.com/en/?m=view&id=techdocs&no=10429&xtag=lte-lte-identification&xref=lte-identification-i-ue-and-me-identifiers

- The slide just covers few of IDs in 5G not all.

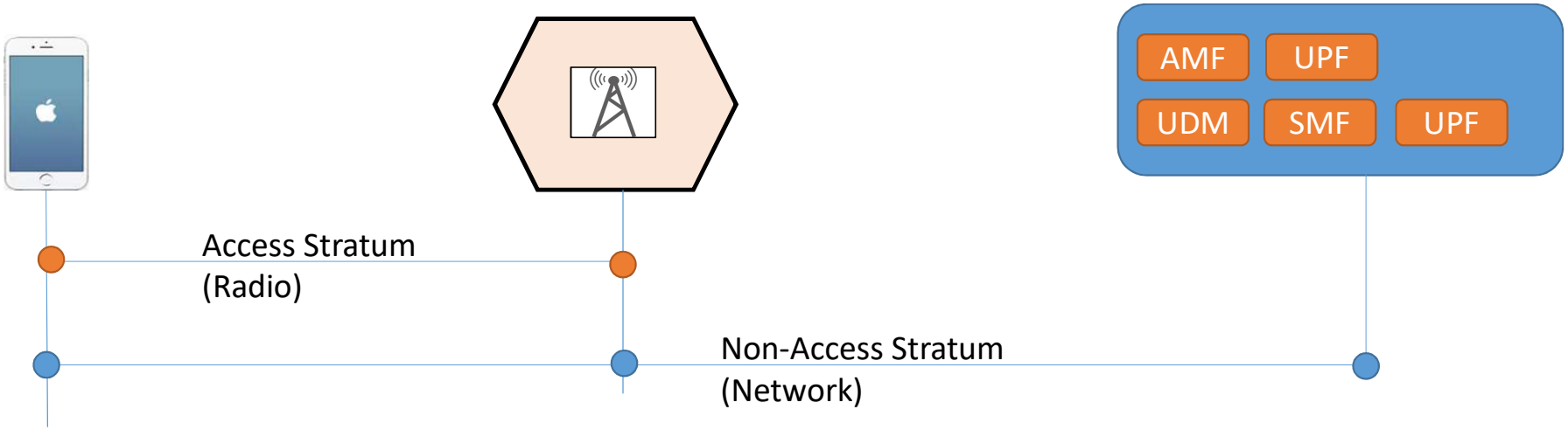
- After the session you will answer “What” and “Why” of IDs and a little bit call flow for “How” question.

Agenda

- Identifiers for **User Equipment** (UE IDs)
- Identifiers for **Network Equipment** and **Location**
- Identifiers For PDU Session/**Bearer**
- Identifiers for **Network Slice**



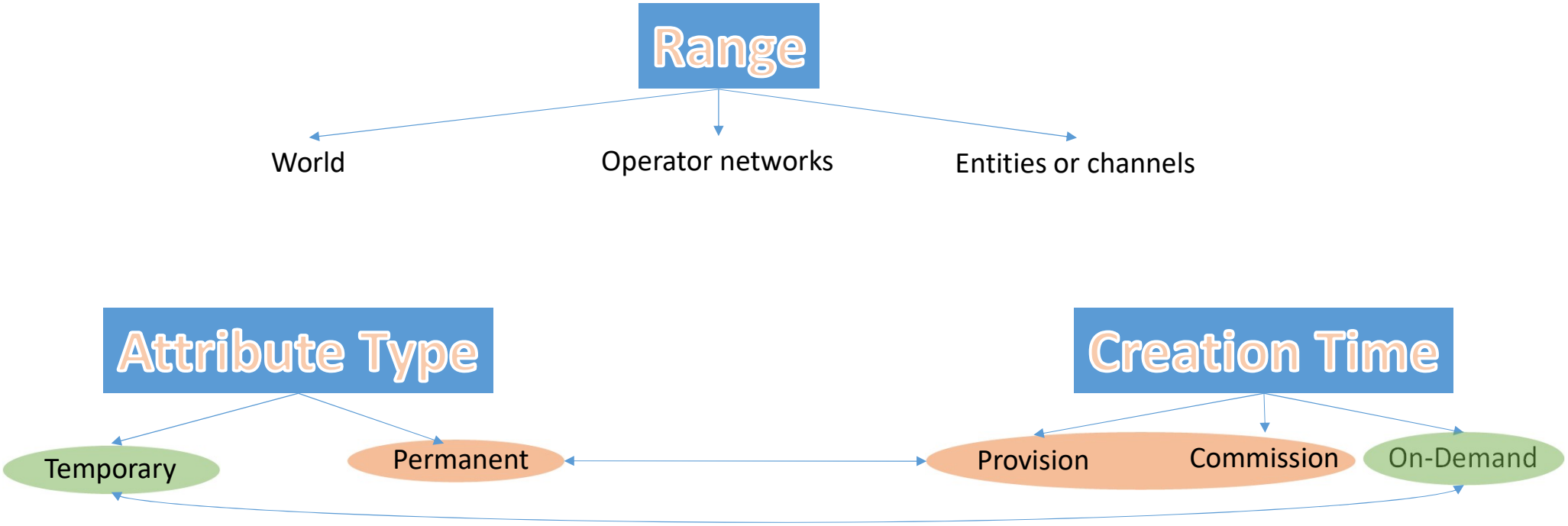
Relationship between UE and gNB, 5GC



ID Group	NR ID
UE ID	IMSI, SUPI, SUCI, GUTI, S-TMSI, IP address, C-RNTI, gNB UE NGAP ID, AMF UE NGAP ID, UE XnAP ID
ME ID	IMEI
NE ID	GUAMI, AMFI, Global gNB ID, NCGI, gNB ID, S-NSSAI
Location ID	TAI, TAC
Session/Bearer ID	PDU ID, QFI (QoS Flow Identifier), DRB ID, TEID, LBI

Attribute

Features of these NR IDs will be explained in terms of their :

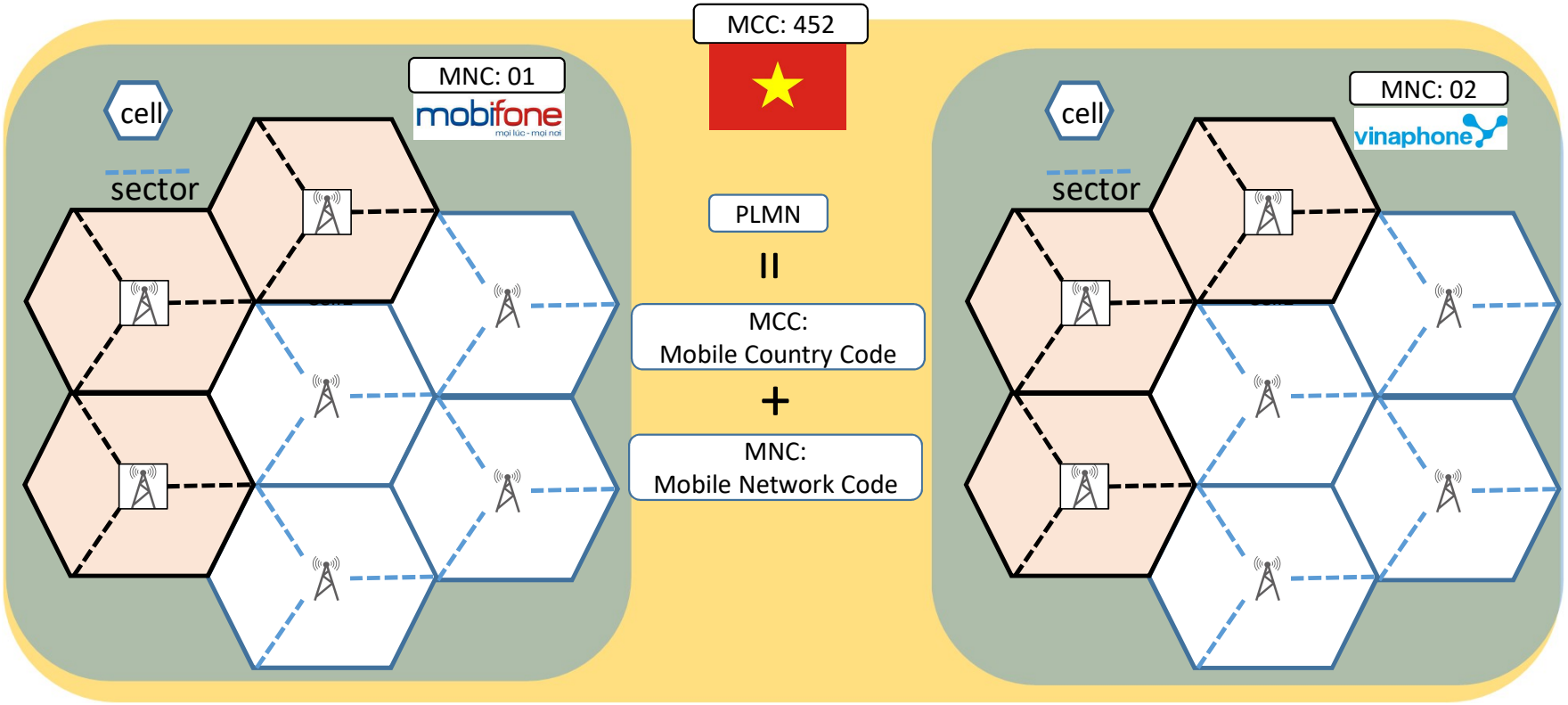


Identifiers for User Equipment (UE IDs)

ID Group	NR ID
UE ID	IMSI, SUPI, SUCI, GUTI, S-TMSI, IP address, C-RNTI, gNB UE NGAP ID, AMF UE NGAP ID, UE XnAP ID

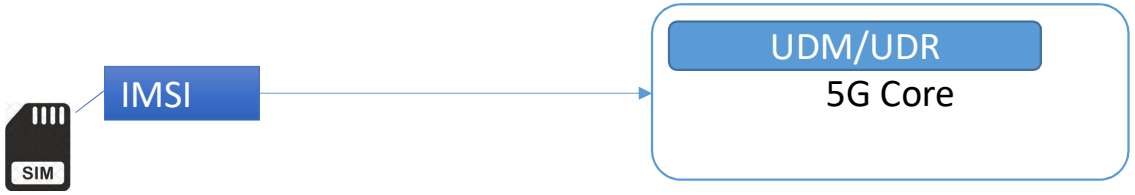
Public Land Mobile Network

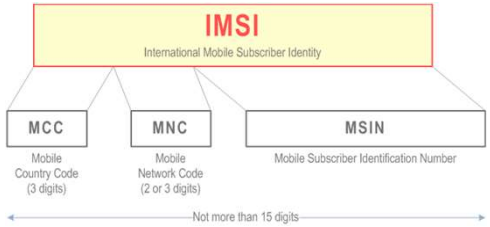
- **Public Land Mobile Network** (**PLMN**) (wiki) is a combination of wireless communication services offered by a specific operator in a specific country.
- A PLMN typically consists of several cellular technologies like GSM/2G, UMTS/3G, LTE/4G, offered by a single operator within a given country, often referred to as a cellular network.



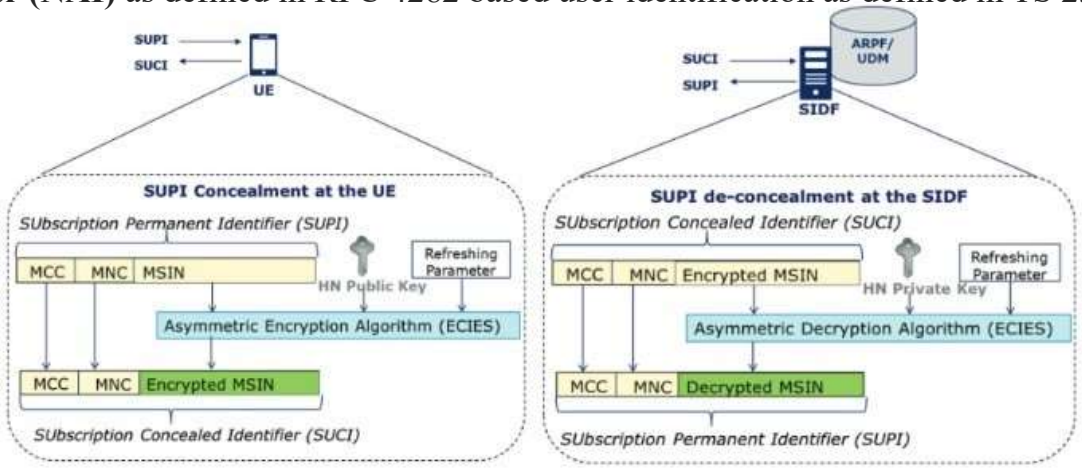
Subscription Permanent Identifier (SUPI)

- A SUPI is a 5G globally unique Subscription Permanent Identifier (SUPI) allocated to each subscriber (IMSI, NAI) :

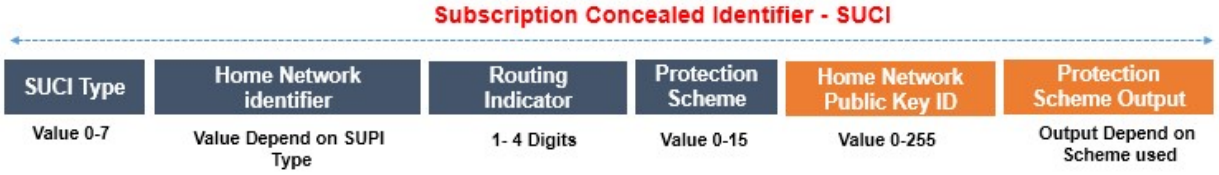




- **International Mobile Subscriber Identity** (IMSI) is a unique number identifying a mobile subscriber globally
- **Network Access Identifier (NAI)** as defined in RFC 4282 based user identification as defined in TS 23.003 for non-3GPP RAT

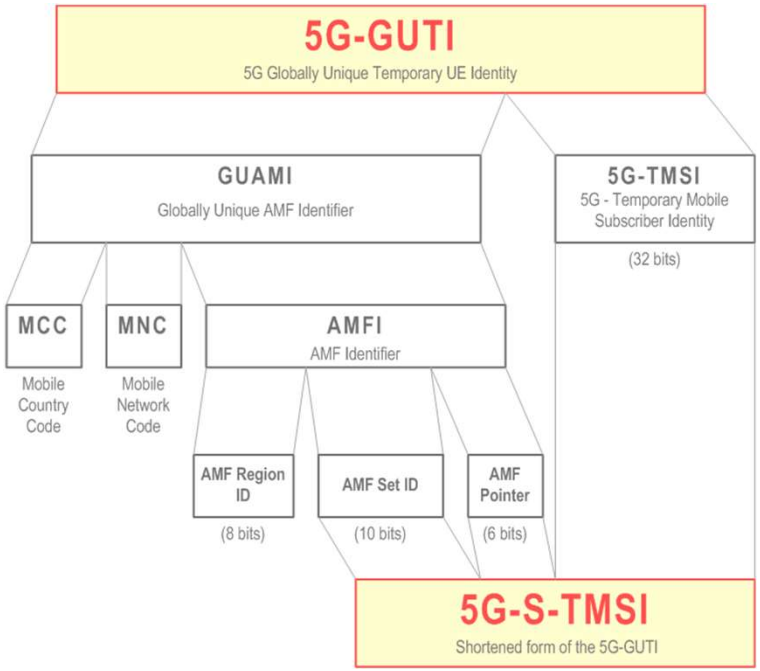


Subscription Concealed Identifier (SUCI) is a privacy preserving identifier containing the concealed SUPI

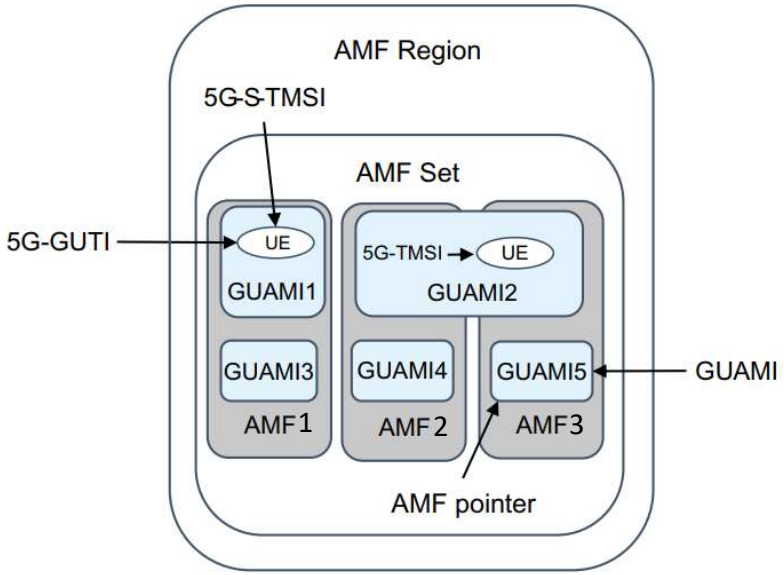


5G Globally Unique Temporary UE Identify (5G-GUTI)

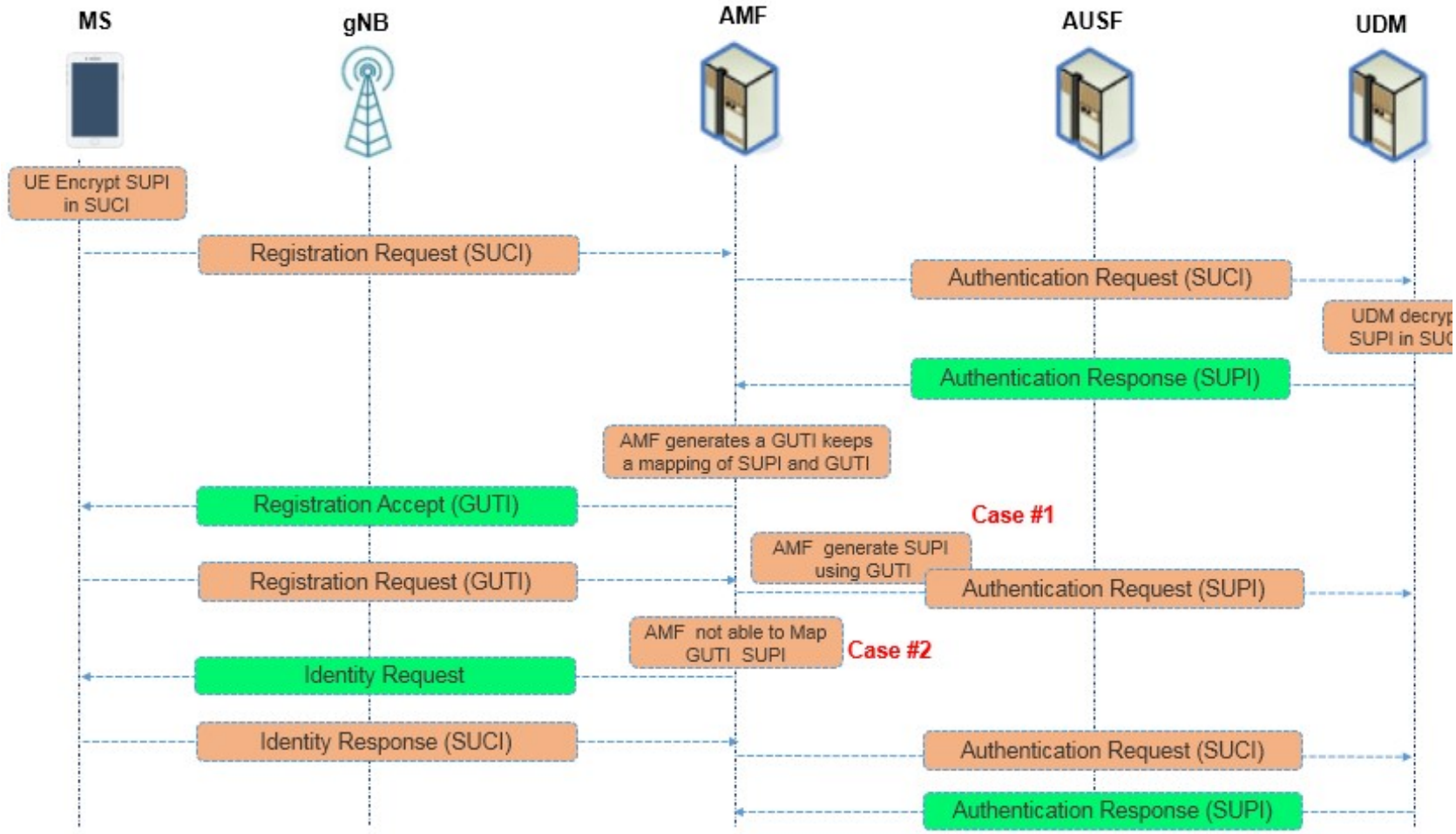
5G-GUTI is to provide an unambiguous identification of the UE that does not reveal the UE or the user's permanent identity in 5GS



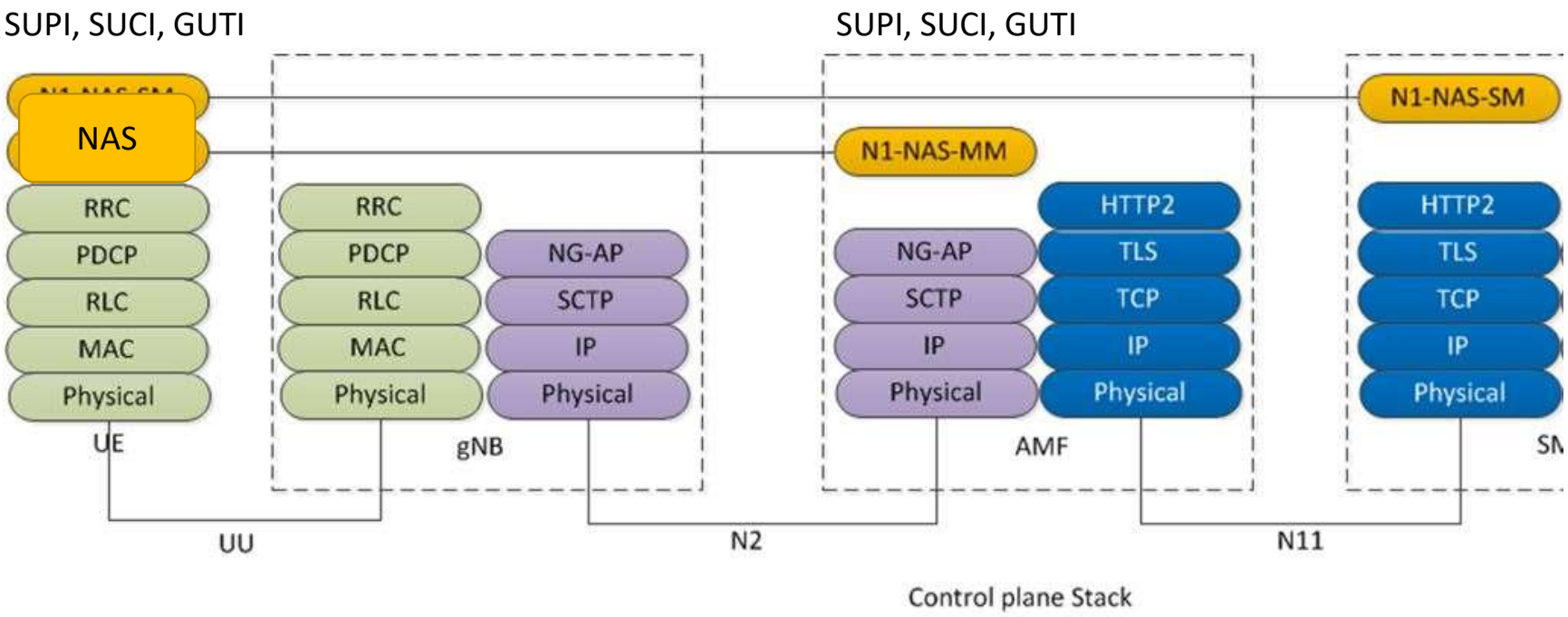
5G-S-TMSI: used to uniquely identify a UE within an AMF region.
It is shorter than a GUTI and used during Paging and Service Request for more efficient radio signaling



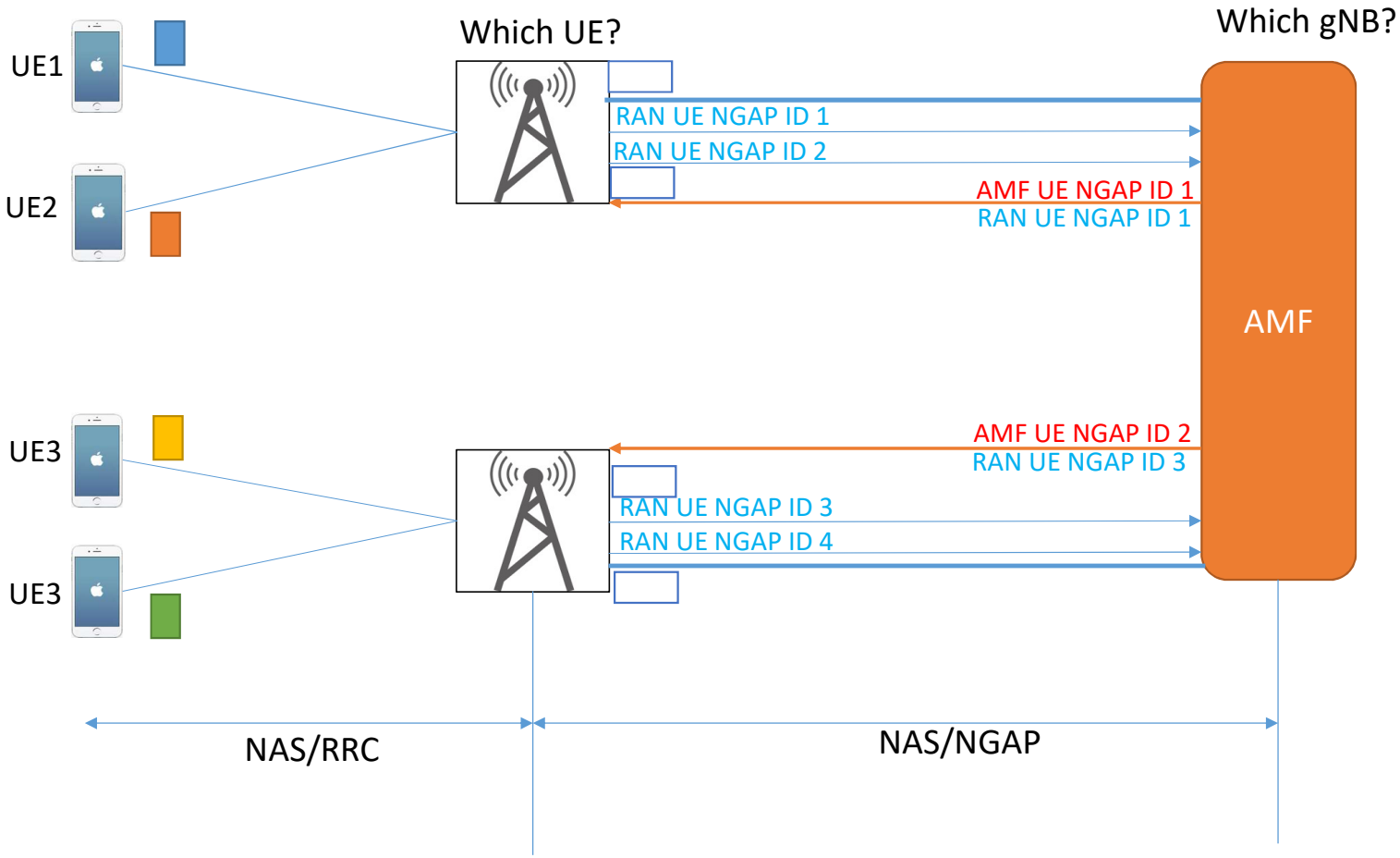
5G Identity Exchange between UE and Network



UE ID Review

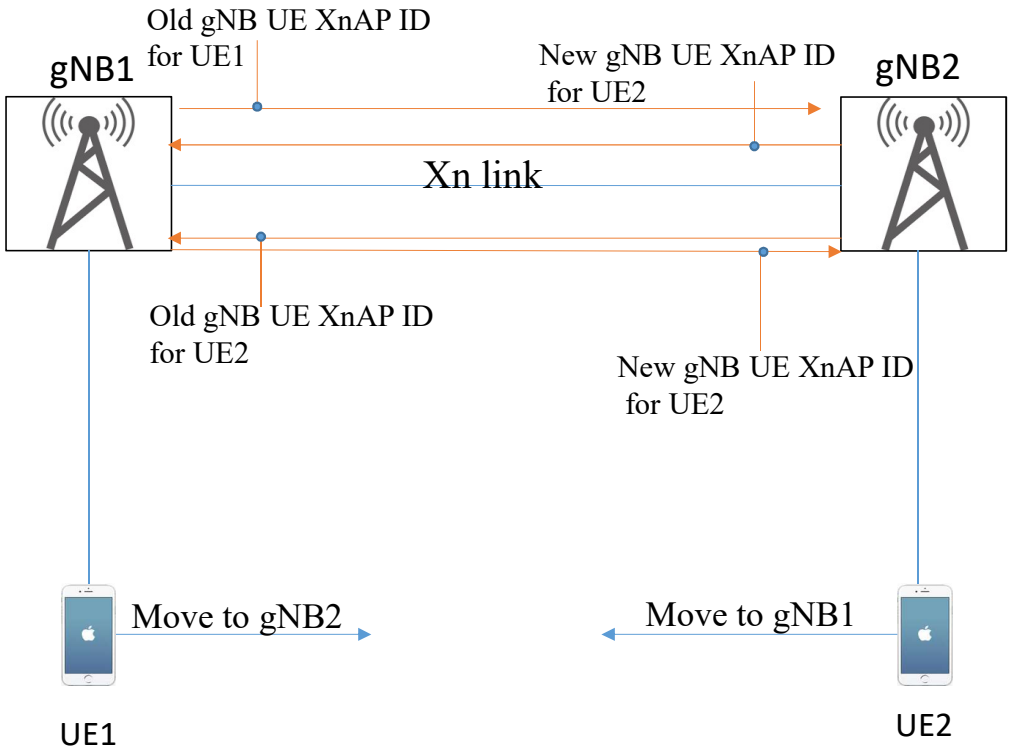

SUPI, SUCI, GUTI
SUPI, SUCI, GUTI
NAS
N1-NAS-SM
N1-NAS-MM
RRC
PDCP
RLC
MAC
Physical
RRC
PDCP
RLC
MAC
Physical
NG-AP
SCTP
IP
Physical
NG-AP
SCTP
IP
Physical
HTTP2
TLS
TCP
IP
Physical
HTTP2
TLS
TCP
IP
Physical
UE
gNB
AMF
UU
N2
N11
Control plane Stack

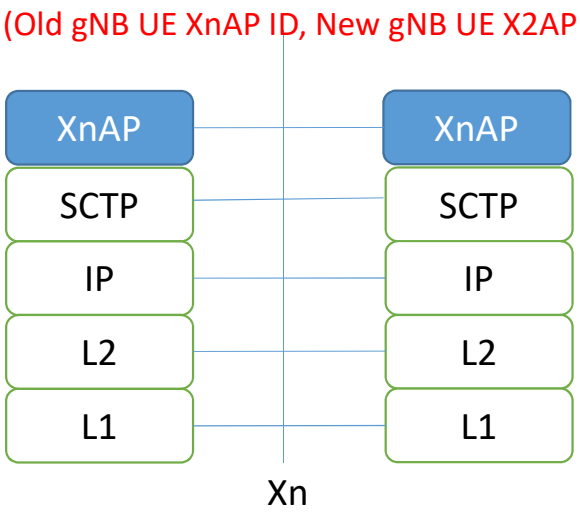
RAN UE NGAP ID And AMF UE NGAP ID



UE XnAP ID

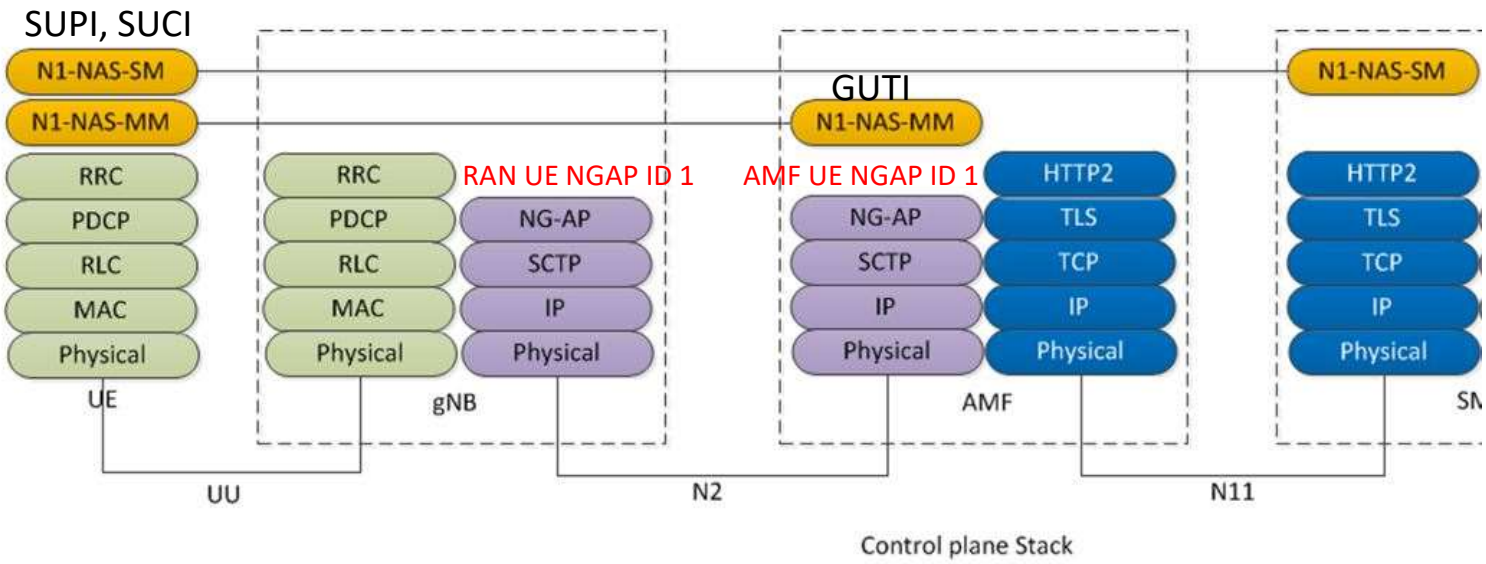
UE X2AP IDs needed to distinguish UEs over the Xn Interface

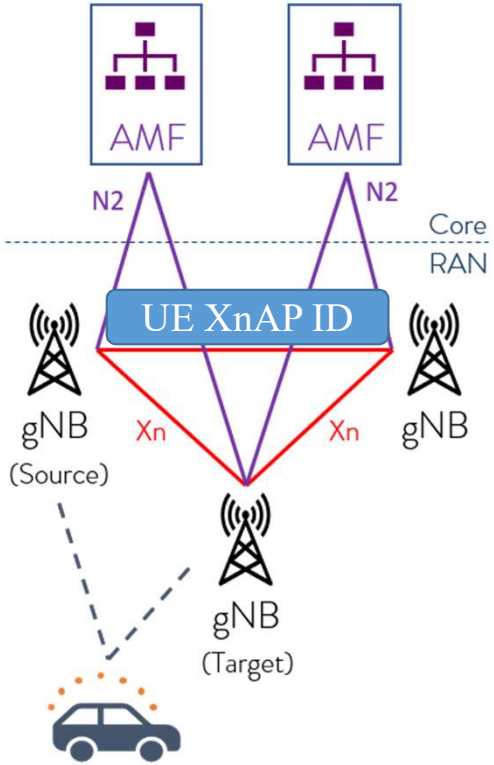




https://www.eventhelix.com/lte/handover/LTE-X2-Handover-Messaging.pdf

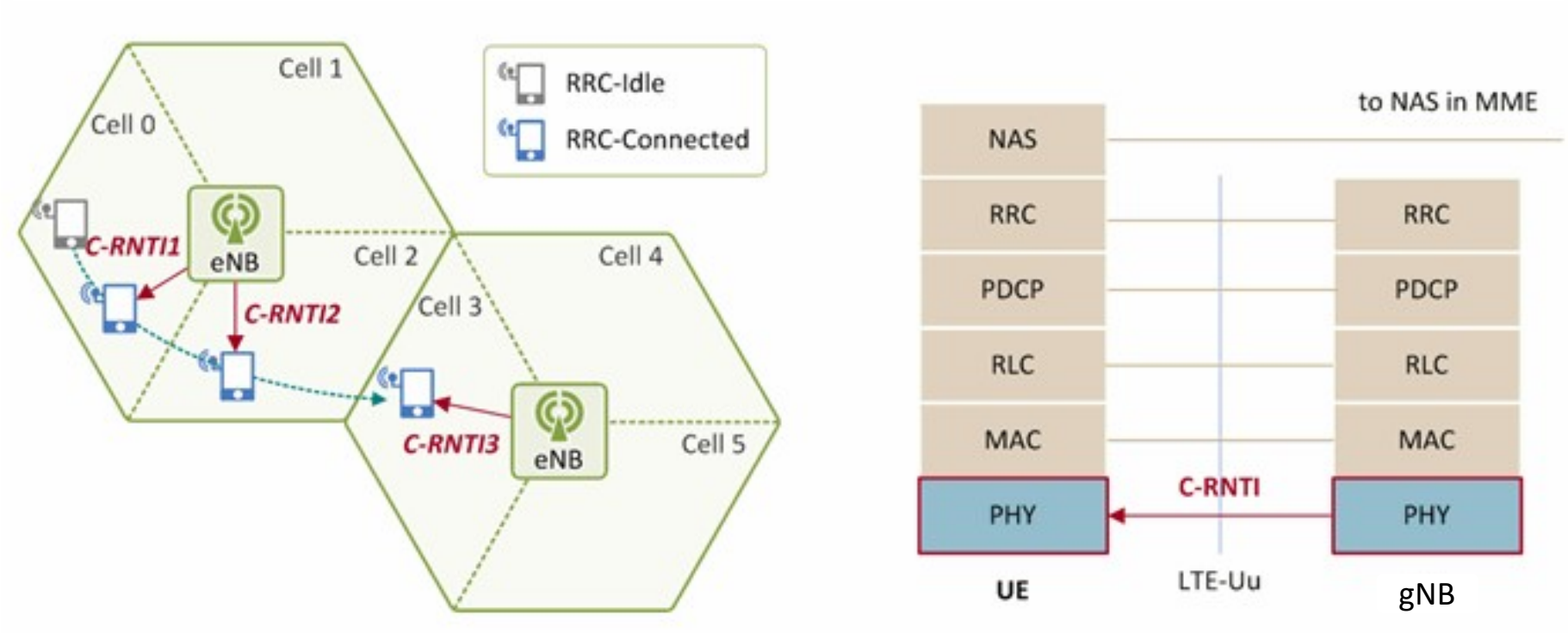
UE ID Review


SUPI, SUCI
GUTI
N1-NAS-SM
N1-NAS-MM
RRC
PDCP
RLC
MAC
Physical
RAN UE NGAP ID 1
AMF UE NGAP ID 1
NG-AP
SCTP
IP
HTTP2
TLS
TCP
UE
gNB
AMF
UU
N2
N11
Control plane Stack

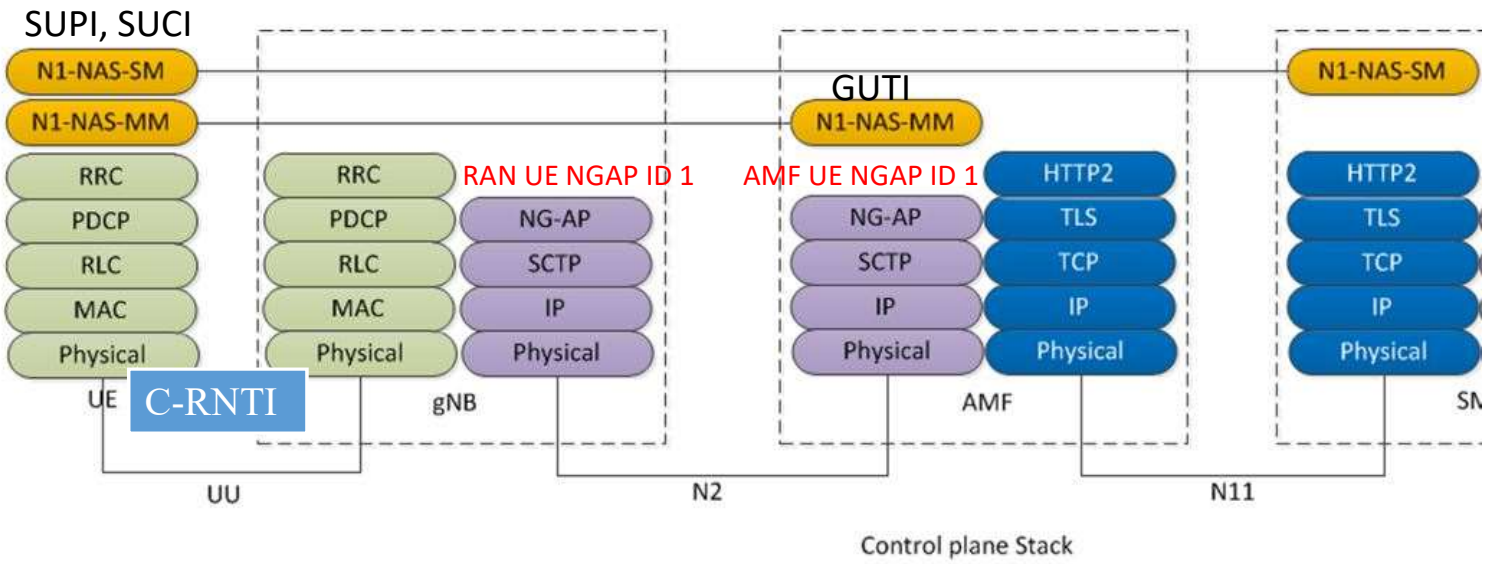

AMF
AMF
N2
N2
Core
RAN
UE XnAP ID
gNB
(Source)
Xn
Xn
gNB
gNB
(Target)

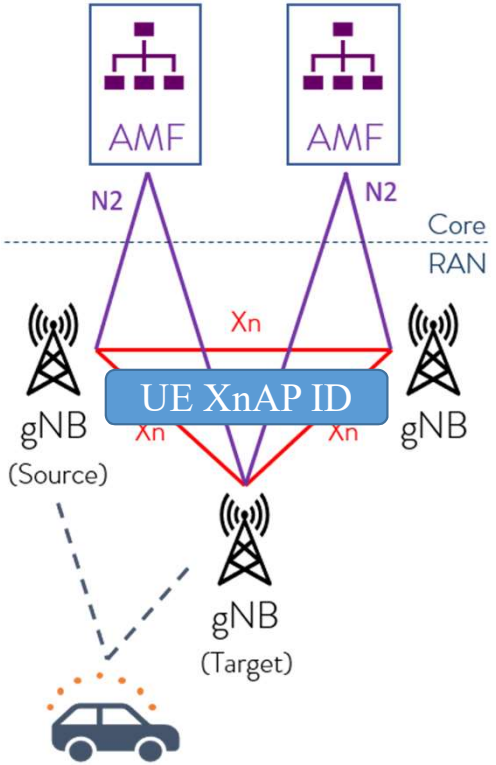
Cell Radio Network Temporary Identifier (C-RNTI)

C-RNTI: ID required to distinguish UEs within a Cell and is allocated to a UE by an gNB through a random access procedure in a cell controlled by the gNB and is effective only within the [serving] cell



UE ID Review

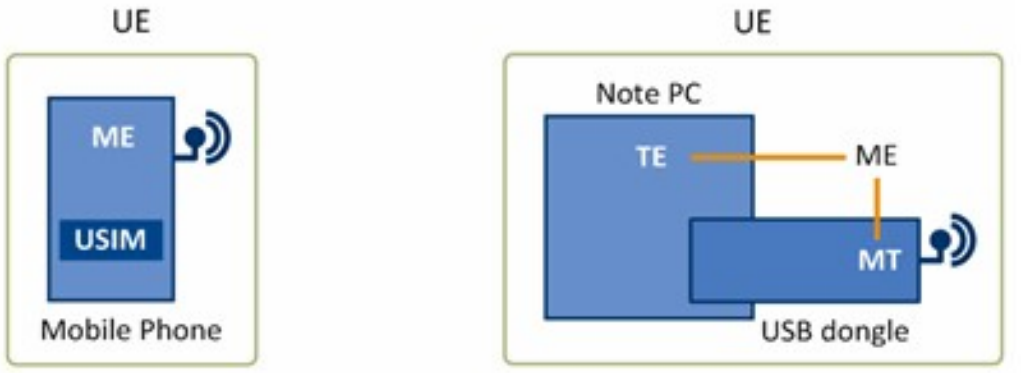

SUPI, SUCI
N1-NAS-SM
N1-NAS-MM
GUTI
N1-NAS-SM
N1-NAS-MM
RRC
PDCP
RLC
MAC
Physical
RRC
PDCP
RLC
MAC
Physical
RAN UE NGAP ID 1
NG-AP
SCTP
IP
Physical
AMF UE NGAP ID 1
NG-AP
SCTP
IP
Physical
HTTP2
TLS
TCP
IP
Physical
HTTP2
TLS
TCP
IP
Physical
UE
C-RNTI
gNB
AMF
SM
UU
N2
N11
Control plane Stack


AMF
AMF
N2
N2
Core
RAN
Xn
UE XnAP ID
Xn
Xn
gNB
(Source)
gNB
gNB
(Target)

International Mobile Equipment Identity (IMEI)

-A UE consists of an ME and a Universal Subscriber Identity Module (USIM), and an ME can further be divided into Terminal Equipment (TE) and a Mobile Terminal (MT).

-An MT is where radio access protocols work (e.g. USB dongle) while TE is where the MT control functions work.



IMEI is a unique number allocated to each mobile equipment (ME)

- **IMEI, IMEI/SV Format**

- IMEI:

TAC	SNR	CD
NNXXXXYY	ZZZZZZ	A
8 digits	6 digits	1 digit

- IMEI/SV:

TAC	SNR	SVN
NNXXXXYY	ZZZZZZ	SS
8 digits	6 digits	2 digits

	Format	Description [4]
TAC*	NN	Reporting Body ID
	XXXXYY	ME Type ID defined by Reporting Body
SNR	ZZZZZZ	Serial No, Allocated by Reporting Body but assigned per ME by the manufacturer
CD	A	Check Digit, defined as a function of all other IMEI digits
SVN	SS	Software Version Number, 00 – 98. 99 is reserved for future use.

* TAC: Type Allocation Code

- **Example**

IMEI: 356432053951377			
TAC	35643205		
	RBID	35	BABT**
	ME Type ID	643205	Samsung SHV-E330S
SNR	395137		
CD	7		

** BABT: British Approvals Board for Telecommunications

Device Information	
Brand	Samsung
Model	SHV-E330S
Manufacturer	Samsung Korea
Device type	Phone
Additional Info.	E330S Galaxy S4 LTE-A

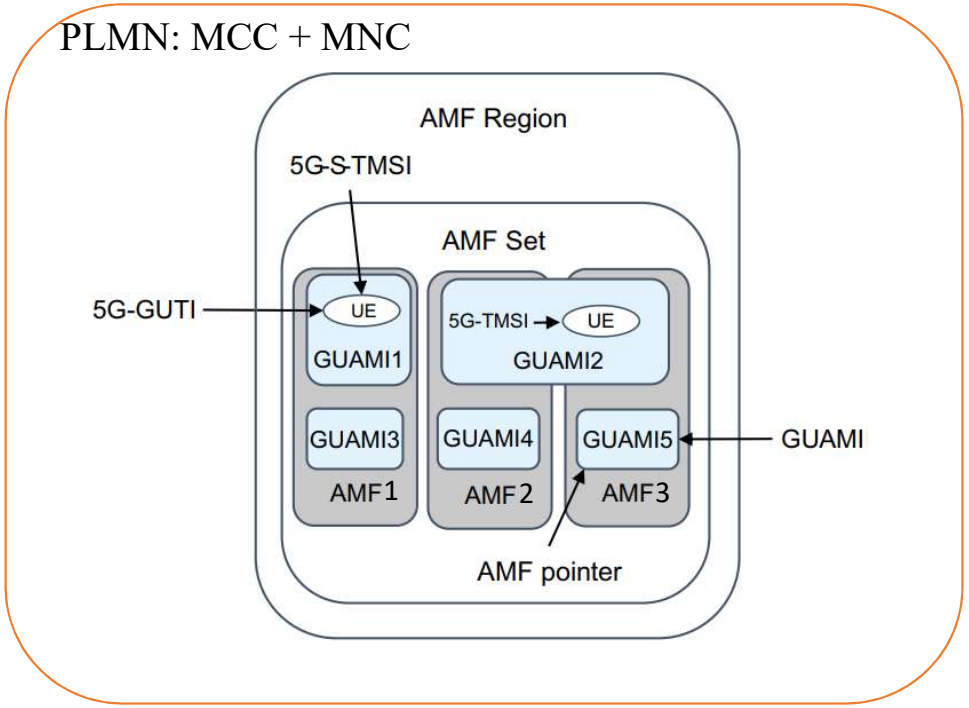
UE ID and ME ID Summary

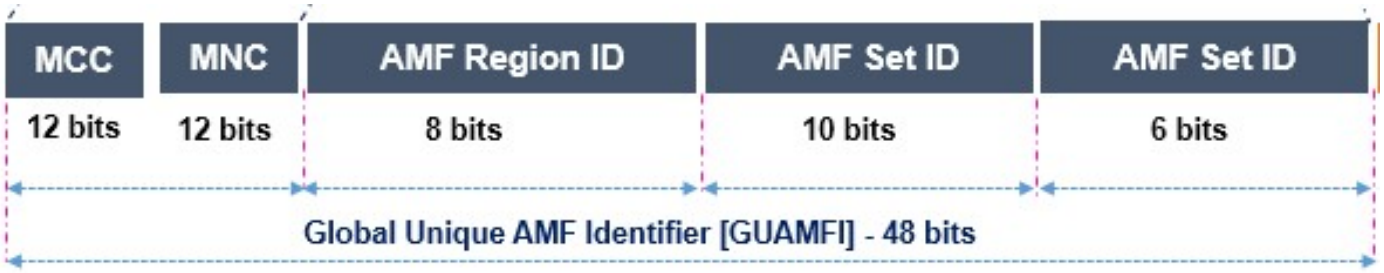
ID Group	NR Identifier	Range (uniquely identified within)	Allocator	Type of value
UE ID	SUPI (IMSI, NAI)	Global	Operator	Permanent
	5G-GUTI	Global	AMF	Temporary
	5G-S-TMSI	AMF Group	AMF	Temporary
	C-RNTI	Cell	gNB	Temporary
	RAN UE NGAP ID	gNB	gNB	Temporary
	AMF UE NGAP ID	AMF	AMF	Temporary
	Old UE XnAP ID	gNB	Source eNB	Temporary
	New UE XnAP ID	gNB	Target eNB	Temporary
ME ID	IMEI	Global	Manufacturer	Permanent

Identifiers for Network Equipment and Location

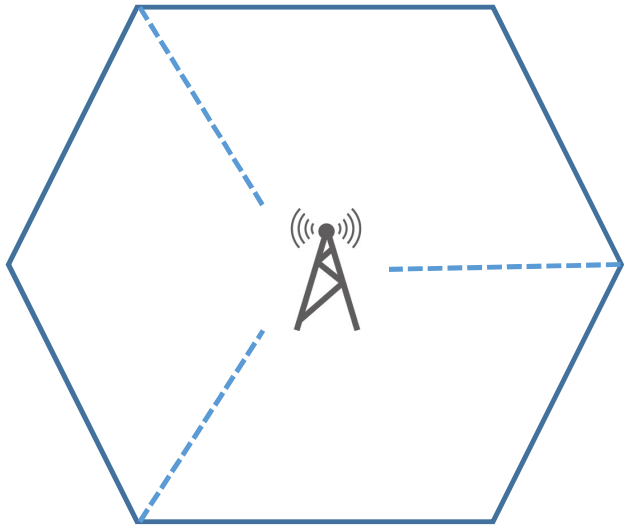
ID Group	NR ID
NE ID	GUAMI, AMFID, Global gNB ID, NCGI, gNB ID, S-NSSAI
Location ID	TAI, TAC

GUAMI, AMFI, NCGI



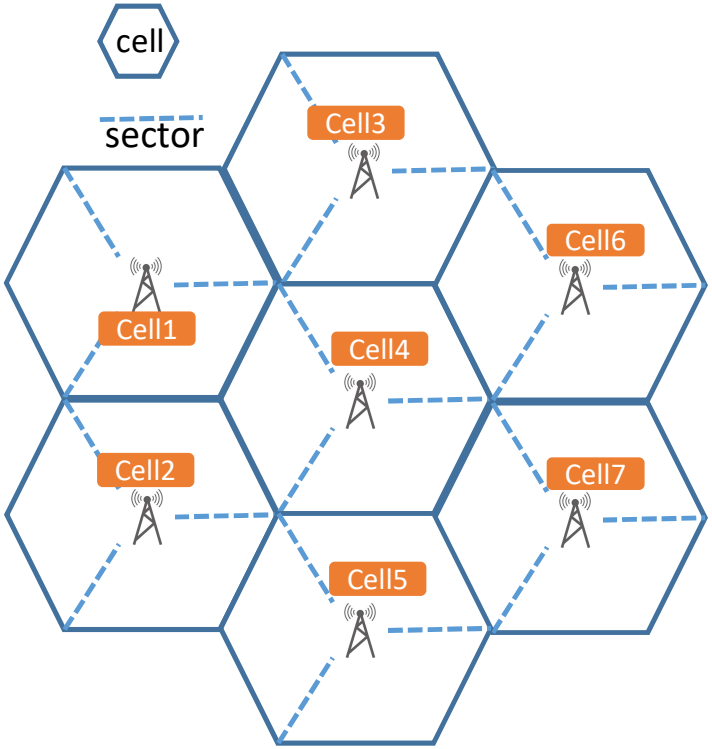


TAI, TAC, NCGI(Location ID)



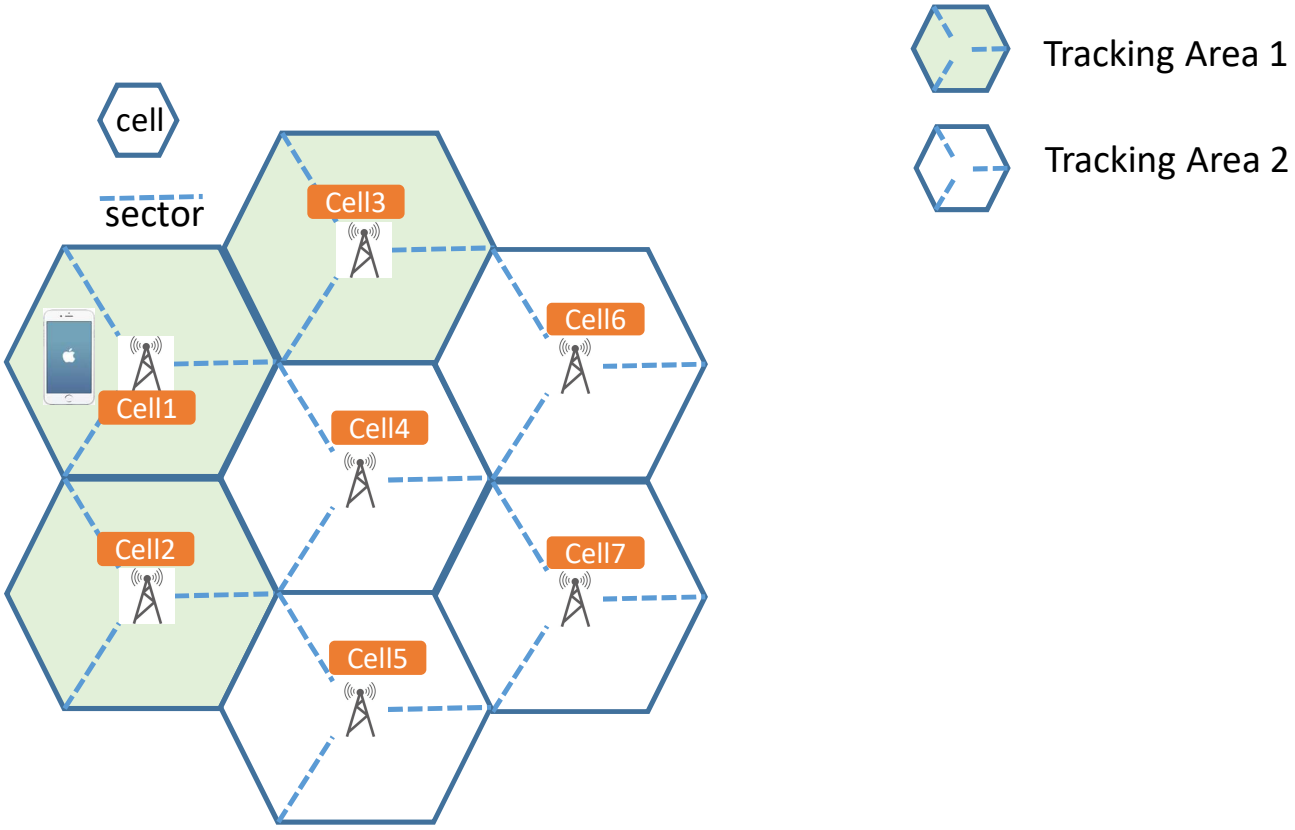
TAI, TAC, NCGI(Location ID)

NR Cell Global Identity (NCGI) = PLMN + NR Cell Identity (NCI)



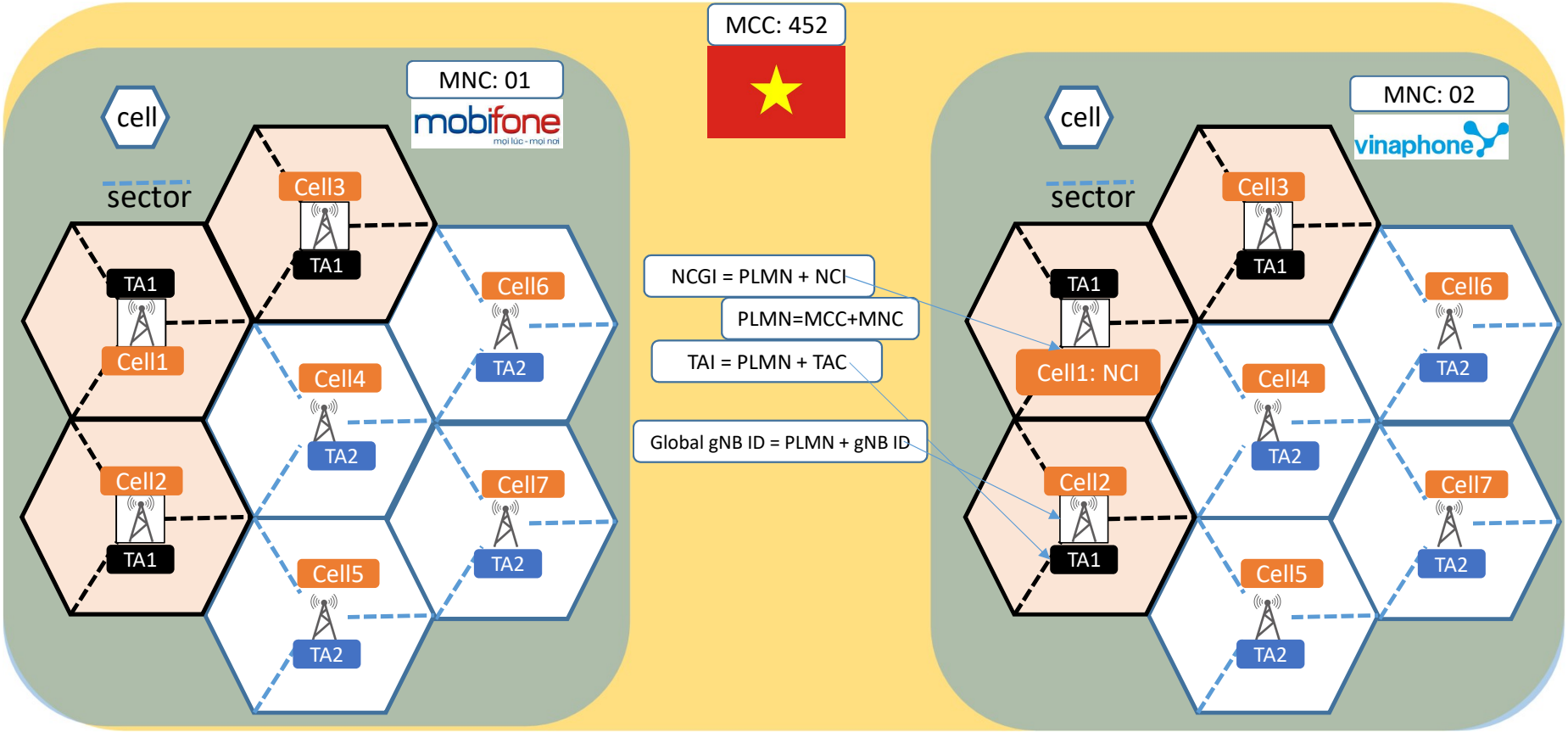
TAI, TAC, NCGI(Location ID)

Tracking Are Identifier (TAI) = PLMN + Tracking Area Code (TAC)



Location of a UE is known by the LTE network at cell level if the UE is in active state and is using services, or at TA level if it is in idle state and thus not using services

TAI, TAC, NCGI(Location ID)

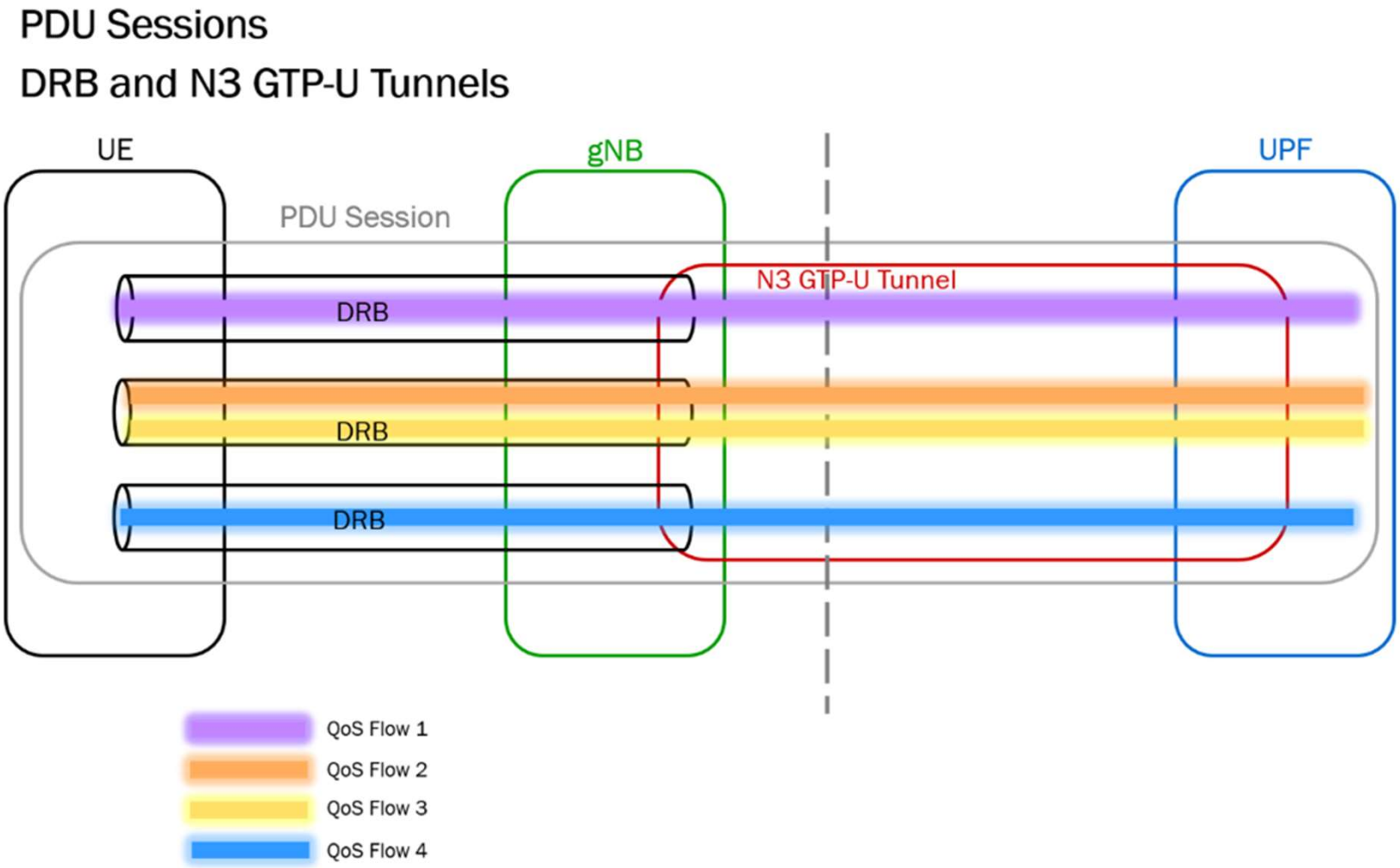


NE ID and Location ID Summary

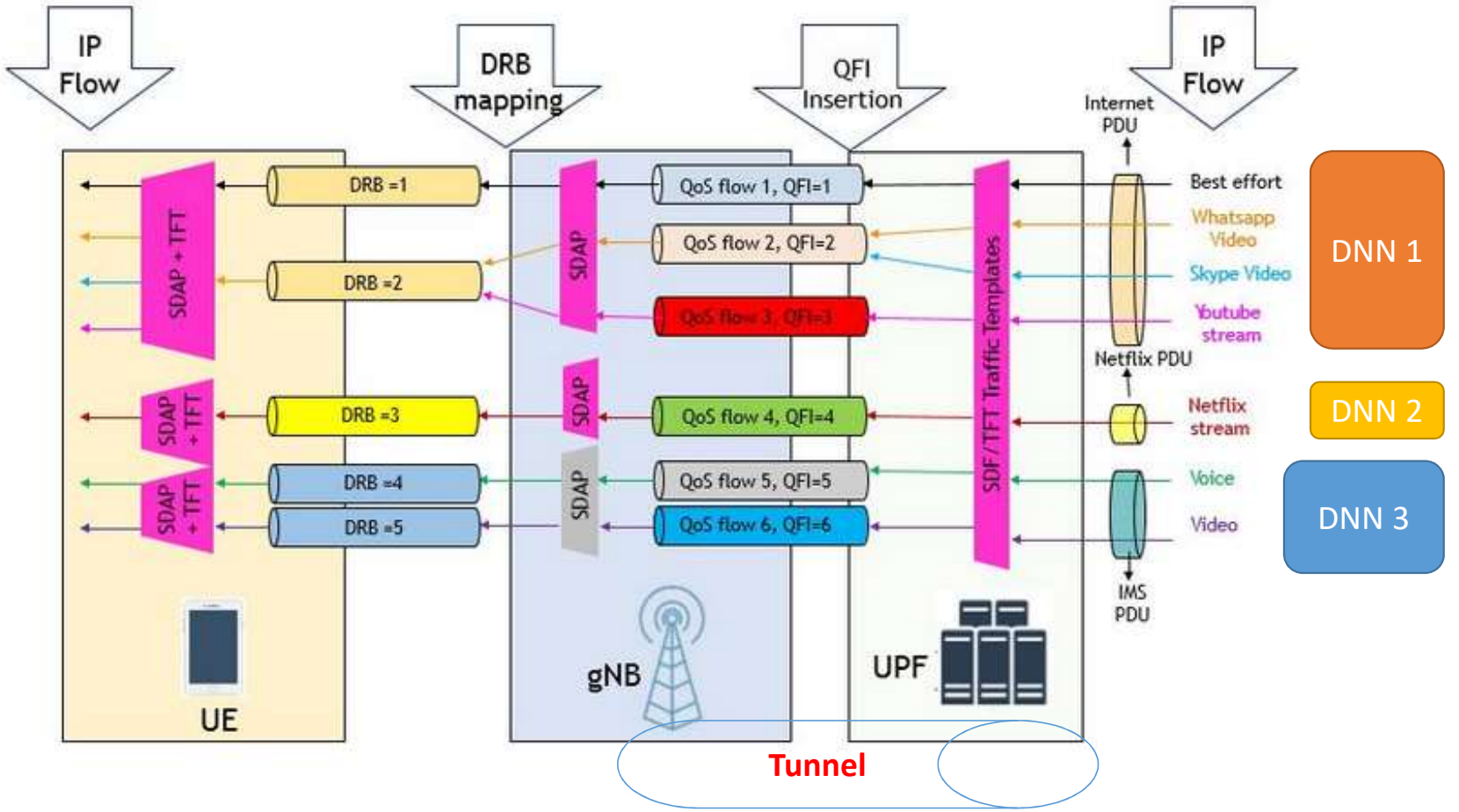
ID Group	NR Identifier	Range (uniquely identified within)	Allocator	Type of value
NE ID	GUAMI	Global	Operator	Permanent
	AMFI	Operator Network	Operator	Permanent
	Global gNB ID	AMF Group	Operator	Permanent
	gNB ID	Operator Network	Operator	Permanent
	NCGI	Global	Operator	Permanent
Location ID	TAI	Global	Operator	Permanent
	TAC	Operator Network	Operator	Permanent

Identifiers For PDU Session/Bearer

PDU session


PDU Sessions
DRB and N3 GTP-U Tunnels
UE
gNB
UPF
PDU Session
N3 GTP-U Tunnel
DRB
DRB
DRB
QoS Flow 1
QoS Flow 2
QoS Flow 3
QoS Flow 4

DRBI, QFI, DNN ID, TEI

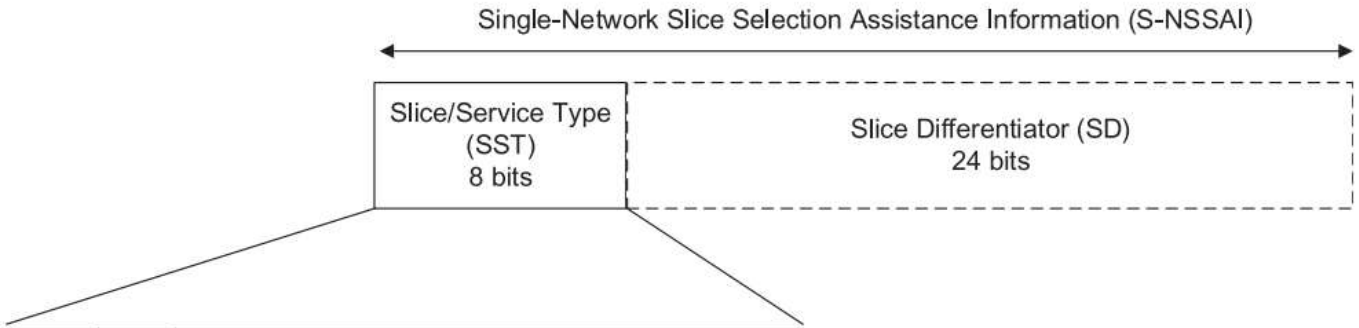


Access Point Names
APN

Bearer ID Summary

ID Group	NR Identifier	Range (uniquely identified within)	Allocator	Type of value
Session/ Bearer ID	DNN ID (APN)	Global	Operator	Permanent
	QFI	UE	AMF	Temporary
	DRBI	UE	Operator	Temporary
	TEID	Operator Network	gNB	Temporary

ID for Network Slices



0		Reserved
1	eMBB	Network Slice suitable for handling of 5G enhanced Mobile Broadband
2	URLLC	Network Slice suitable for handling of ultra-reliable low latency communications
3	MIoT	Network Slice suitable for handling of massive IoT
4	V2X	Network Slice suitable for handling of V2X services
5–127		Reserved
128–255		Operator-specific

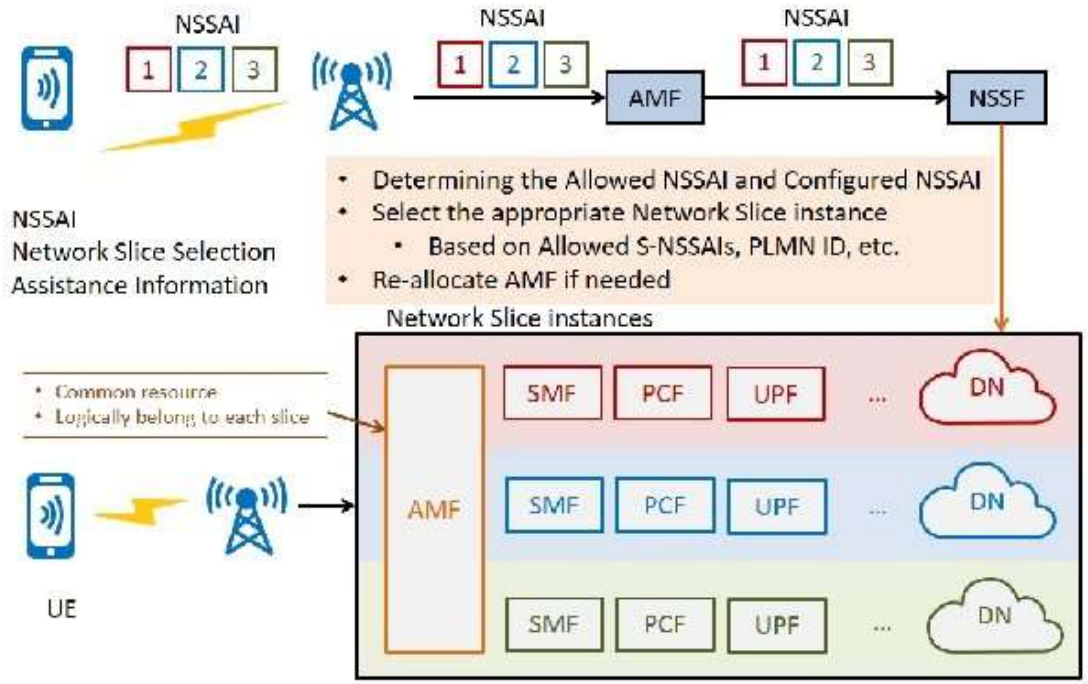
Fig. 11.4 Format of the S-NSSAI.

❖ Allowed NSSAI

```
    7 0.063217356   127.0.0.1           127.0.0.1           NGAP/NAS-5GS                174 UplinkNASTransport
    8 0.164223973   127.0.0.1           127.0.0.1           NGAP/NAS-5GS                250 InitialContextSetupRequest
    9 0.166401893   127.0.0.1           127.0.0.1           NGAP                         98 InitialContextSetupResponse
   10 0.370072837   127.0.0.1           127.0.0.1           NGAP/NAS-5GS                230 UplinkNASTransport
   11 0.427237808   127.0.0.1           127.0.0.1           NGAP/NAS-5GS                230 PDUSessionResourceSetupRequest
   12 0.429579601   127.0.0.1           127.0.0.1           NGAP                        118 PDUSessionResourceSetupResponse
```

```
> Frame 8: 250 bytes on wire (2000 bits), 250 bytes captured (2000 bits) on interface lo, id 0
> Ethernet II, Src: 00:00:00_00:00:00 (00:00:00:00:00:00), Dst: 00:00:00_00:00:00 (00:00:00:00:00:00)
> Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
> Stream Control Transmission Protocol, Src Port: 38412 (38412), Dst Port: 9487 (9487)
v NG Application Protocol
  v NGAP-PDU: initiatingMessage (0)
    v initiatingMessage
        procedureCode: id-InitialContextSetup (14)
        criticality: reject (0)
      v value
        v InitialContextSetupRequest
          v protocolIEs: 9 items
            > Item 0: id-AMF-UE-NGAP-ID
            > Item 1: id-RAN-UE-NGAP-ID
            > Item 2: id-GUAMI
            v Item 3: id-AllowedNSSAI
              v ProtocolIE-Field
                  id: id-AllowedNSSAI (0)
                  criticality: reject (0)
                v value
                  v AllowedNSSAI: 2 items
                    v Item 0
                      v AllowedNSSAI-Item
                        v s-NSSAI
                            sST: 01
                            sD: 010203
                    v Item 1
                      v AllowedNSSAI-Item
                        v s-NSSAI
                            sST: 01
                            sD: 112233
            > Item 4: id-UESecurityCapabilities
            > Item 5: id-SecurityKey
            > Item 6: id-MobilityRestrictionList
            > Item 7: id-MaskedIMEISV
            > Item 8: id-NAS-PDU
```

Network Slice Selection Function (NSSF)



Q&A