Cisco Support Community Expert Series Webcast:

Mobile Wireless: How Your Cellular Phone Surfs the Internet

Deepak Michael
Network Consulting Engineer

March 5, 2013

Cisco Support Community – Expert Series Webcast

- Today's featured expert is Cisco Support Network Consulting Engineer Deepak Michael
- Ask him questions now about Wireless Mobility

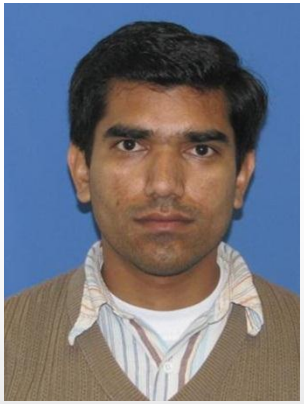
Deepak Michael

Topic: Mobile Wireless: How Your Cellular Phone Surfs the Internet

Event Date: March 5, 2013

Panel of Experts

Archit Sinha
NCE



Kirit Soheliya
NCE

Thank You for Joining Us Today

- Today's presentation will include audience polling questions
- We encourage you to participate!

Thank You for Joining Us Today

If you would like a copy of the presentation slides, click the PDF link in the chat box on the right or go to

https://supportforums.cisco.com/community/netpro/wireless-mobility/begin-wireless

Or, https://supportforums.cisco.com/docs/DOC-30239

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Polling Question 1

What is your level of experience with Mobile wireless technology?

a) I know basic WiFi concepts, but no idea about Mobile internet.

b) I theoretically know Mobile Wireless, but no practical experience.

c) I’m playing with it in the lab.

d) I’m running it in production.

Submit Your Questions Now!

Use the Q&A panel to submit your questions. Experts will start responding those

Cisco Support Community Expert Series Webcast:

Mobile Wireless: How Your Cellular Phone Surfs the Internet

Deepak Michael

Network Consulting Engineer

2/28/2013

Agenda

How Your Cellular Phone Surfs the Internet

- LTE overview & real world examples
- Control and User plane protocol
- LTE Architecture
- Aggregation Service Router (ASR) 5500
- LTE Call Flow
- Q&A

LTE overview & real world examples

LTE overview & real world examples

- Look at your smart phone today capable of an array of applications ranging from shopping on-line, making dinner reservations and downloading music. Who would have thought its predecessor would come from the two mobile devices below.
- In 1973 Martin Cooper invented the first cellular phone. Weighing 2 pounds, costing ~4K and with 30 minutes talk time.
- Cellular phone were used predominantly by the government and some businesses due to high cost.

→Enter the era of LTE ushering a mobile wireless landscape that has no boundaries offering speeds over 100 MBps.

LTE overview & real world examples

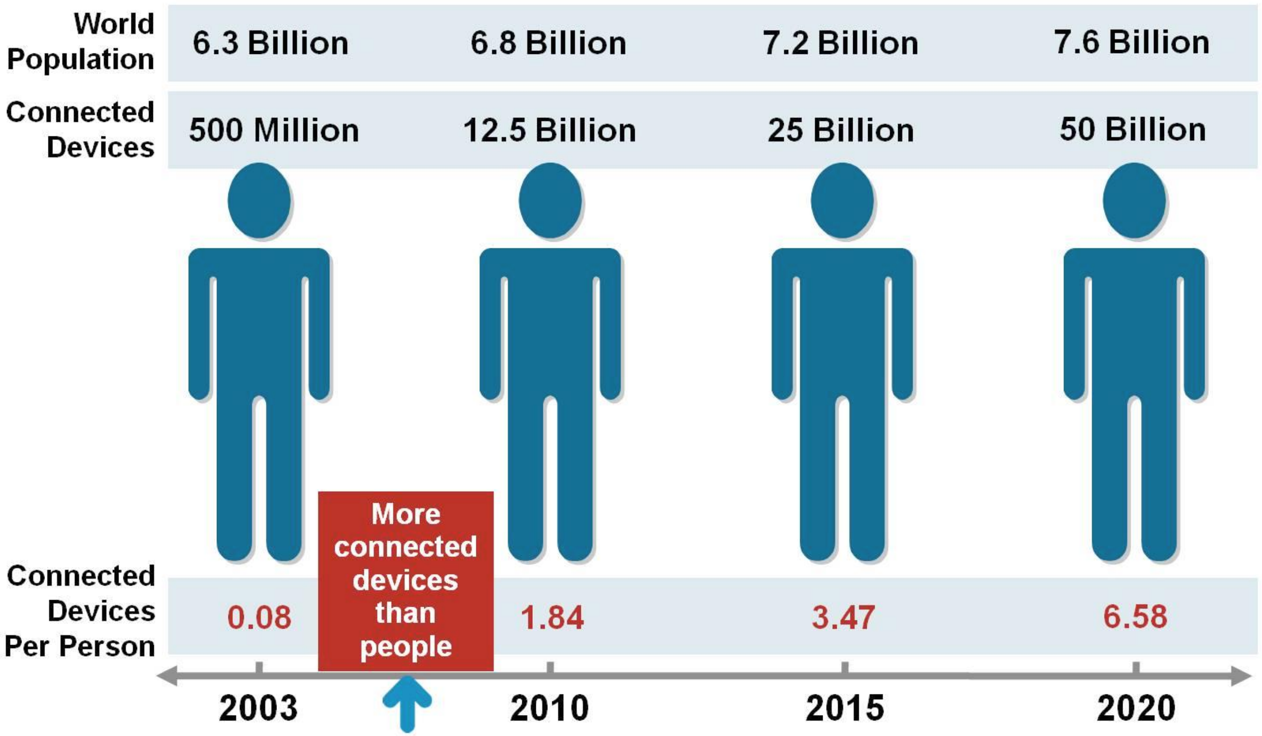
- Long Term Evolution also known as LTE is made possible through the 3rd Generation Partnership Project (3GPP).
- 3GPP is a collaboration between groups of telecommunications associations, known as the Organizational Partners. The initial scope of 3GPP was to make a globally applicable third-generation (3G) mobile phone system specification based on evolved Global System for Mobile Communications (GSM) specifications within the scope of the International Mobile Telecommunications-2000 project of the International Telecommunication Union (ITU).
- 3GPP defines the standards to allow different vendors the ability to work in tandem leading to transparent global mobility for the end user.
- Find more 3GPP @ http://www.3gpp.org/specifications

LTE overview & real world examples

- Today mobile devices maybe found everywhere performing functions never explored with wire line technology.
- Operators such a AT&T & Verizon have over 300 Machine 2 Machine (M2M) devices certified for enterprise customers.
- What are these devices doing?
  - -Monitoring prescriptions usage
  - -Asset monitoring
  - -Location services
  - -Inventory control
  - -Usage reporting
  - -Security
  - -Streaming music in your car
  - -And much more!

LTE overview & real world examples

- Where are we going with connected devices?



Polling Question 2

How familiar are you with 3GPP Release 8?

a) Theoretical knowledge only

b) I have minimal working experience with release 8

c) I have expert knowledge with 1 or more release 8

Submit Your Questions Now!

Use the Q&A panel to submit your questions. Experts will start responding those

Control and User plane protocols

Control and User plane protocols

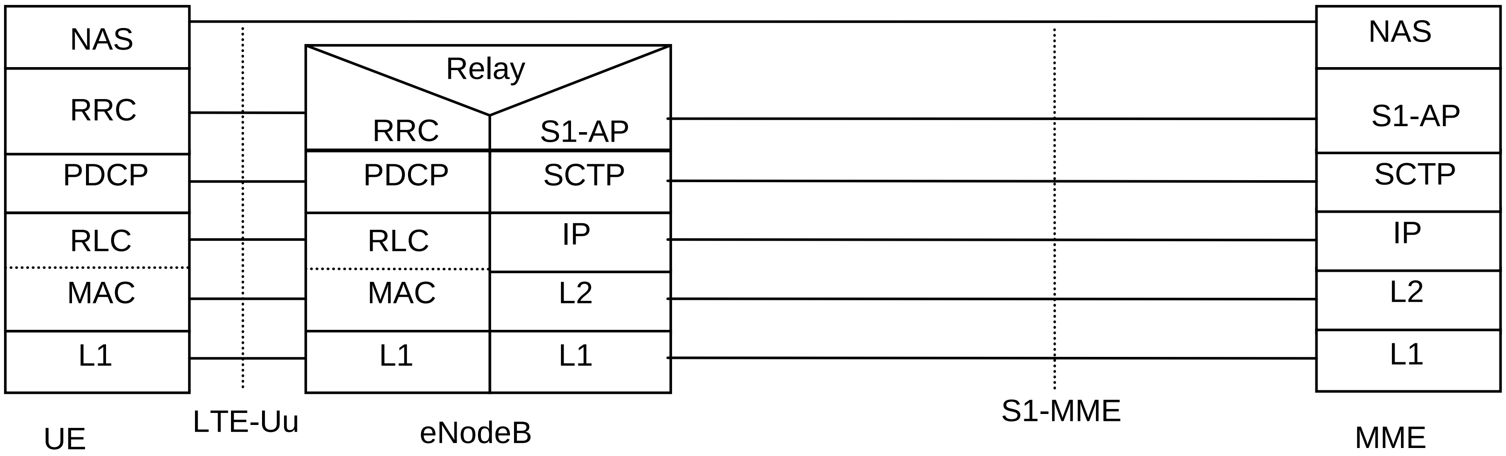
- Unlike IP networks that rely on source & destination routing, mobile networks require constant updates in the from of control plane messaging.
- IP is the means of reaching the devices within the network, however mobile networks utilizes a process of encapsulation and decapsulation via control & user plane messaging.
- Remember the slide about 3GPP? 3GPP creates standards to achieve both control & user plane protocols.
- Think of Control plane as set-up messages and keep lives while user plane is actual data i.e. HTTP wrapped in GTP.
- Common control plane protocols include GTP-C, S1AP while GTP-U is the predominate user plane protocol.

Control and User plane protocols

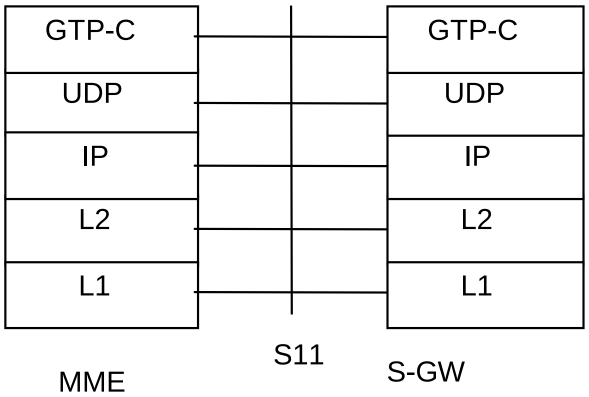
- Per 23.401 section 5.1.1

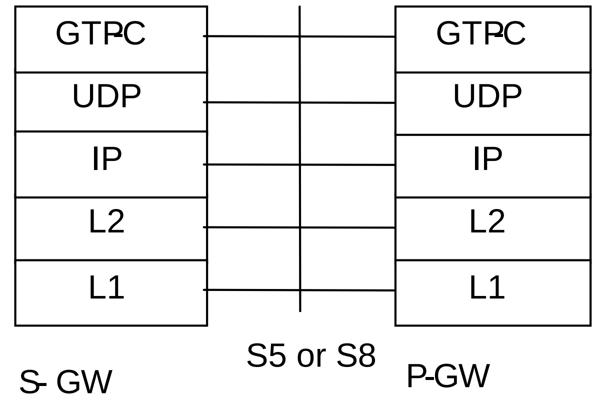
- The control plane consists of protocols for control and support of the user plane functions.
- Controlling the E-UTRA network access connections, such as attaching to and detaching from E-UTRAN;
- Controlling the attributes of an established network access connection, such as activation of an IP address;
- Controlling the routeing path of an established network connection in order to support user mobility; and
- Controlling the assignment of network resources to meet changing user demands.

Control Plane- LTE



Control Plane- LTE



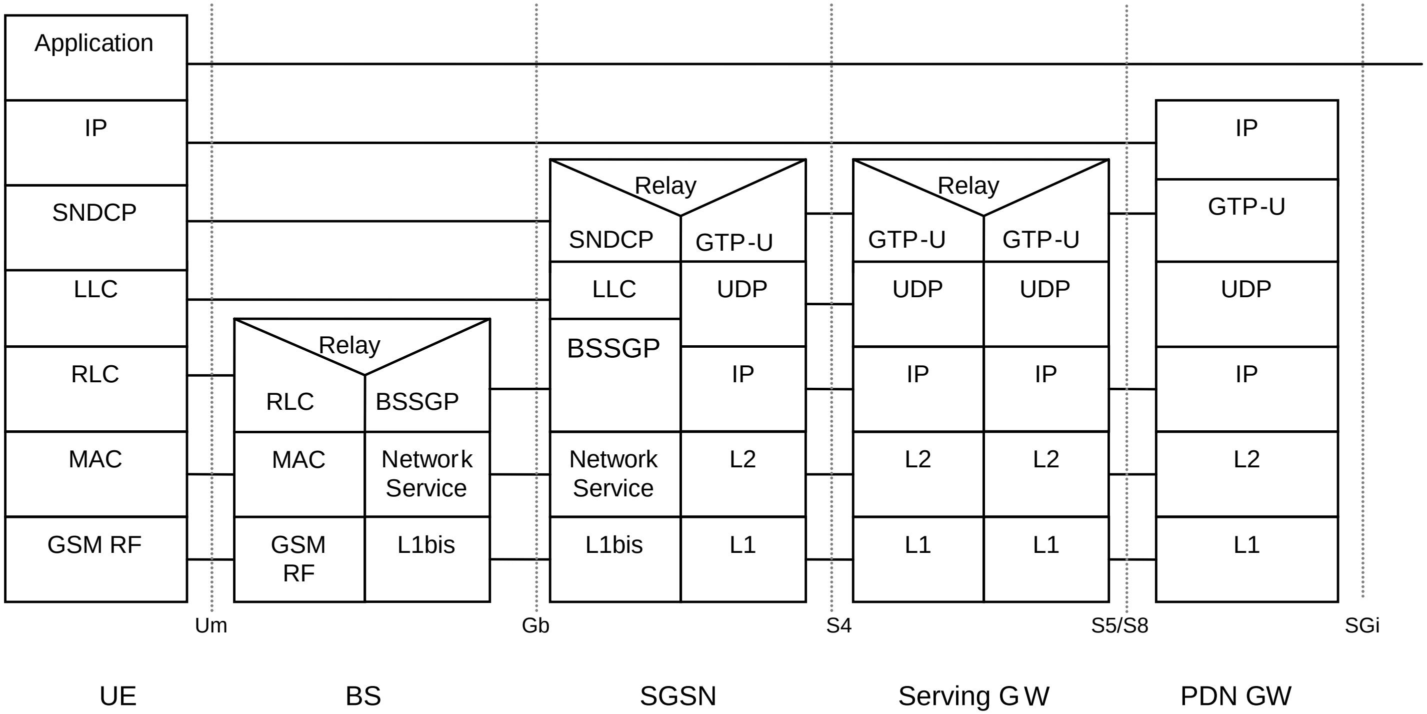


Control and User plane protocols

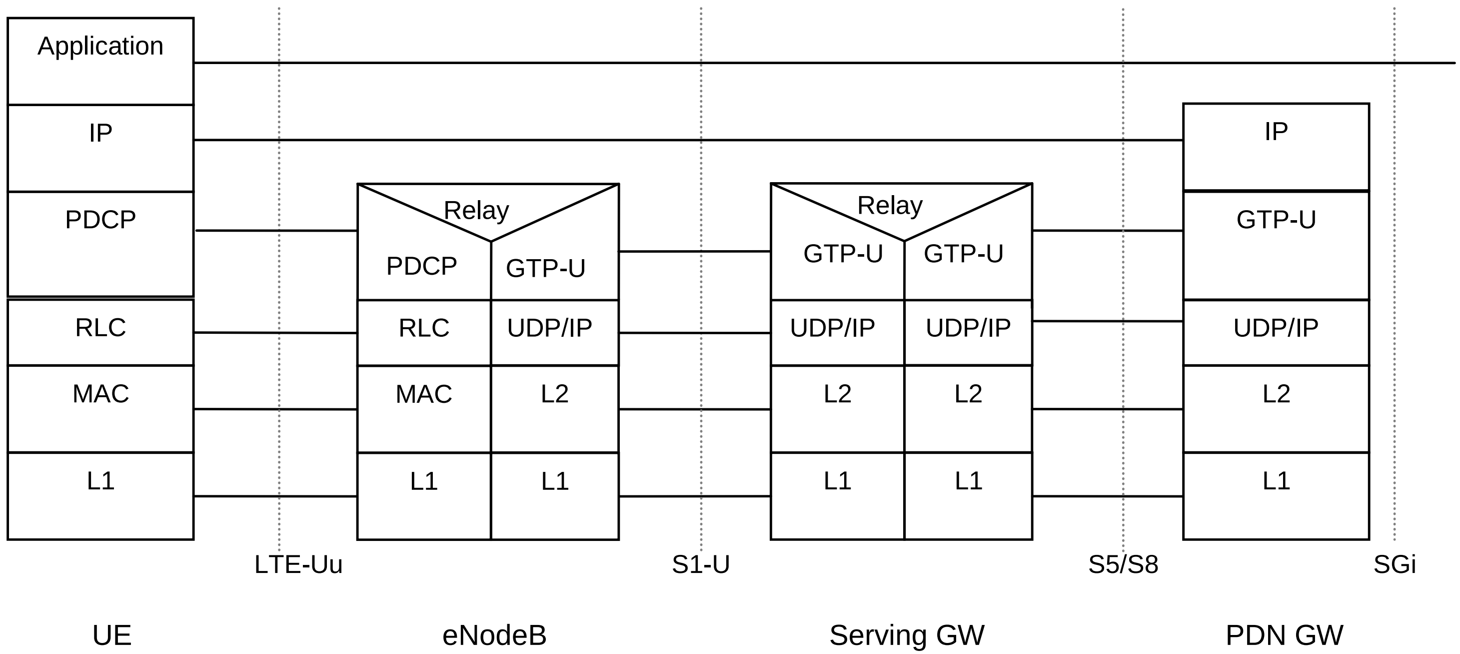
- Per 29.060

- The user plane messages are used to carry user data packets, and signalling messages for path management and error indication.
- The GTP-U protocol entity provides packet transmission and reception services to user plane entities in the GGSN, in the SGSN and, in UMTS systems, in the RNC. In LTE GTP-U is carried amongst EnB,SGSN,SGW & PGW.
- The GTP-U protocol entity receives traffic from a number of GTP-U tunnel endpoints and transmits traffic to a number of GTP-U tunnel endpoints. There is a GTP-U protocol entity per IP address.

User Plane- LTE



User Plane- LTE

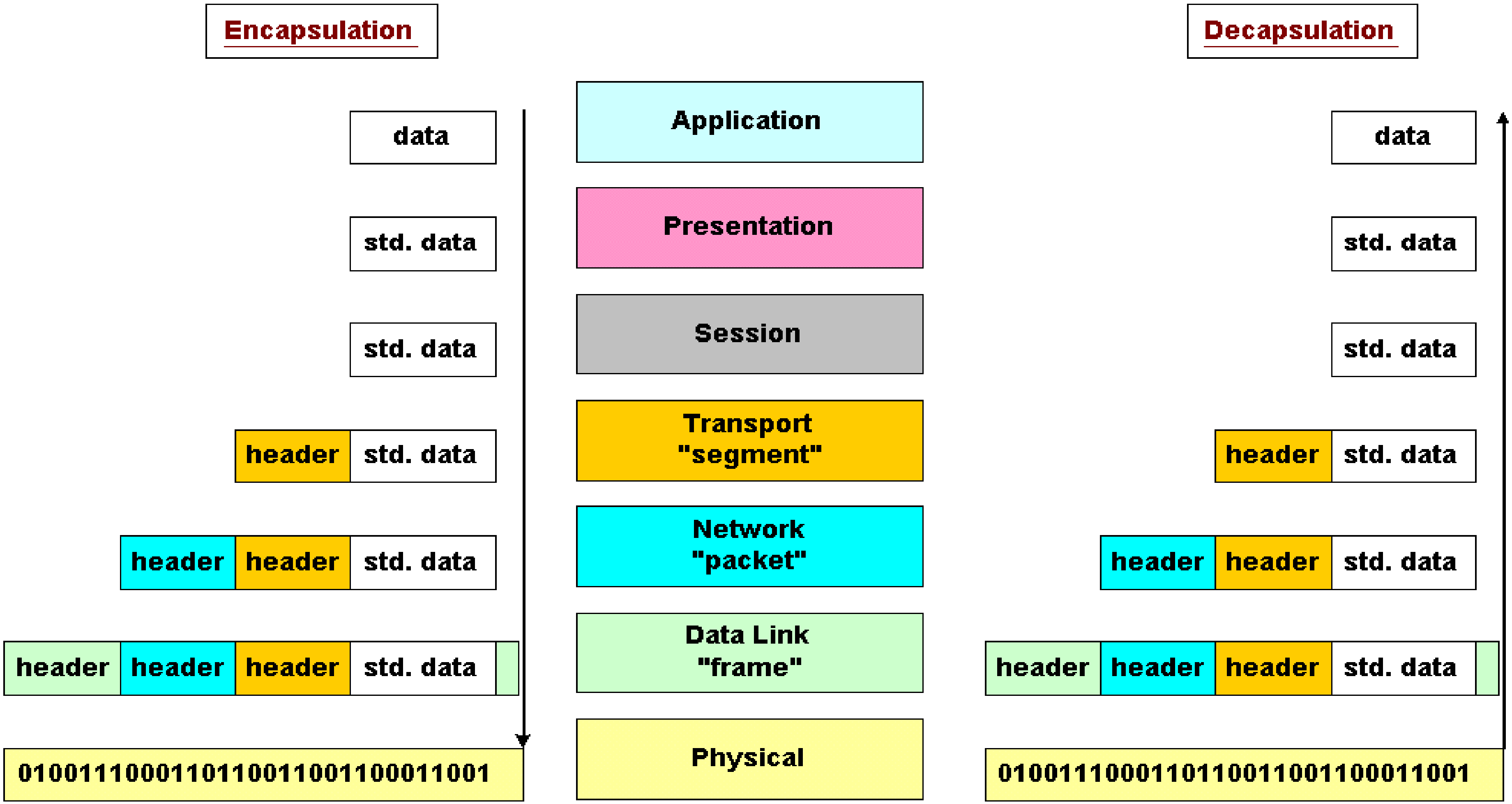


Control and User plane protocols

What is GTP??

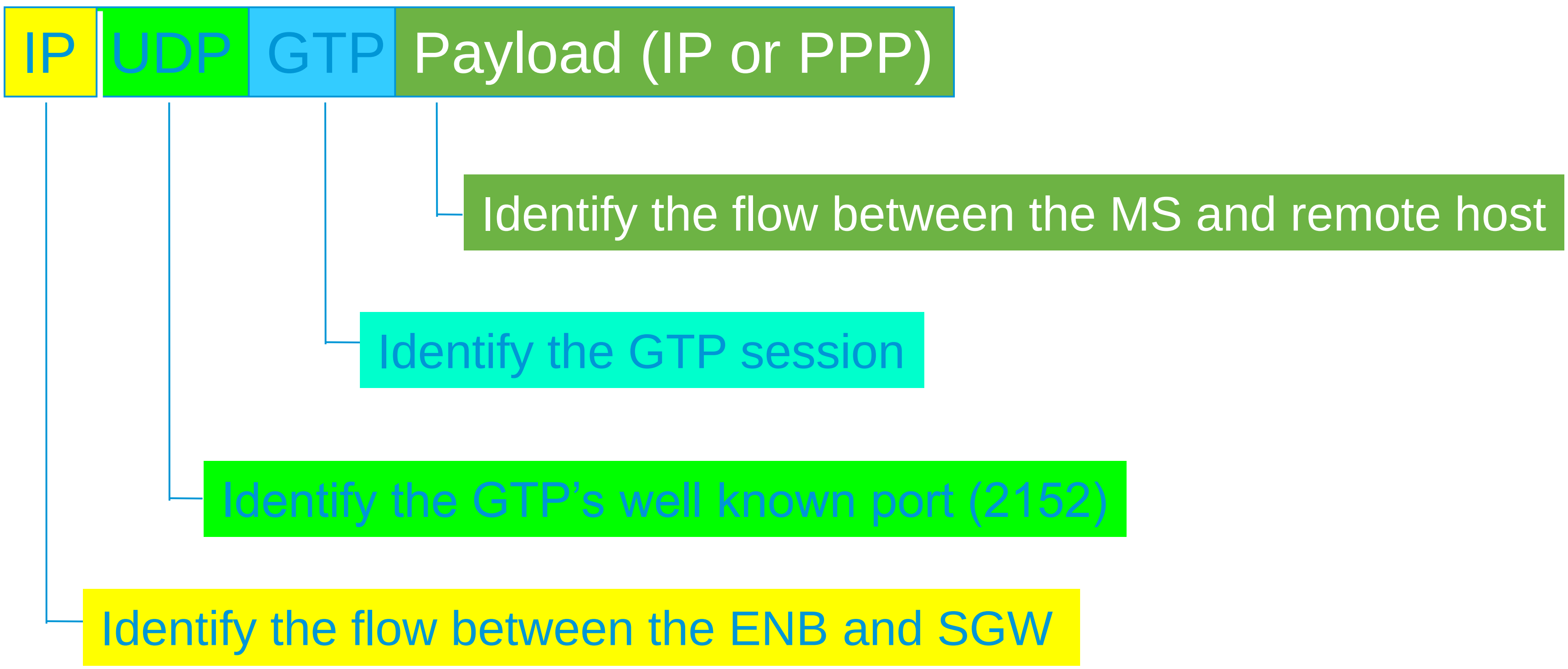
- GPRS Tunnelling Protocol is used for encapsulation
- GTP tunnels are used between two nodes communicating over a GTP based interface, to separate traffic into different communication flows.
- A GTP tunnel is identified in each node with a TEID (Tunnel End Point ID) an IP address and a UDP port number.
- The receiving end side of a GTP tunnel locally assigns the TEID value the transmitting side has to use. The TEID values are exchanged between tunnel endpoints using GTP-C or S1-MME messages.
- The criteria defining when the same or different GTP tunnels shall be used between the two nodes differs between the control and the user plane, and also between interfaces.

Sidebar – Encapsulation/Decapsulation



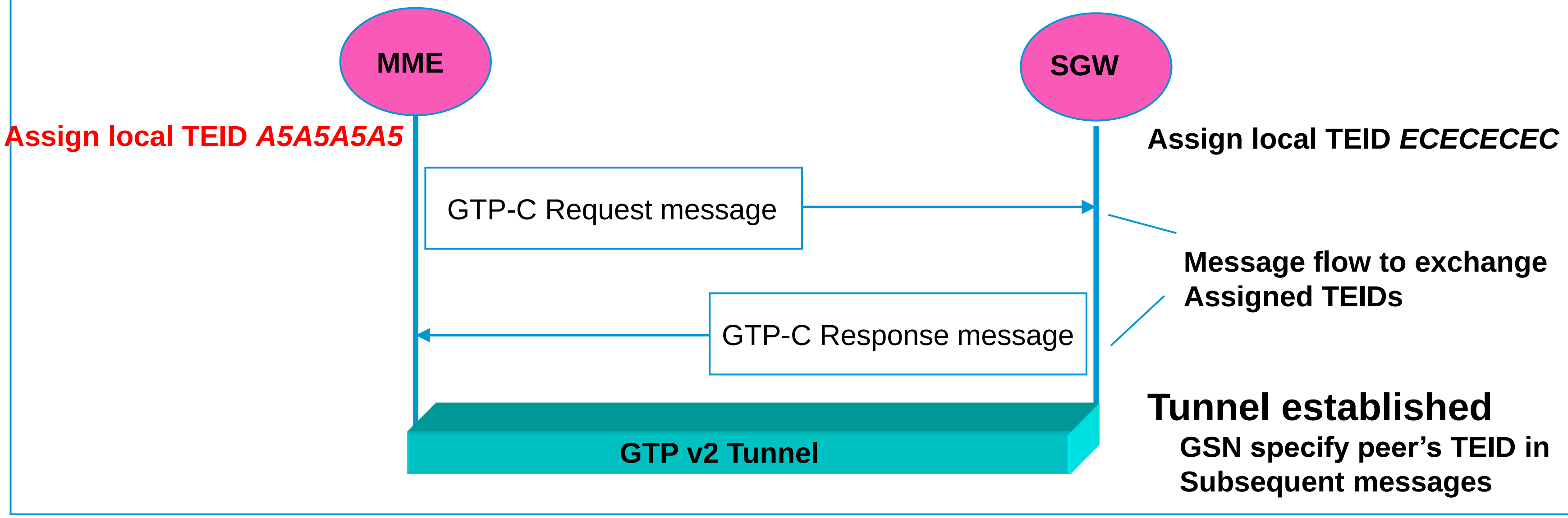
GPRS Tunneling Protocol

Layer 3 Tunneling Protocol with mobility support



Tunnel Endpoint Identifier (TEID)

- Identifies a tunnel endpoint in *receiving* GTP-C/GTP-U protocol entity



Control and User plane protocols

Message Type value (Decimal)	Message	GTP-C	GTP-U
0	Reserved		
1	Echo Request	X	X
2	Echo Response	X	X
3	Version Not Supported Indication	X	
4 to 24	Reserved for S101 interface		
25 to 31	Reserved for Sv interface		
	SGSN/MME to PGW (S4/S11, S5/S8)		
32	Create Session Request	X	
33	Create Session Response	X	
34	Modify Bearer Request	X	
35	Modify Bearer Response	X	
36	Delete Session Request	X	
37	Delete Session Response	X	

Example of Commons GTP-C and GTP-U messages taken from 29.274

Create Session Request Expanded with Information Elements.

The direction of this message shall be from MME/S4-SGSN to SGW and from SGW to PGW

- The Create Session Request message shall be sent on the S11 interface by the MME to the SGW, and on the S5/S8 interface by the SGW to the PGW as part of the procedures:

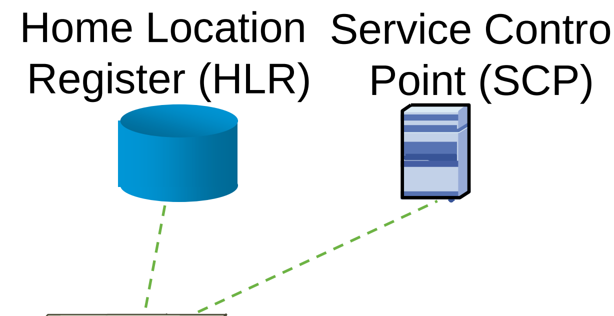
- E-UTRAN Initial Attach
- UE requested PDN connectivity

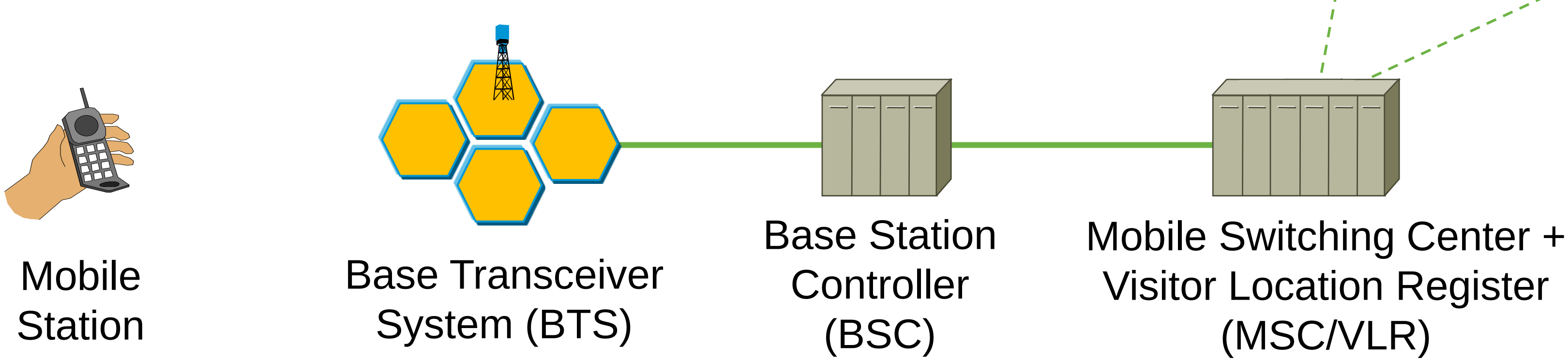
Information elements	**P**	**Condition / Comment**	**IE Type**
IMSI	M		IMSI
MSISDN	C	For an E-UTRAN Initial Attach the IE shall be included when used on the S11 interface, if provided in the subscription data from the HSS. For a PDP Context Activation procedure the IE shall be included when used on the S4 interface, if provided in the subscription data from the HSS. The IE shall be included for the case of a UE Requested PDN Connectivity, it shall be included if the MME has it stored for that UE. It shall be included when used on the S5/S8 interfaces if provided by the MME/SGSN.	MSISDN
ME Identity (MEI)	C	The MME shall include the ME Identity (MEI) IE, if it is available.	MEI
RAT Type	M		RAT Type

LTE Architecture

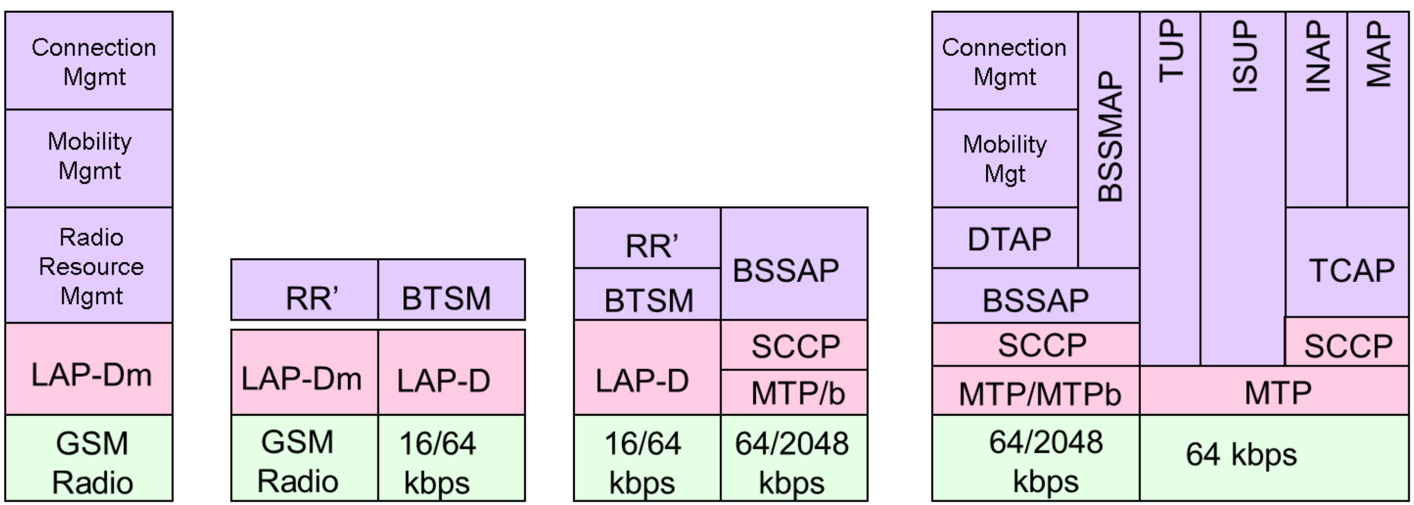
In the beginning….

- There was wireless ISDN (aka GSM)



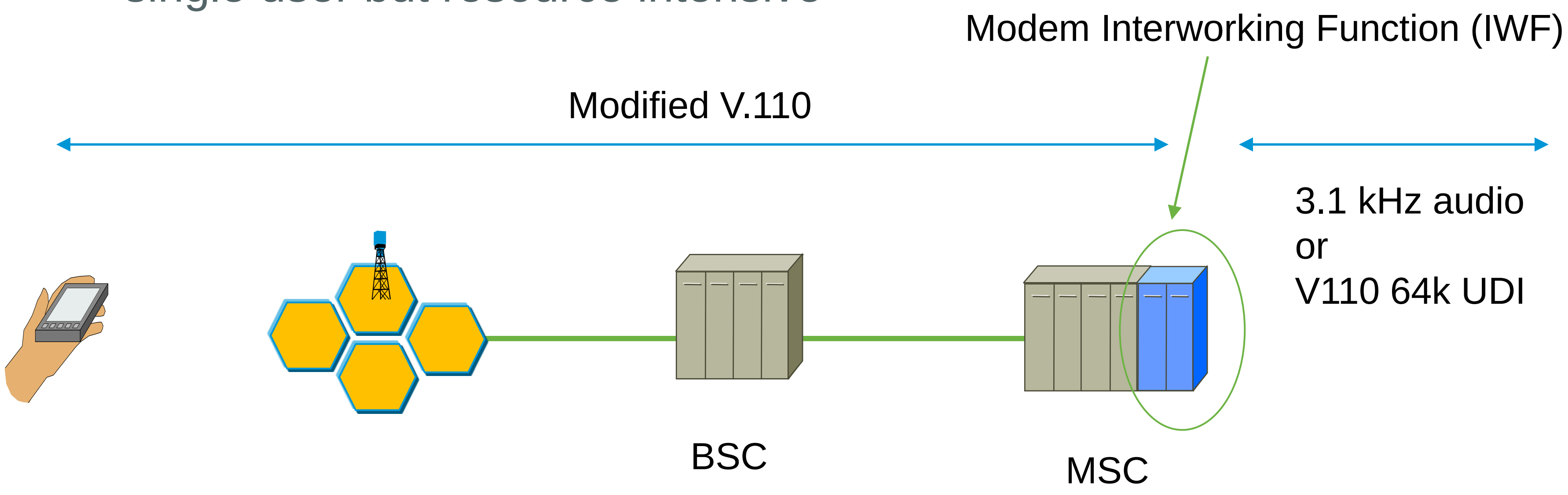


- Voice oriented architecture
- Re-define fixed wireline services (e.g. SS and IN)
- SMS is a signalling transport rather than a data service
- Network transport based on TDM

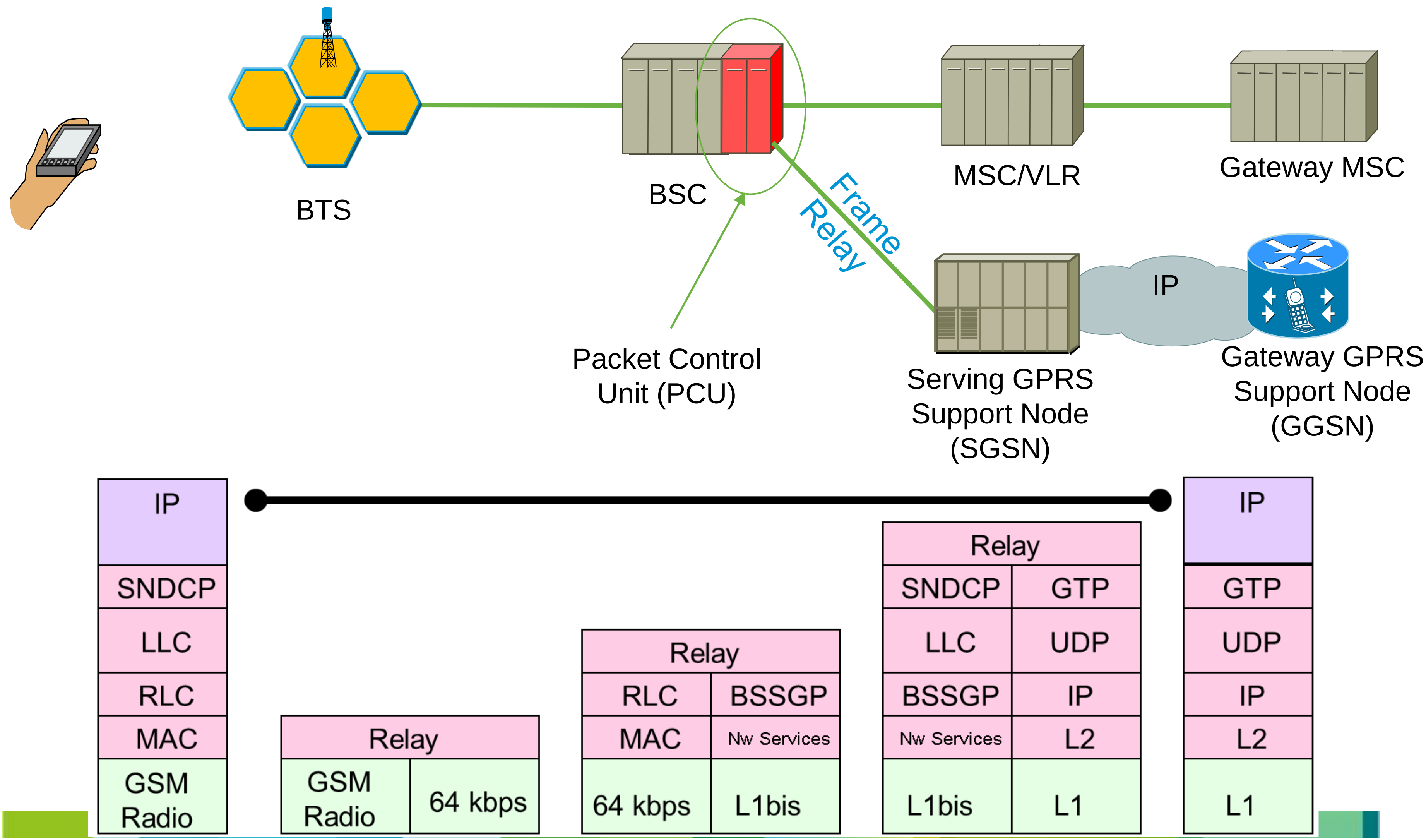


… data was circuit switched

- One burst every TDMA frame was sufficient to transport a speech frame with source rate of 13 kbit/s
- GSM Phase 2 (circa 1996) added Circuit Switched Data support offering 9.6 kbit/s service
- High Speed CSD consisted in aggregating multiple timeslot for a single user but resource intensive

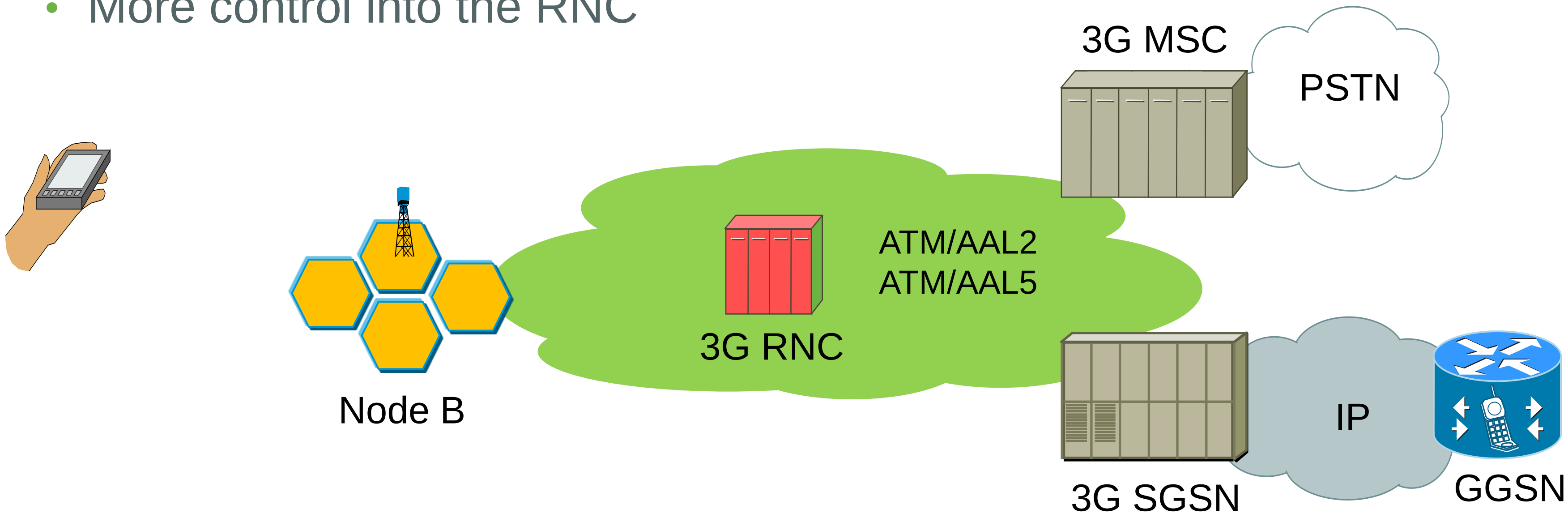


.. and eventually packet data with General Packet Radio System was bolted on



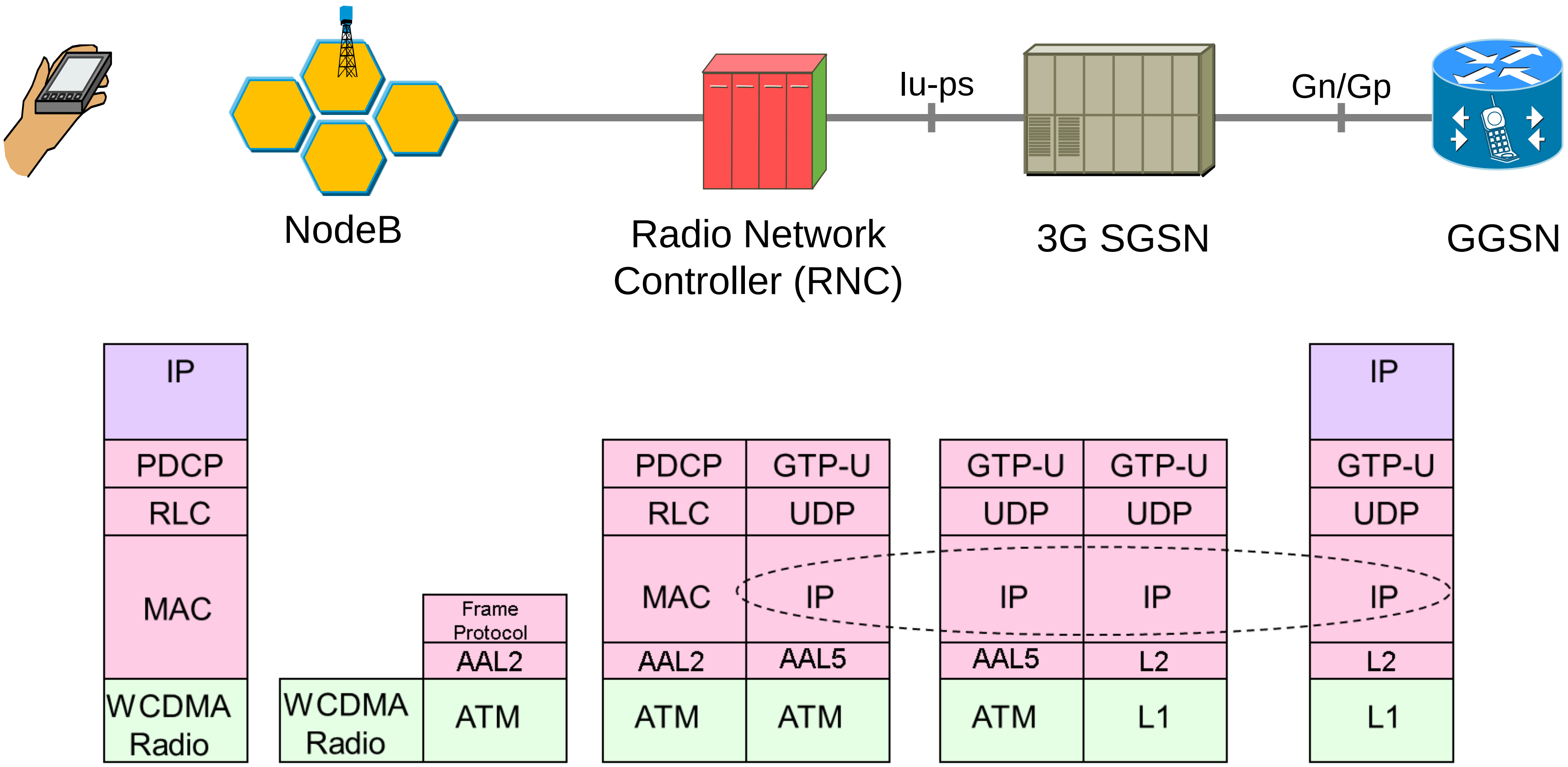
3GPP UMTS System

- First step towards an all IP network
- Designed to accommodate greater packet throughput
- Core network remains largely unchanged from 2.5G
- Migration to ATM for Radio Access Transport
- More control into the RNC

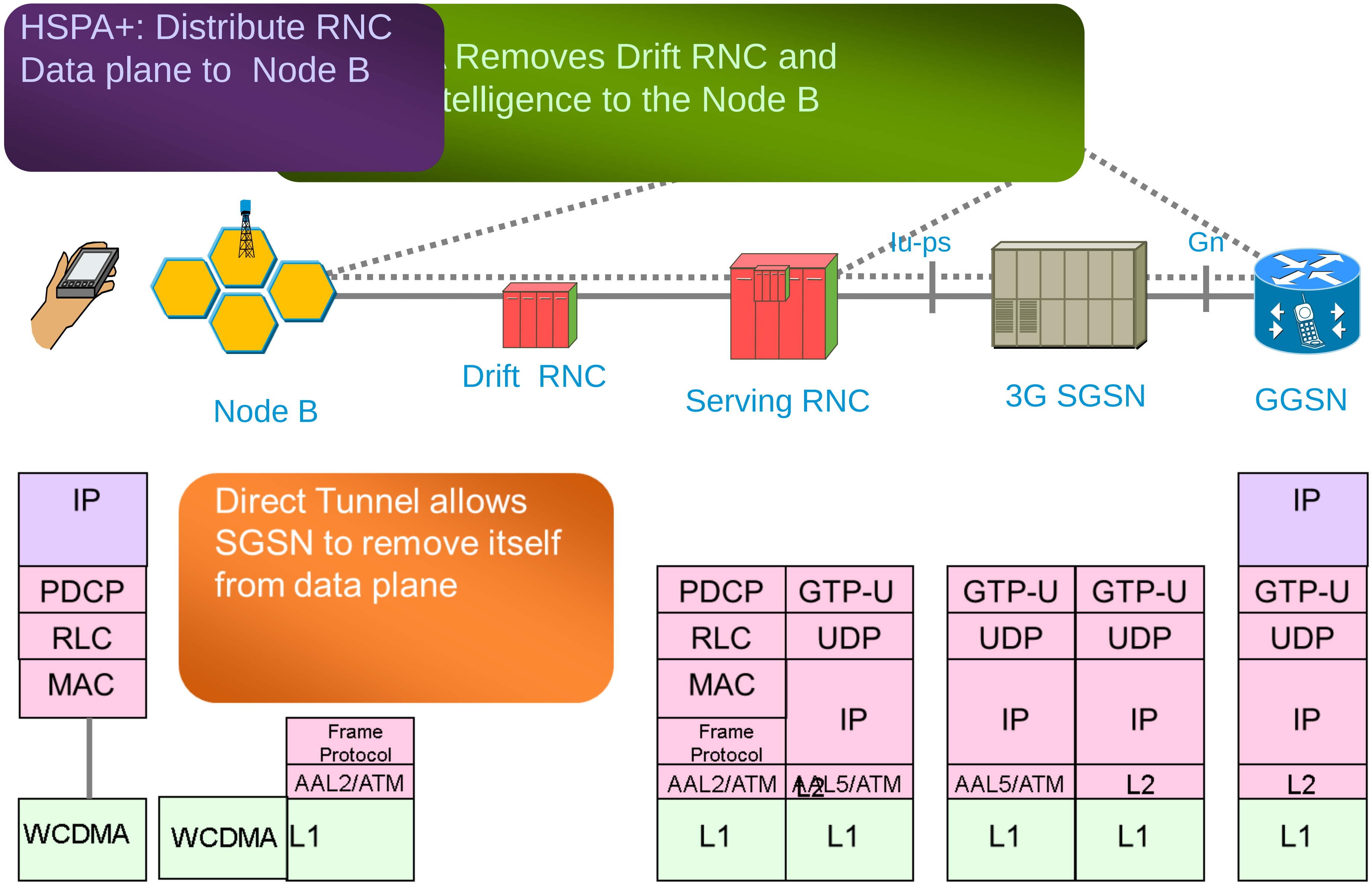


3G Packet Services

- So hopefully WCDMA got it right on packet services…

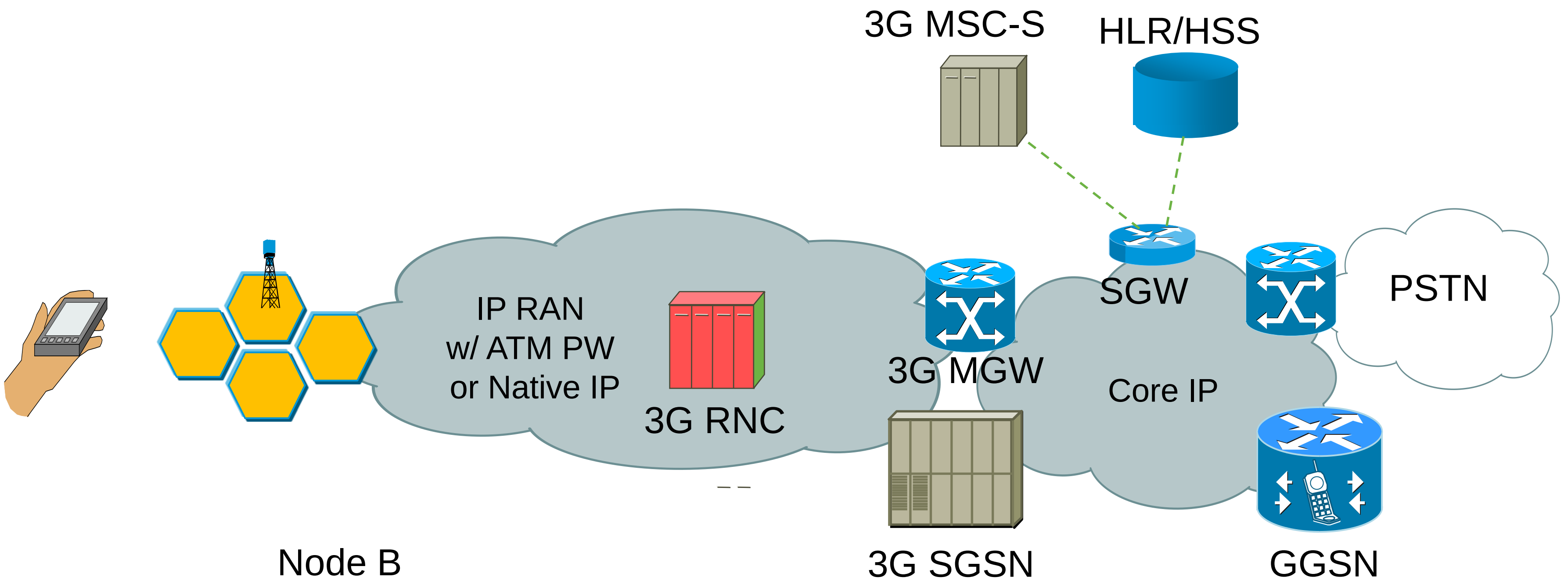


3GPP R5 to R7: Addressing the Bottlenecks

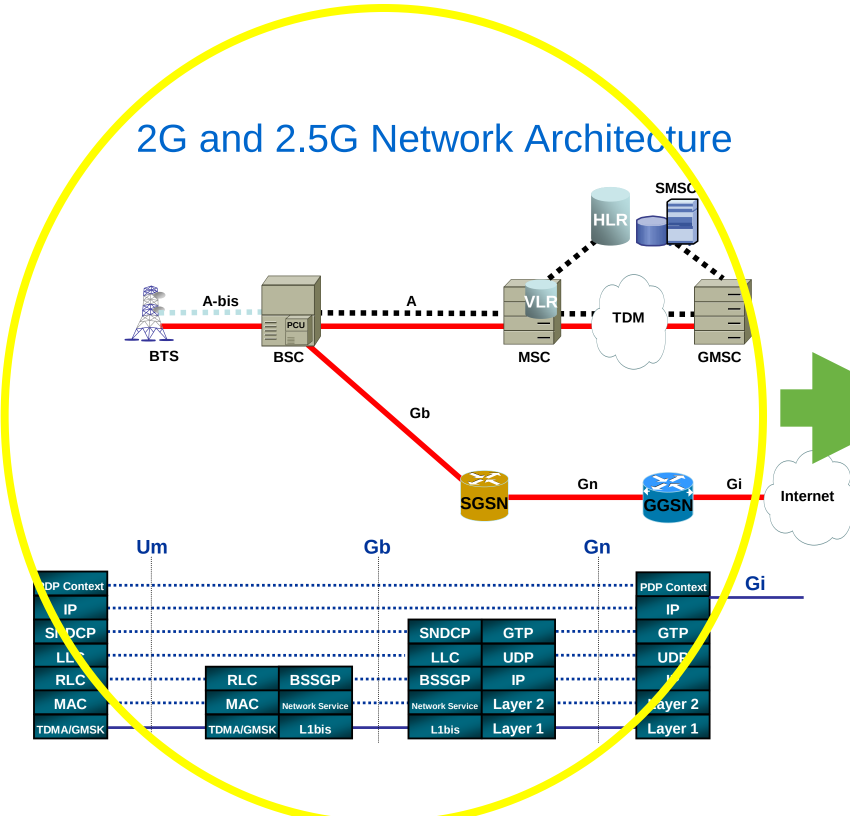


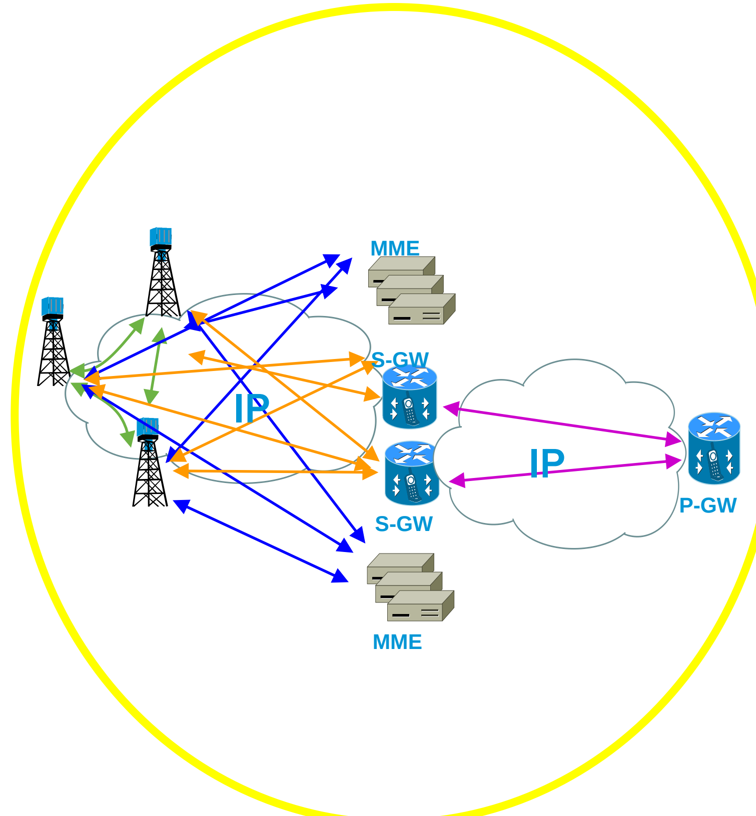
3G architecture summary

- Highlighting the growing importance of IP transport



Mobile Architectural Evolution



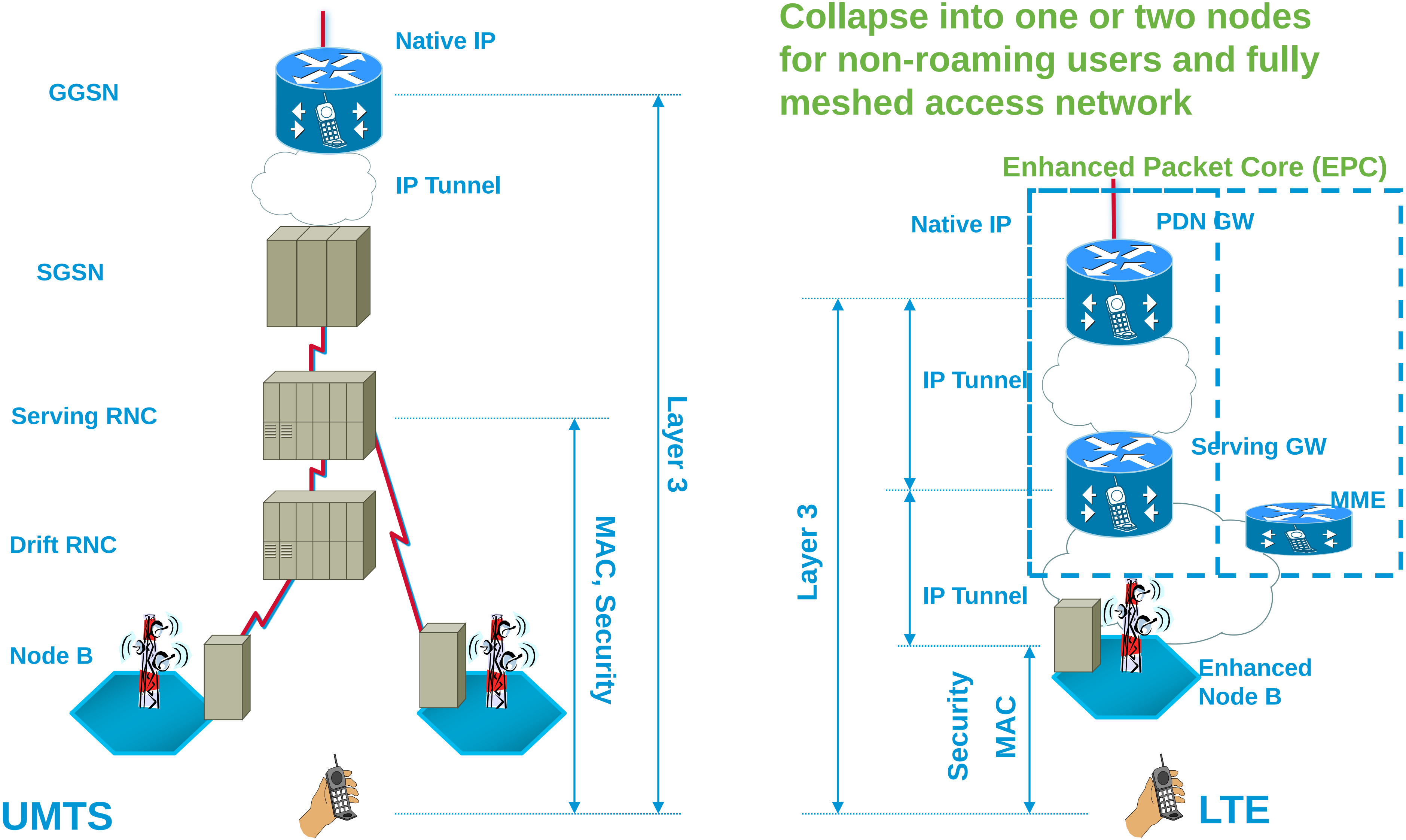


Structured, Centralised Approach

Less Rigid, Distributed Approach i.e. moving intelligence into the network

LTE Collapsing Architectural Hierarchy

Collapse into one or two nodes for non-roaming users and fully meshed access network



LTE Background

- 3GPP work on the Evolution of the 3G Mobile System started with the RAN Evolution Work Shop in late 2004, with the objective

  "*to develop a framework for the evolution of the 3GPP radio-access technology towards a **high-data-rate**, **low-latency** and **packet-optimized** radio-access technology*"

- 3GPP TR 25.913 captures the resulting detailed requirements, e.g.
  - 100 Mb/s downlink and 50 Mb/s uplink peak data rates,
  - Low control plane latency (<50 ms from idle to active)
  - Low user plane latency (<5 ms for small IP packet)

- Compare that to the 1998 specs for UMTS:
  - 144 Kb/s in rural outdoor radio environments.
  - 384 Kb/s in urban or suburban outdoor radio environments.
  - 2 Mb/s in indoor or low range outdoor radio environment.
  - More than 2 Mb/s in urban or low-range outdoor radio environments – this later was added when HSDPA (High Speed Downlink Packet Access) was introduced in UMTS specifications.

- In short, this meant the development of a new type of a Radio Access Network: E-UTRAN, which is specified in the 3GPP 36.xxx series, e.g.:

  TS 36.401: Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture description (Release 8)

  TS 36.300: Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 8)

- This evolution of the RAN is called LTE (Long Term Evolution)

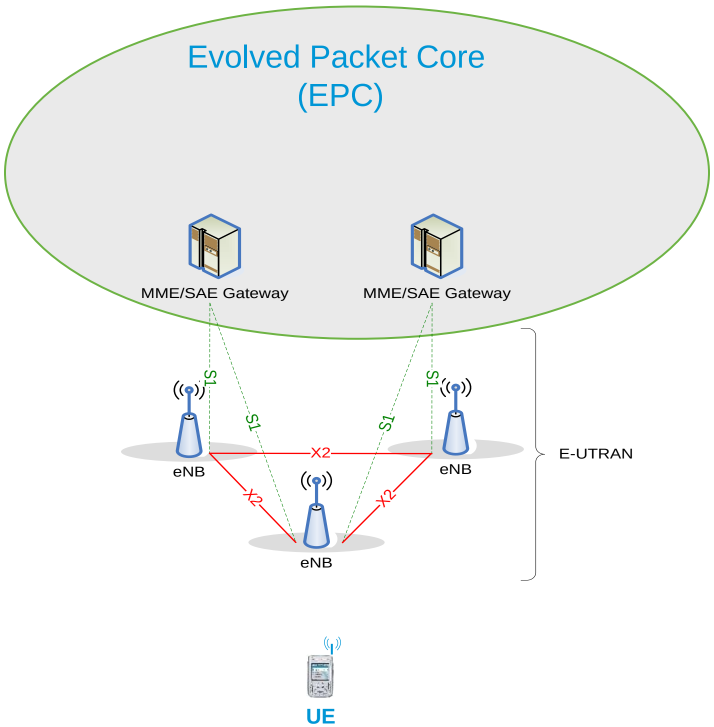
E-UTRAN Architecture Overview

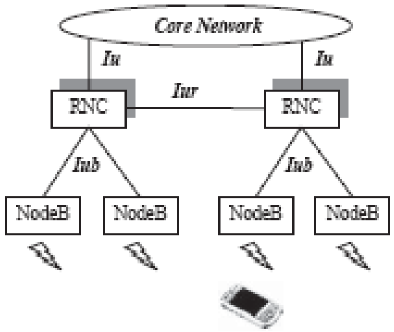
- The E-UTRAN consists of eNodeBs (eNBs), providing the E-UTRA user plane (PDCP*/RLC*/MAC/PHY) and control plane (RRC) protocol terminations towards the UE
- eNodeBs (eNB) are interconnected with each other by means of the X2 interface
- eNodeBs are also connected by means of the S1 interface to the EPC (Evolved Packet Core), more specifically:

  To the Mobility Management Entity (MME) by means of the S1-MME interface

  To the Serving (SAE) Gateway by means of the S1-U interface
- The S1 interfaces support a many-to-many relation between MMEs / Serving Gateways and eNBs

  However, a UE can only be associated with one Serving Gateway at a given point in time.
- Note that this is a logical change from the UTRAN (3G) architecture, where the NodeB (BS in 2.5G parlance) was connected to the RNC (BSC in 2.5G parlance). The RNC in turn interfaced with the MSCs/SGSNs.
- The MME now handles some of the functions of the RNC, while the rest are pushed to the eNodeB.

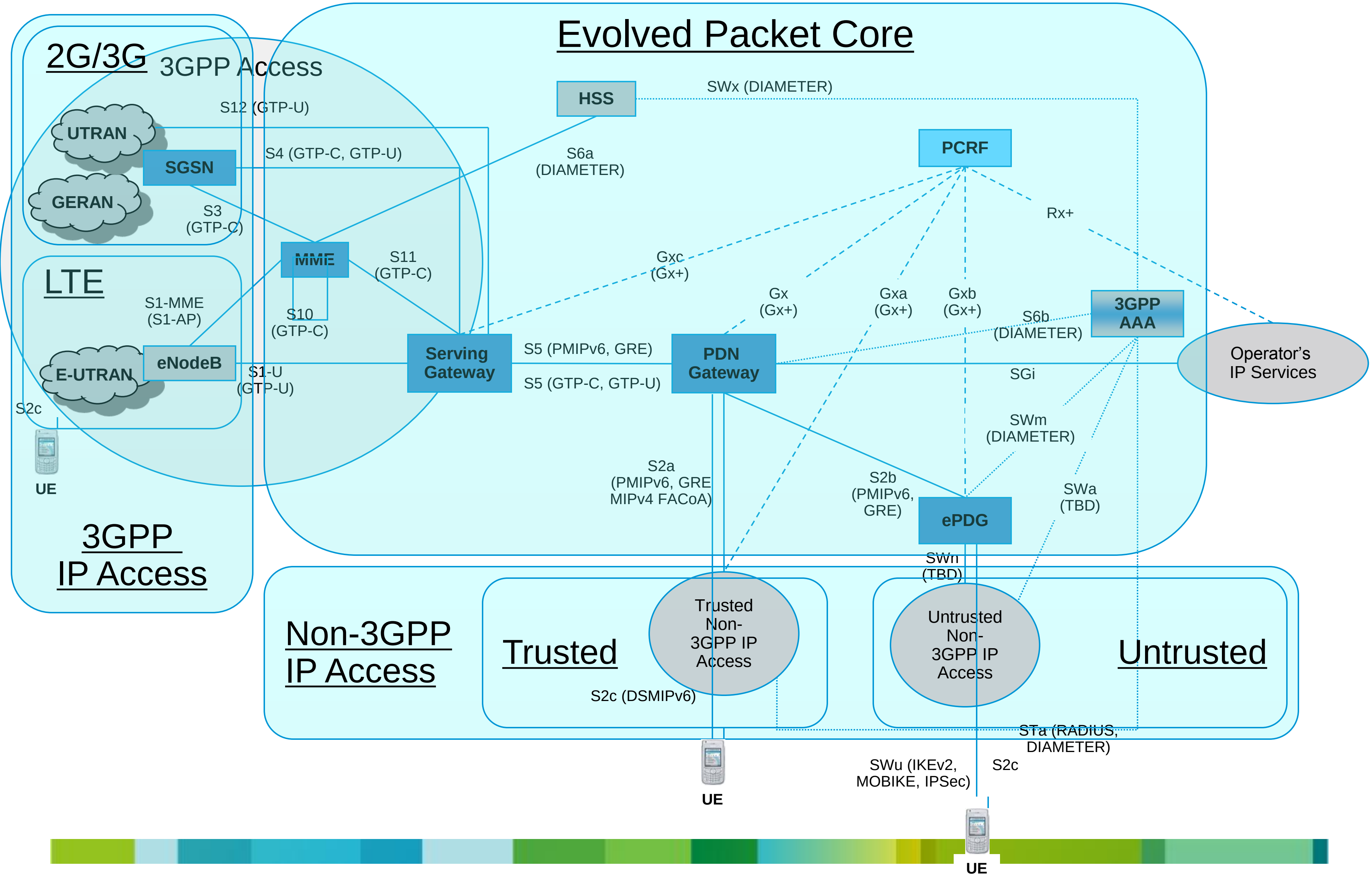




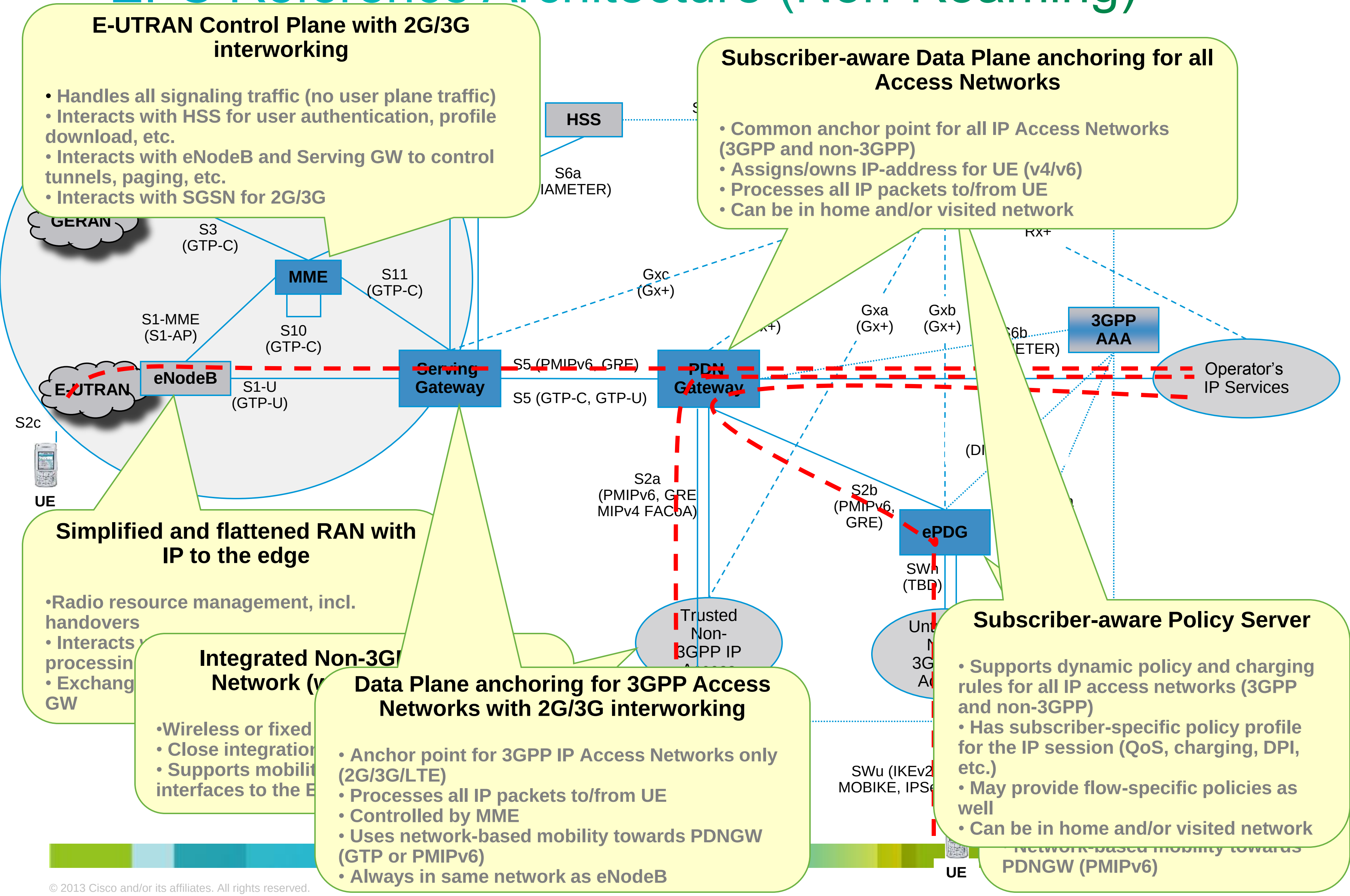
UTRAN architecture

Note: The "Serving Gateway" used to be referred to as the "SAE Gateway"

EPS Reference Architecture



EPS Reference Architecture (Non-Roaming)



Polling Question 3

How familiar are you with EPC ?

a) Theoretical knowledge only
b) I have minimal hands on working with EPC
c) I have expert knowledge pertaining to EPC
d) I work with boxes that communicate with EPC

Submit Your Questions Now!

Use the Q&A panel to submit your questions. Experts will start responding those

Aggregation Service Router (ASR) 5500

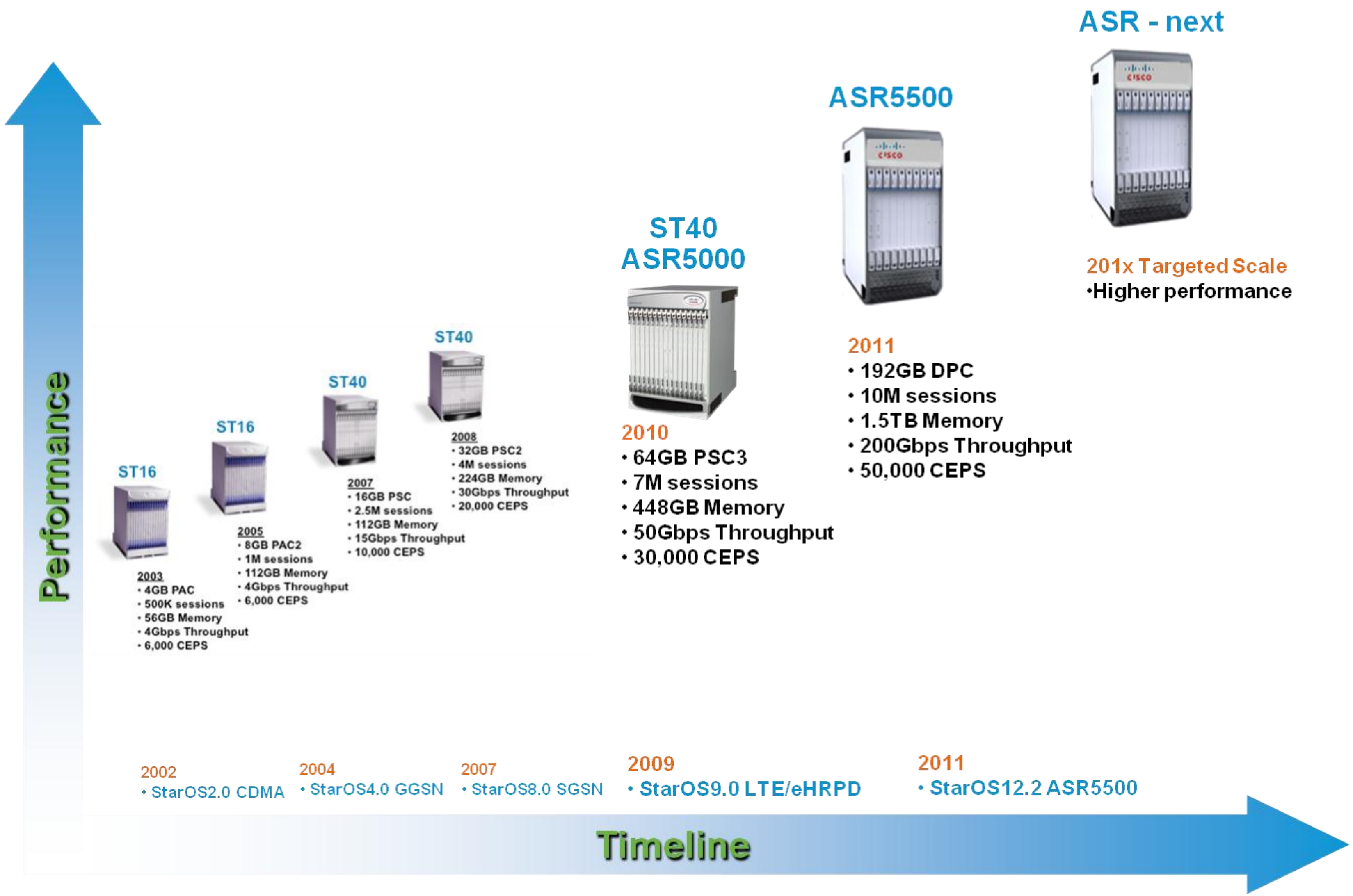
ASR5500 Architecture: Platform Overview

Front View

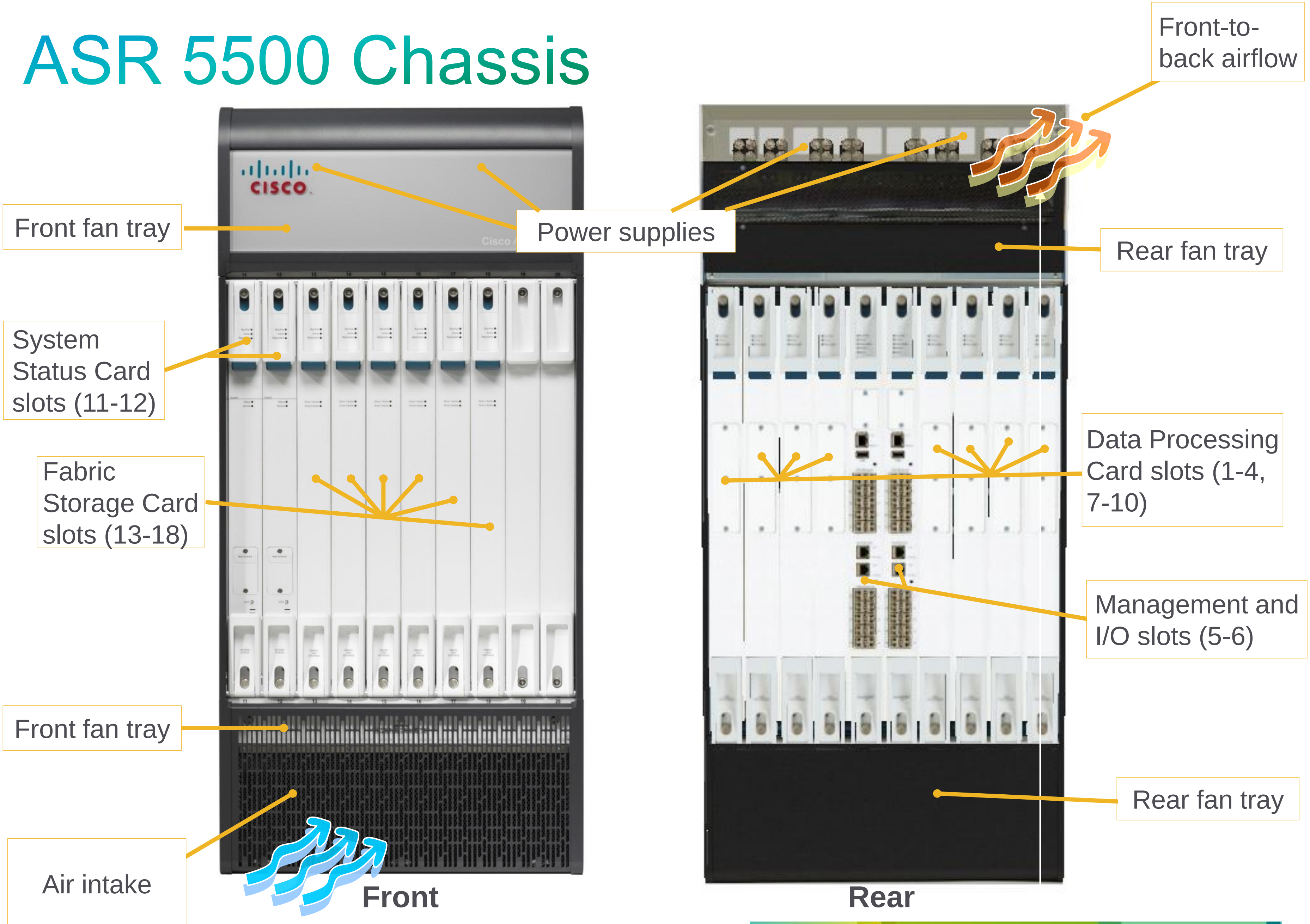
Rear View

- The ASR 5500 is a 21RU, 19" rack-mount mid-plane based chassis.
- Input / Output (I/O) and processing cards located in the rear, with fabric, storage and status cards in the front.
- Two ASR 5500 chassis fit into 42RU of rack space.

MITG Product Evolution
Hardware and Software



ASR 5500 Chassis



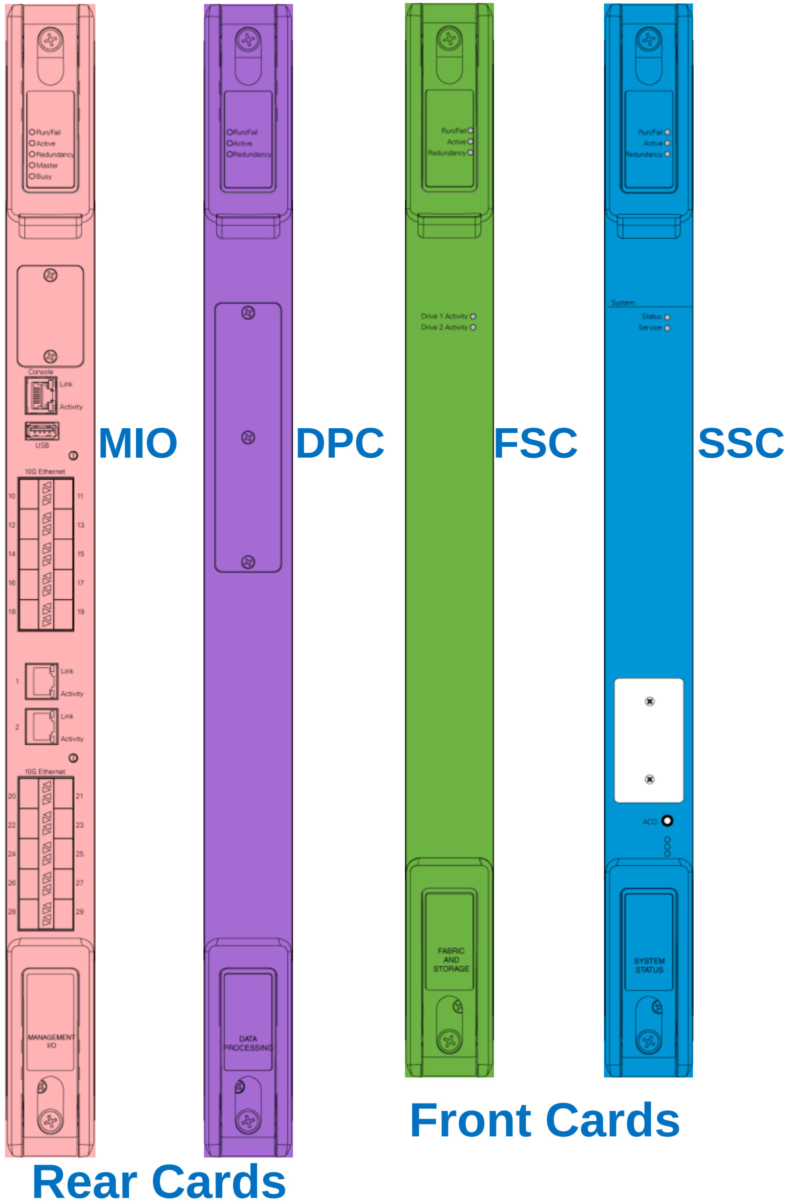
ASR 5500 Hardware - Card Types

Rear Cards (21.75”H x 1.75”W x 19.5”D)

- Management I/O (MIO)
- Data Processing Card (DPC)

Front Cards (19.75”H x1.75”W x 6.75”D)

- Fabric and Storage Card (FSC)
- System Status Card (SSC)



MIO Summary

- Management Input/output Card

1 CPU Subsystem 96 GB of RAM

Management, VPN, Signaling

USB port for an external flash drive

Two 1 GbE ports (used only for local context (OAM))

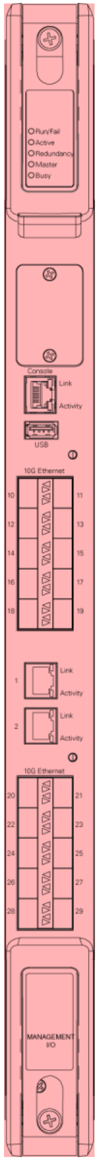
RS-232 serial console for CLI management

4 x NPU I/O Subsystems

Mid-plane connections for chassis control operations

Total of ~200Gb/s FDX Line-Card I/O

I/O options hosted on 2 factory populated daughter cards



MIO

DPC Summary

- A Data Processing Card has:

2 identical CPU subsystems each with:

96 GB RAM (total 192 GB RAM per DPC)

Hardware encryption engine on a daughter card

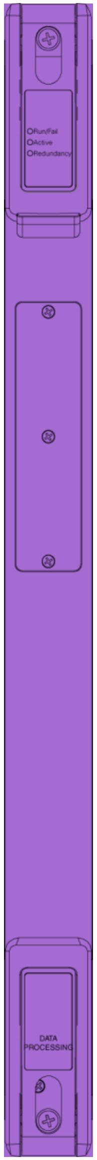
NPU Subsystem for session data offload

75 Gbps data path to fabric

60 Gbps TM (for subscriber traffic)

Common subset of mid-plane connectors on the MIO allowing it to plug into the same slots as the MIO cards

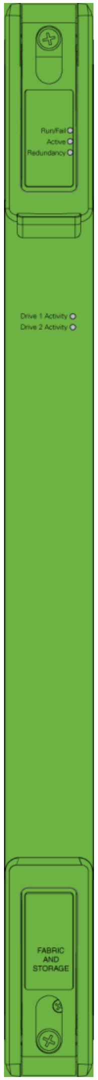
Manages subscriber sessions and control traffic



DPC

FSC Summary

- Fabric Storage Card (FSC)
  - 4 FSC cards
    - 3+1 configuration supported - 4 FSCs are required for redundancy but the system can operate with 3 FSCs in the presence of a failed FSC
  - 1.2 Tbps FDX crossbar fabric per FSC, 4.8 Tbps FDX total
  - Solid State Drives (SSDs) used for short-term persistent storage
  - 2 x 2.5” serial attached SCSI (SAS) HD/SSD, RAID 5
    - 8 drives per system (using 4 FSC cards)
    - 2 x 200 GB SSD per FSC (or 1.2 TB total system capacity
    - ((4-1)*400 GB = 1.2 TB)
  - Each FSC card adds to the available fabric bandwidth to each card.
  - Each FSC connects to both MIOs and DPCs

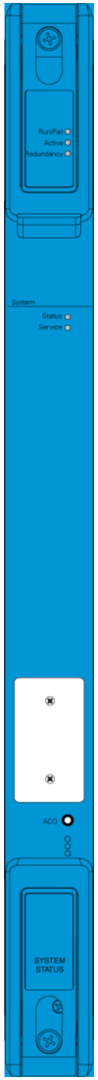


FSC

SSC Summary

System Status Card (SSC)

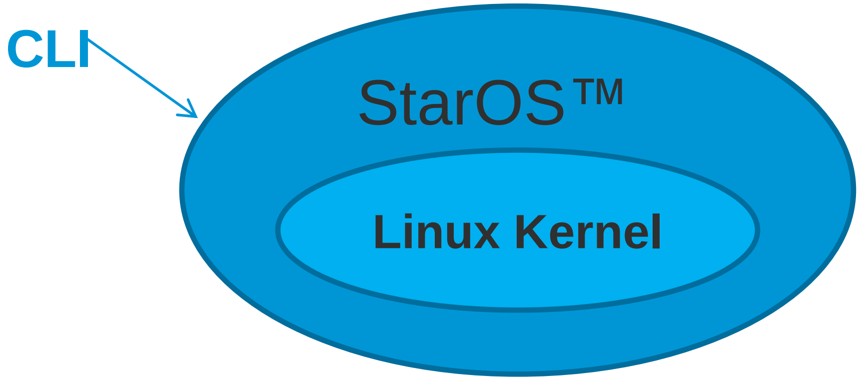
- 2 per system (Active – Active) (minimum 1 SSC to be functional)
- Monitoring
- Temperature, airflow, current (all cards have this ability)
- System Power
- Monitors Power Filter Unit A1-4 and B1-4 feeds
- Also monitors the (-48 V) voltage level
- Audible Alarms – Cutoff (Panel or Remote)
- System Status LEDs – Major, Minor, Critical, Alarm Relays



SSC

ASR 5500 Operating System

- Operating system contained in one binary image
- Based on a Linux kernel
- Surrounding the kernel is the Operating System (StarOS™)
- Command Line Interface (CLI) via telnet/SSH or a serial Console port to StarOS™

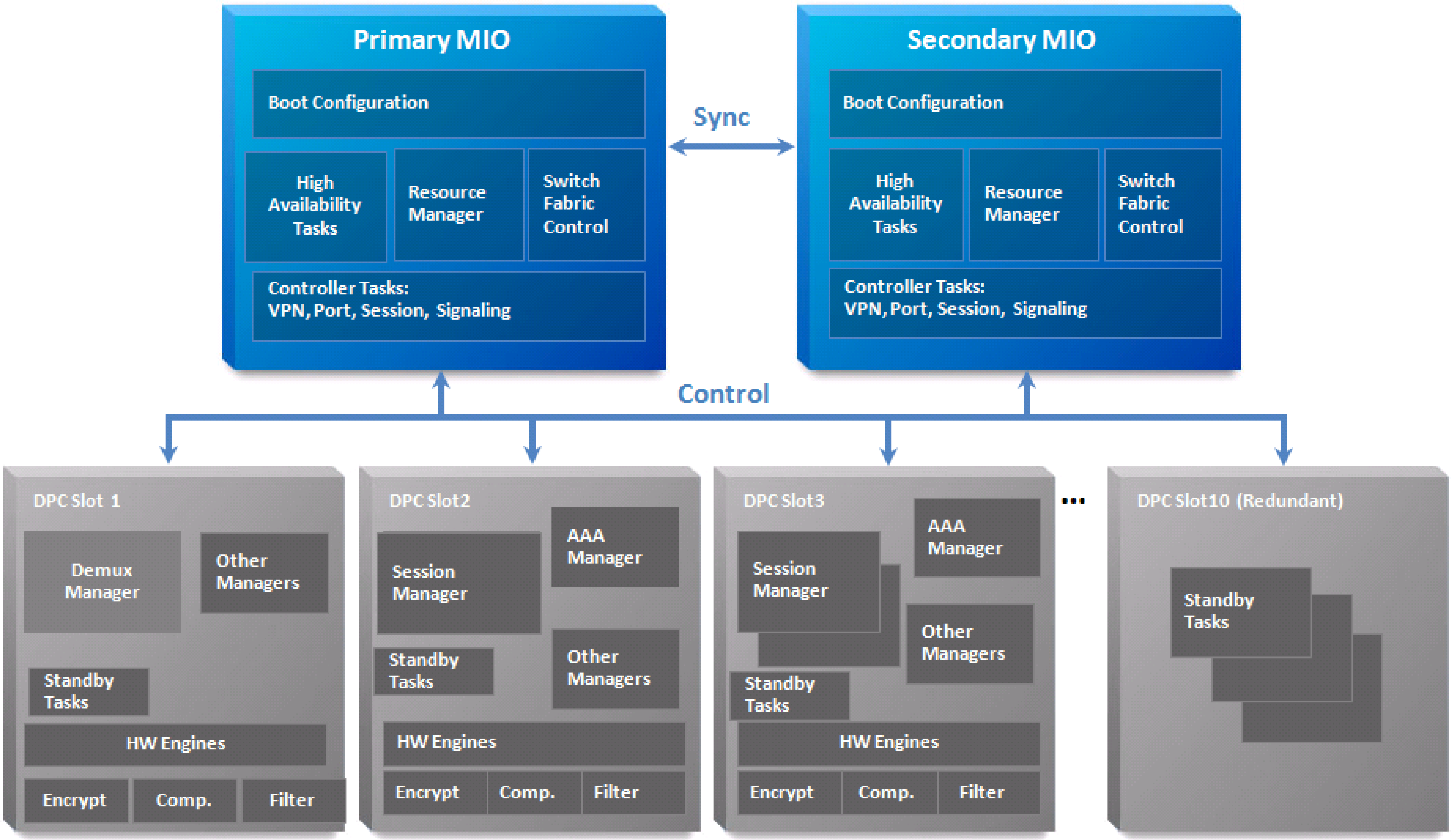


ASR 5500 Operating System

- The ASR 5500 is a model of distributed processing
- All of the control processors (CPs) run the same binary image
- Sharing the same image across multiple CPs is complex, involving the distribution and synchronization of multiple software functions
- Software architecture is designed for redundancy
- Introduced well over a decade ago, field proven architecture

ASR 5500 Software Architecure

Designed for Redundancy



Software Architecture Overview

- Redundancy, scalability and robust call processing
- Tasks communicate with each other as needed to share control and data signals
- Distributed processing across multiple tasks
- Distribution of the tasks is invisible to the user
- Distributed design provides fault containment via check-pointing of processes
- The self-healing attributes of the software architecture protects the user's data sessions while ensuring complete accounting data integrity

Software Architecture Overview (contd.)

- Supports dynamic hardware removal/additions

  By migrating tasks from one card to another via software controls, application cards can be "hot swapped" to dynamically add capacity and perform maintenance operations without service interruption.

- Multiple context support

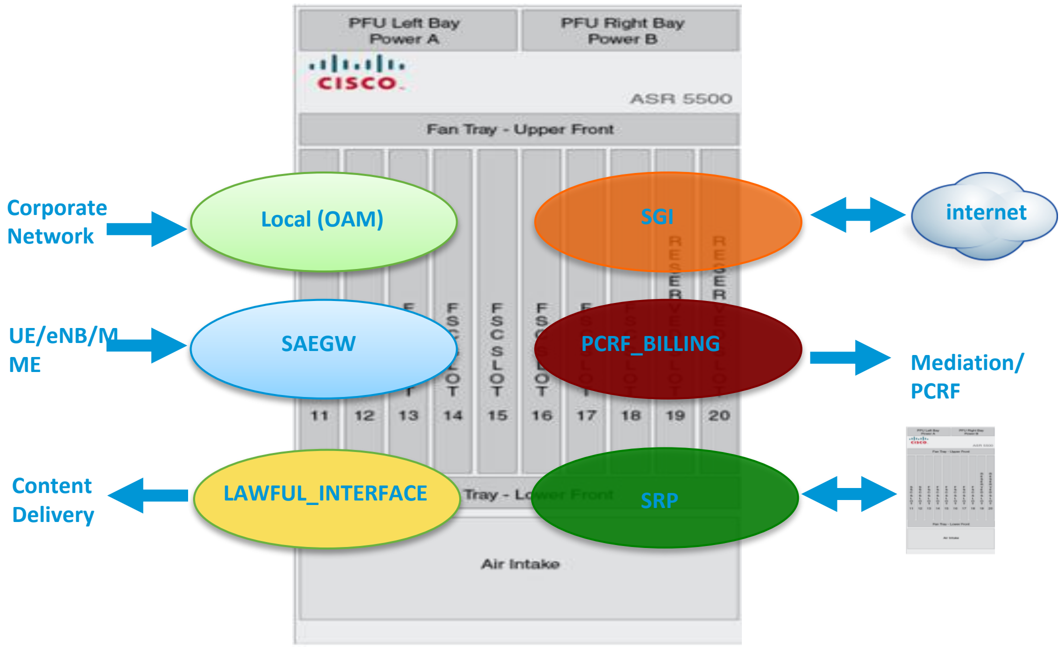
  The system can be fully virtualized to support multiple logical instances of each service. This eliminates the possibility of any one domain disrupting operations for all users in the event of a failure. Further, multiple context support allows operators to assign duplicate/overlapping IP address ranges in different contexts.

- Leverages third party software components:

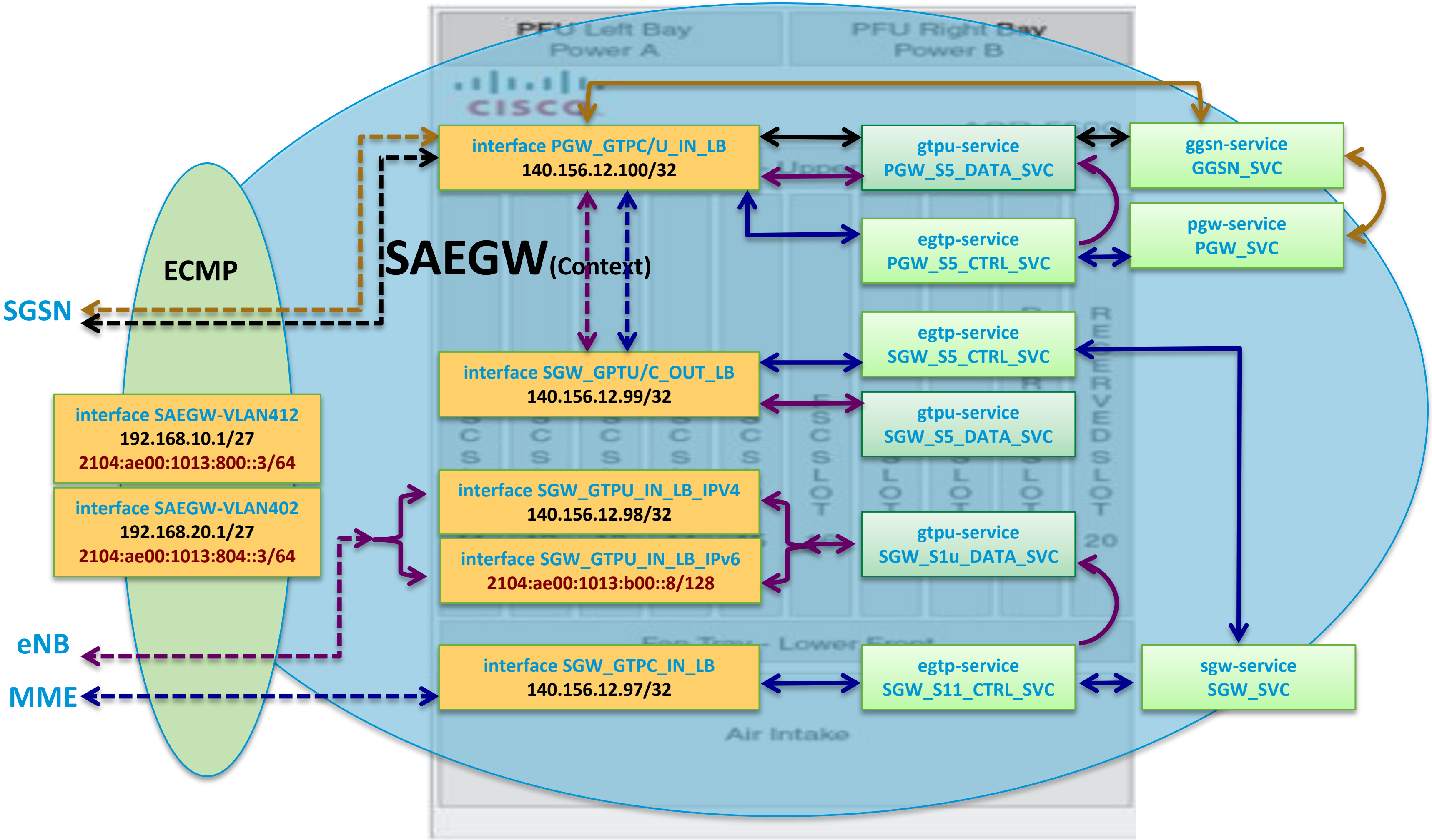
  The use of the Linux operating system kernel enables reuse of many well-tested, stable, core software elements such as protocol stacks, management services, and application programs.

How does it work?

- A context is a logical grouping or mapping of configuration parameters that pertain to various physical ports, logical IP interfaces, and services. A context can be thought of as a virtual private network (VPN).
- Sample Contexts



Services (cont.)



Services

- Services are configured to enable certain functionality. Following are the services configured under SAEGW context.
  - Gateway GPRS Support Node (GGSN) services
  - Serving Gateway (S-GW) Services
  - PDN Gateway (P-GW) Services
    - CLI example from the configuration:

```
ggsn-service GGSN_SVC
  retransmission-timeout 3
  max-retransmission 3
  no echo-interval
  no gtpc ran-procedure-ready-delay
  plmn unlisted-sgsn home
  associate gtpu-service PGW_S5_DATA_SVC
  associate pgw-service PGW_SVC
  bind address 140.156.12.100
exit
pgw-service PGW_SVC
  associate qci-qos-mapping QCI_DSCP_MAP
  associate ggsn-service GGSN_SVC
  associate egtp-service PGW_S5_CTRL_SVC
```

Services (cont.)

```
sgw-service SGW_SVC
  accounting context PCRF_BILLING gtpp group CGF1
  associate ingress egtp-service SGW_S11_CTRL_SVC
  associate egress-proto gtp egress-context SAEGW egtp-service SGW_S5_CTRL_SVC
  associate accounting-policy SGW_CDR_profile
  associate qci-qos-mapping QCI_DSCP_MAP
  no reporting-action event-record
gtpu-service PGW_S5_DATA_SVC
  bind ipv4-address 140.156.12.100
exit
gtpu-service SGW_S1u_DATA_SVC
  bind ipv4-address 140.156.12.98 ipv6-address 2104:ae00:1013:b00:8/128
exit
gtpu-service SGW_S5_DATA_SVC
  bind ipv4-address 140.156.12.99
exit
```

Services (cont.)

```
egtp-service PGW_S5_CTRL_SVC
  no gtpc echo-interval
  gtpc max-retransmissions 3
  gtpc retransmission-timeout 2
  interface-type interface-pgw-ingress
  associate gtpu-service PGW_S5_DATA_SVC
  gtpc bind ipv4-address 140.156.12.100
exit
egtp-service SGW_S11_CTRL_SVC
  no gtpc echo-interval
  gtpc max-retransmissions 2
  gtpc retransmission-timeout 3
  interface-type interface-sgw-ingress
  associate gtpu-service SGW_S1u_DATA_SVC
  gtpc bind ipv4-address 140.156.12.98
exit
egtp-service SGW_S5_CTRL_SVC
  no gtpc echo-interval
  gtpc max-retransmissions 3
  gtpc retransmission-timeout 2
  interface-type interface-sgw-egress
  associate gtpu-service SGW_S5_DATA_SVC
```

IP pools

- A subscriber gets assigned an IP address out of "available" IP address(es) in the pool. IP addresses can be dynamically or statically assigned from a single pool or a group of IP pools.
  - CLI example from the configuration:

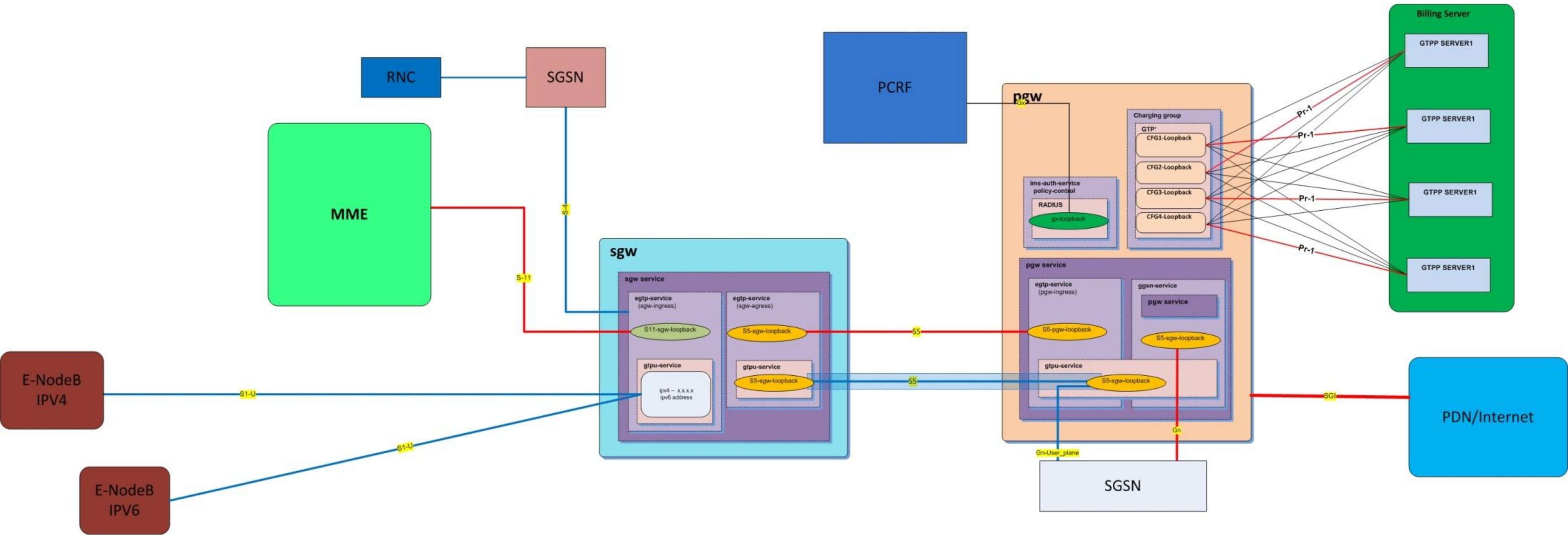
```
context SGI-VLAN103_VLAN213
  ip pool cisco-static 10.0.0.0 255.255.255.0 static srp-activate group-
  name cisco-1

  ip pool cisco-private 10.10.10.1 255.255.255.248 private 0 srp-activate
  group-name cisco-2 vrf cisco
```

APNs

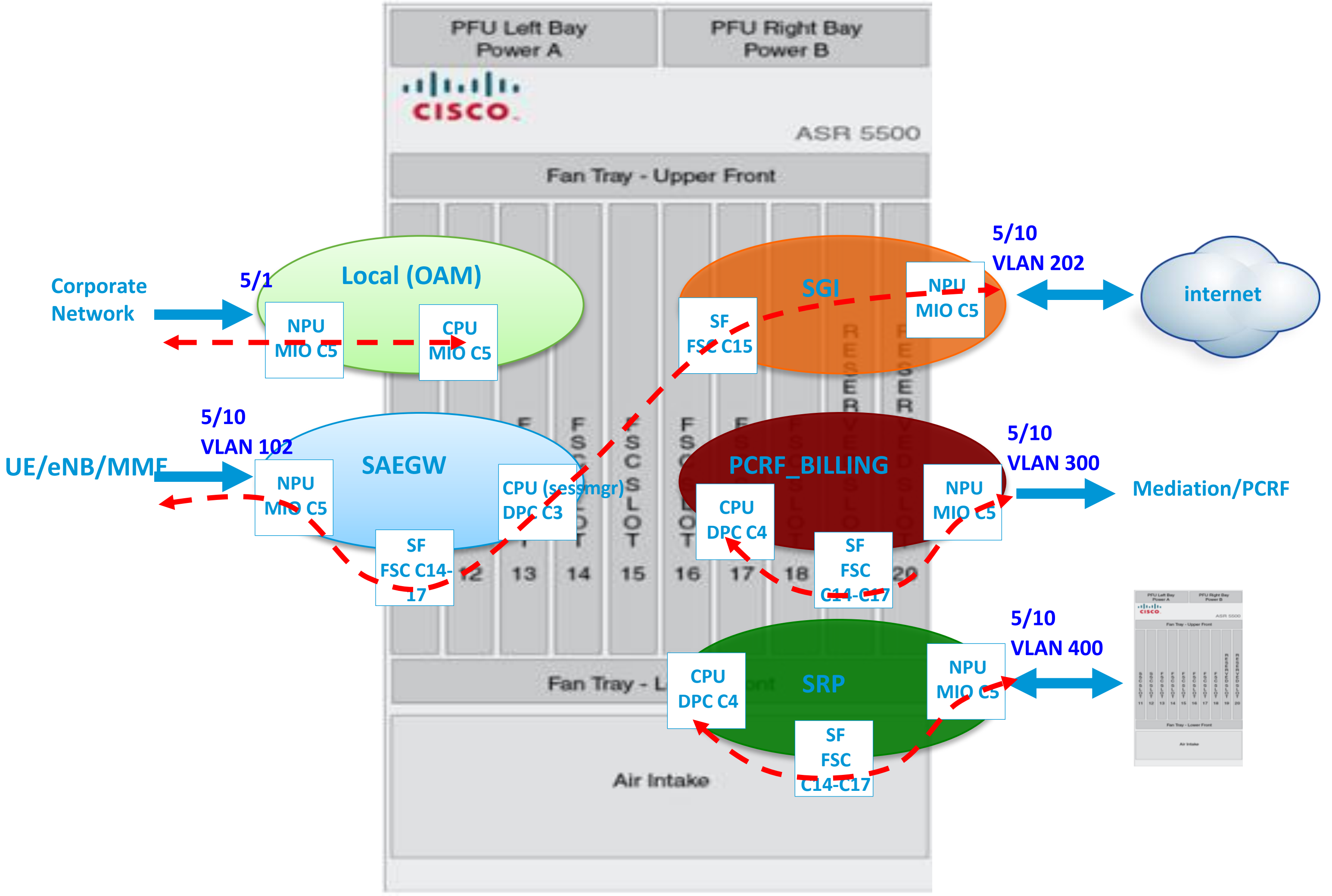
- Access point Names (APN) dictates how subscriber authentication and IP address assignment is to be handled for that APN.
  - APNs from the configuration:
    - CLI example from the configuration:

```
context SGI-VLAN103_VLAN213
     apn cisco-static
        bearer-control-mode mixed
        selection-mode subscribed sent-by-ms chosen-by-sgsn
        accounting-mode none
        gtpp group CGF1 accounting-context PCRF_BILLING
        idle-timeout-activity ignore-downlink
        dns primary 192.168.10.1
        dns secondary 192.168.10.2
        timeout idle 14400
        ip access-group ECS_ACL in
        ip access-group ECS_ACL out
        ip context-name SGI-VLAN103_VLAN213
       ip address pool name cisco-1
       active-charging rulebase RB_01
```

1 box with multiple services

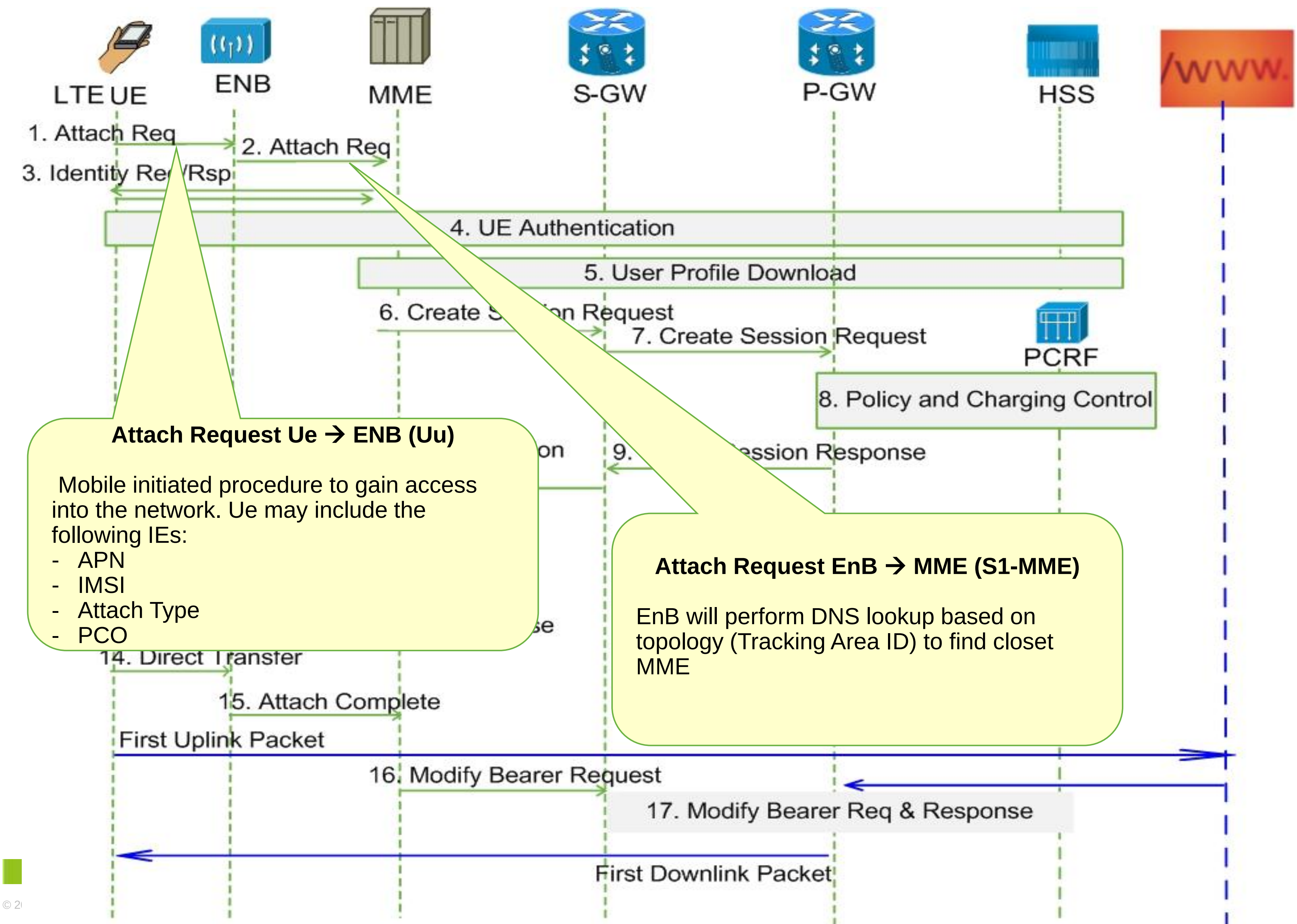


Configuration Call Flow

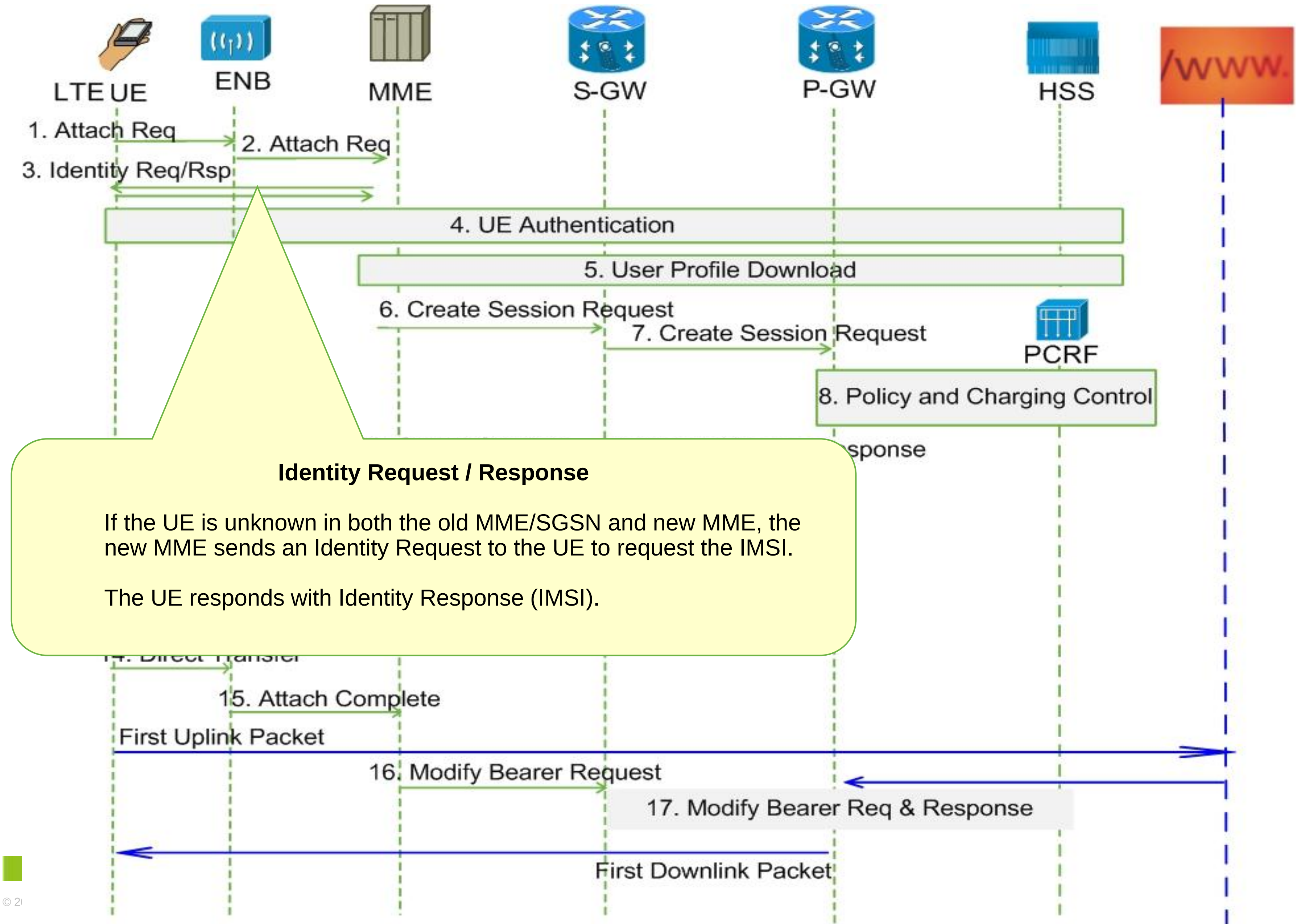


LTE Call Flow

LTE Call Flow



LTE Call Flow

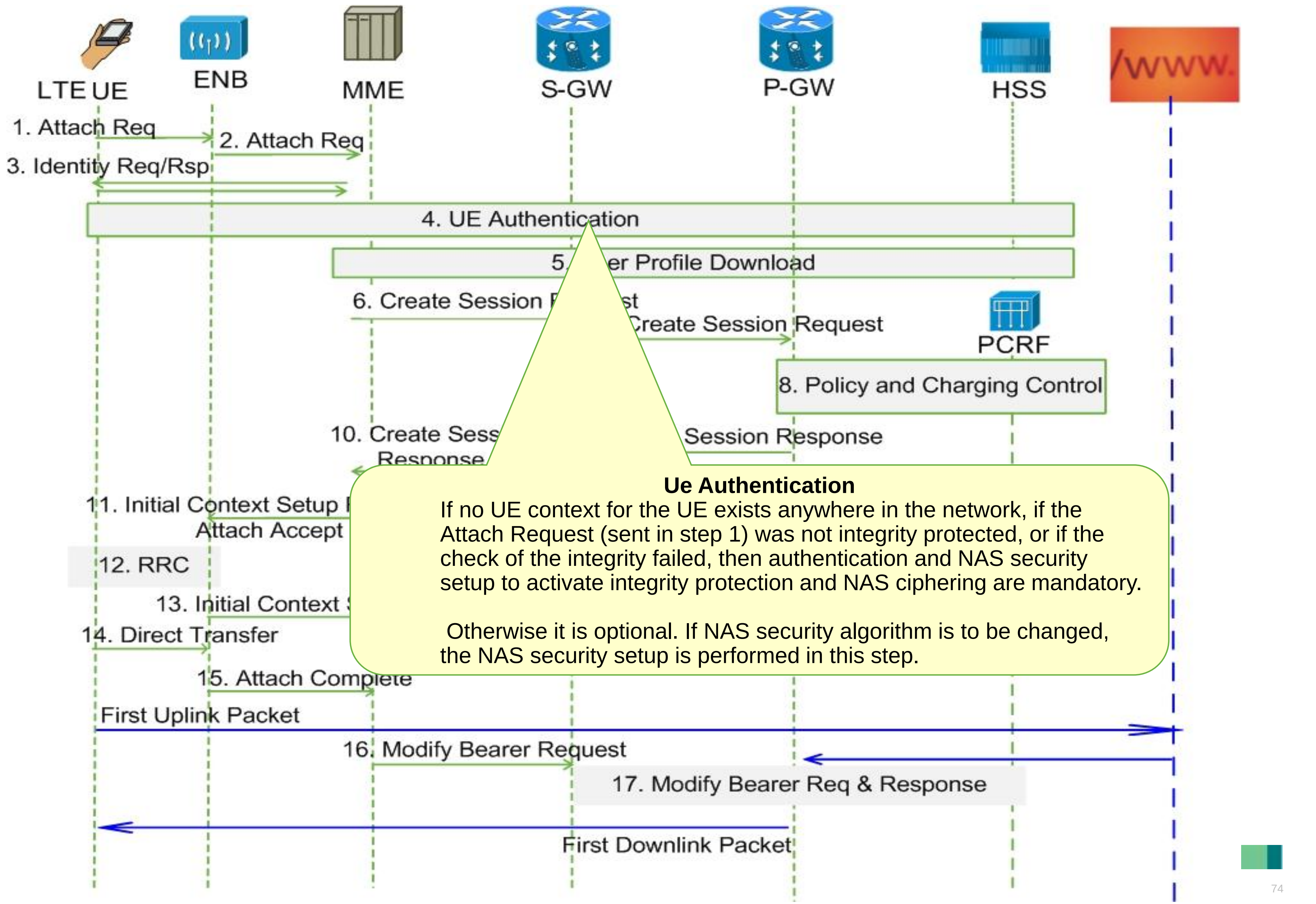


Identity Request / Response

If the UE is unknown in both the old MME/SGSN and new MME, the new MME sends an Identity Request to the UE to request the IMSI.

The UE responds with Identity Response (IMSI).

LTE Call Flow

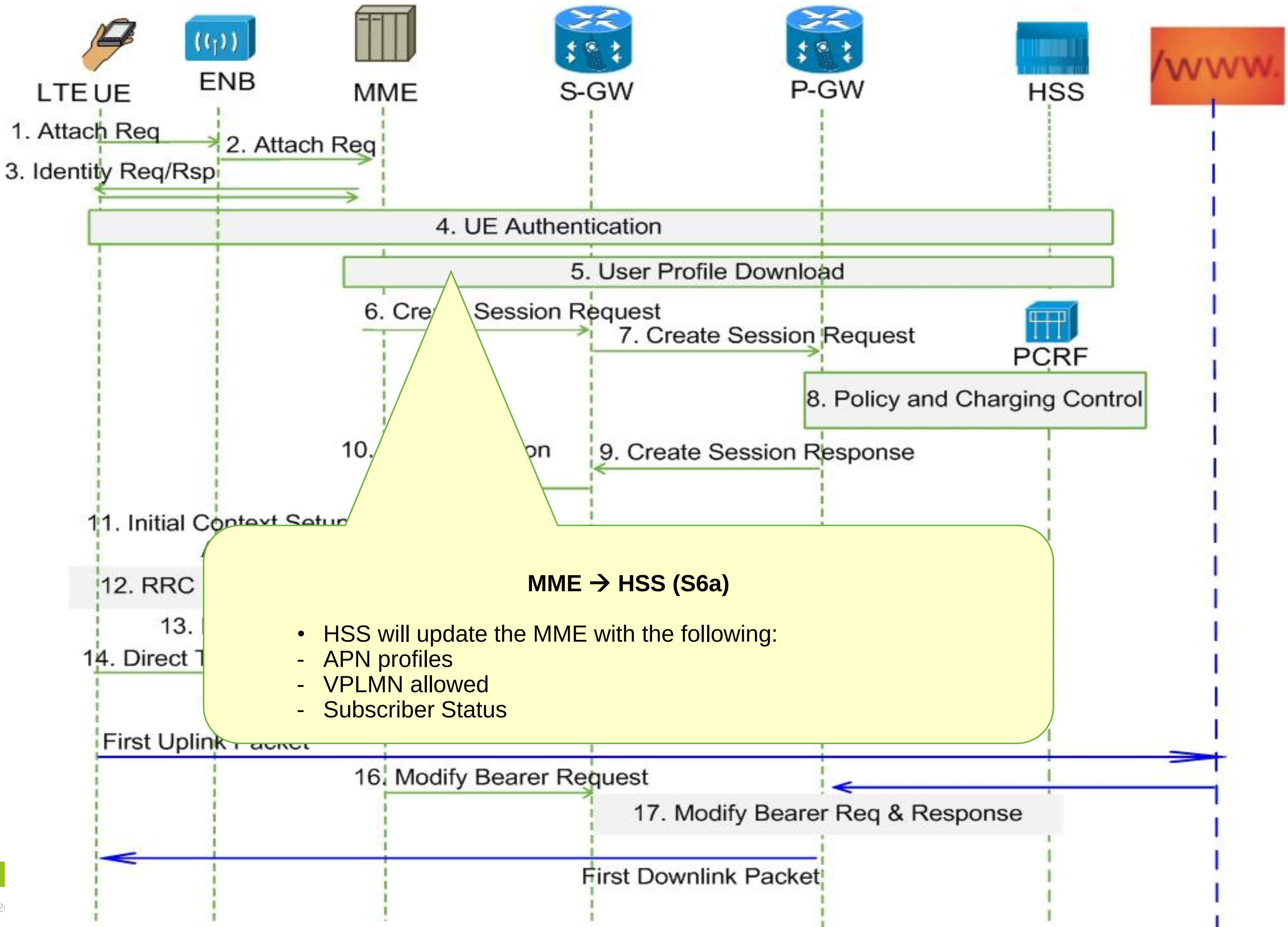


Ue Authentication

If no UE context for the UE exists anywhere in the network, if the Attach Request (sent in step 1) was not integrity protected, or if the check of the integrity failed, then authentication and NAS security setup to activate integrity protection and NAS ciphering are mandatory.

Otherwise it is optional. If NAS security algorithm is to be changed, the NAS security setup is performed in this step.

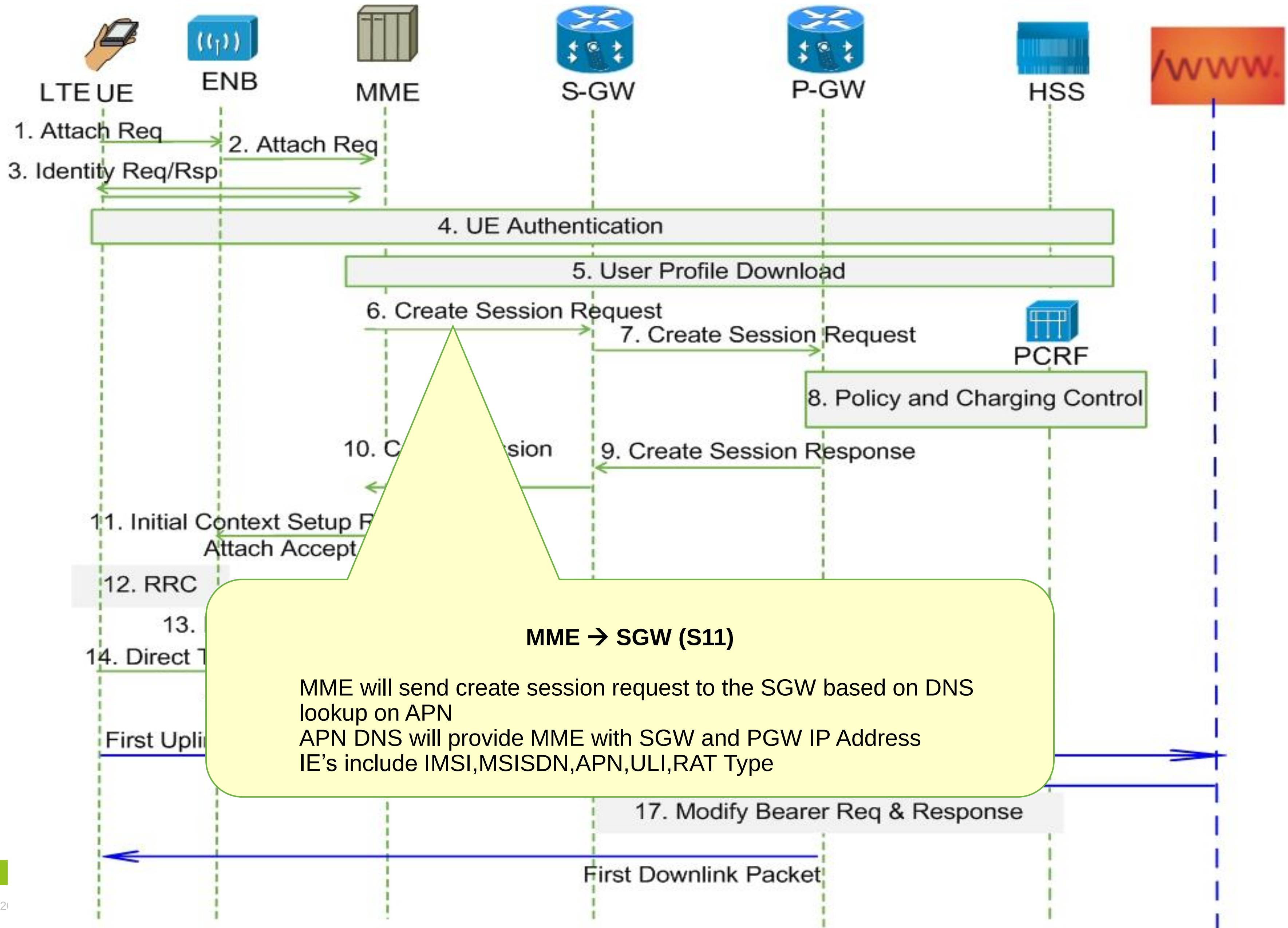
LTE Call Flow



MME → HSS (S6a)

- HSS will update the MME with the following:
- APN profiles
- VPLMN allowed
- Subscriber Status

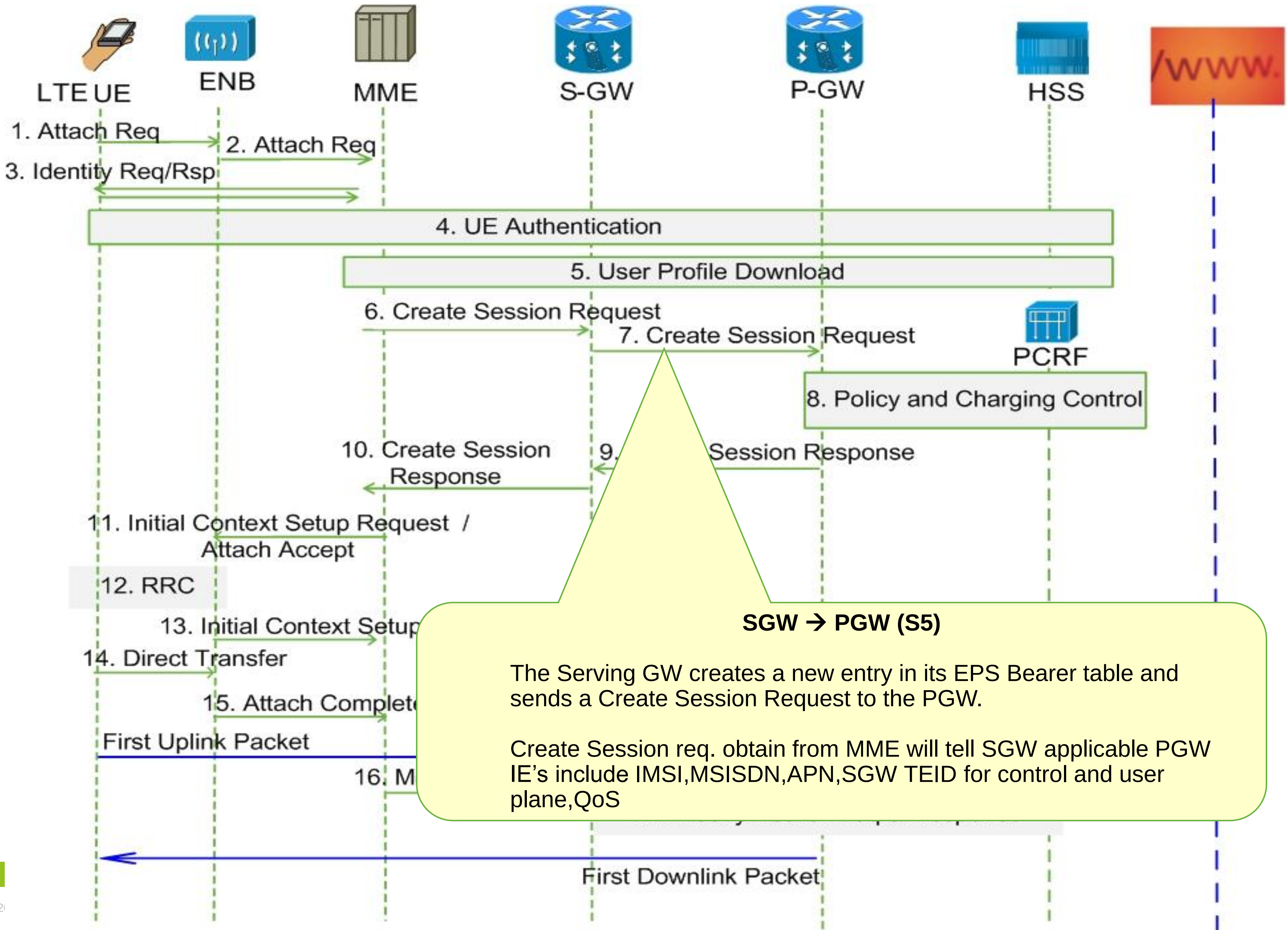
LTE Call Flow



MME → SGW (S11)

MME will send create session request to the SGW based on DNS lookup on APN
APN DNS will provide MME with SGW and PGW IP Address
IE's include IMSI,MSISDN,APN,ULI,RAT Type

LTE Call Flow

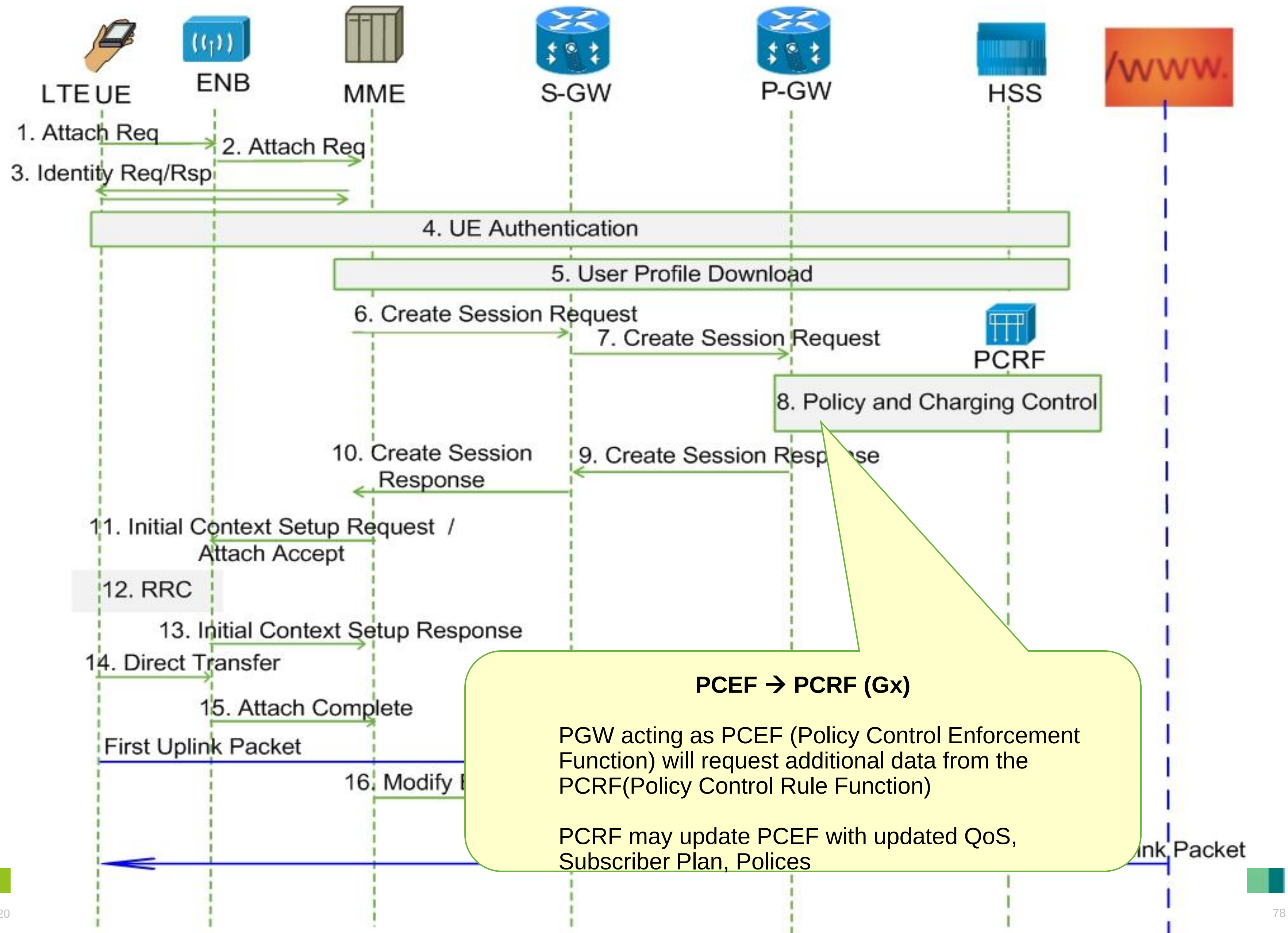


SGW → PGW (S5)

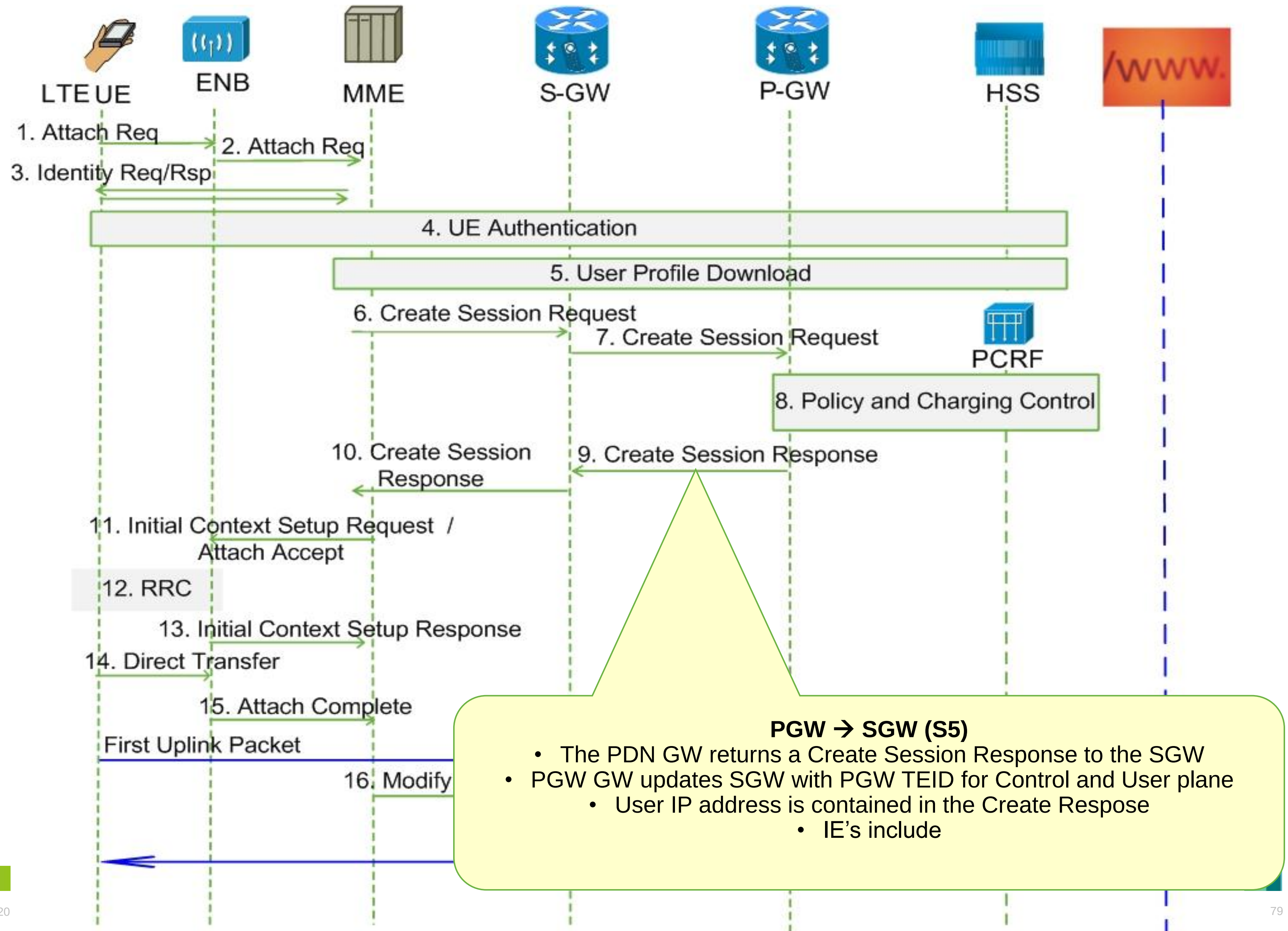
The Serving GW creates a new entry in its EPS Bearer table and sends a Create Session Request to the PGW.

Create Session req. obtain from MME will tell SGW applicable PGW IE's include IMSI,MSISDN,APN,SGW TEID for control and user plane,QoS

LTE Call Flow



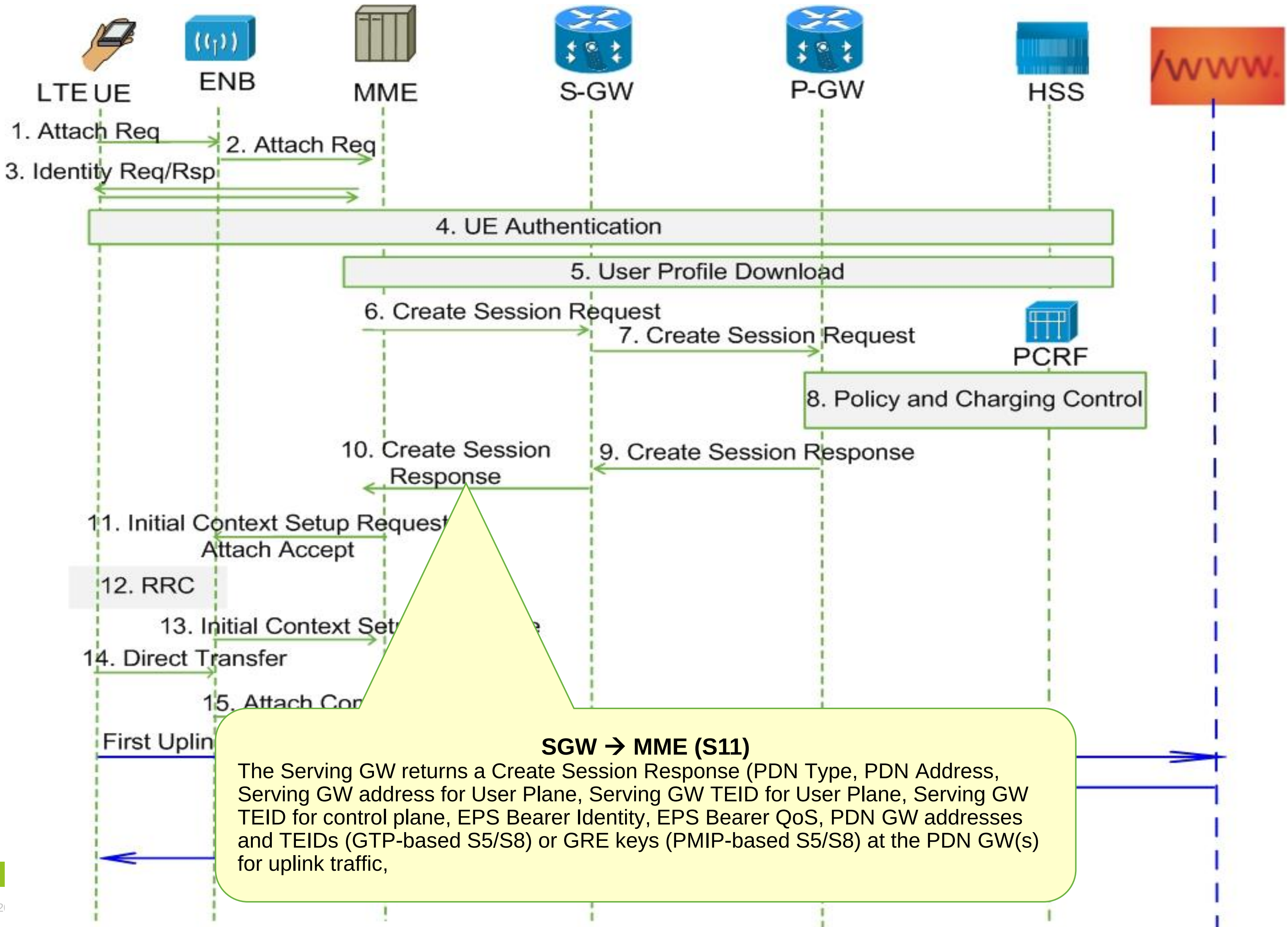
LTE Call Flow



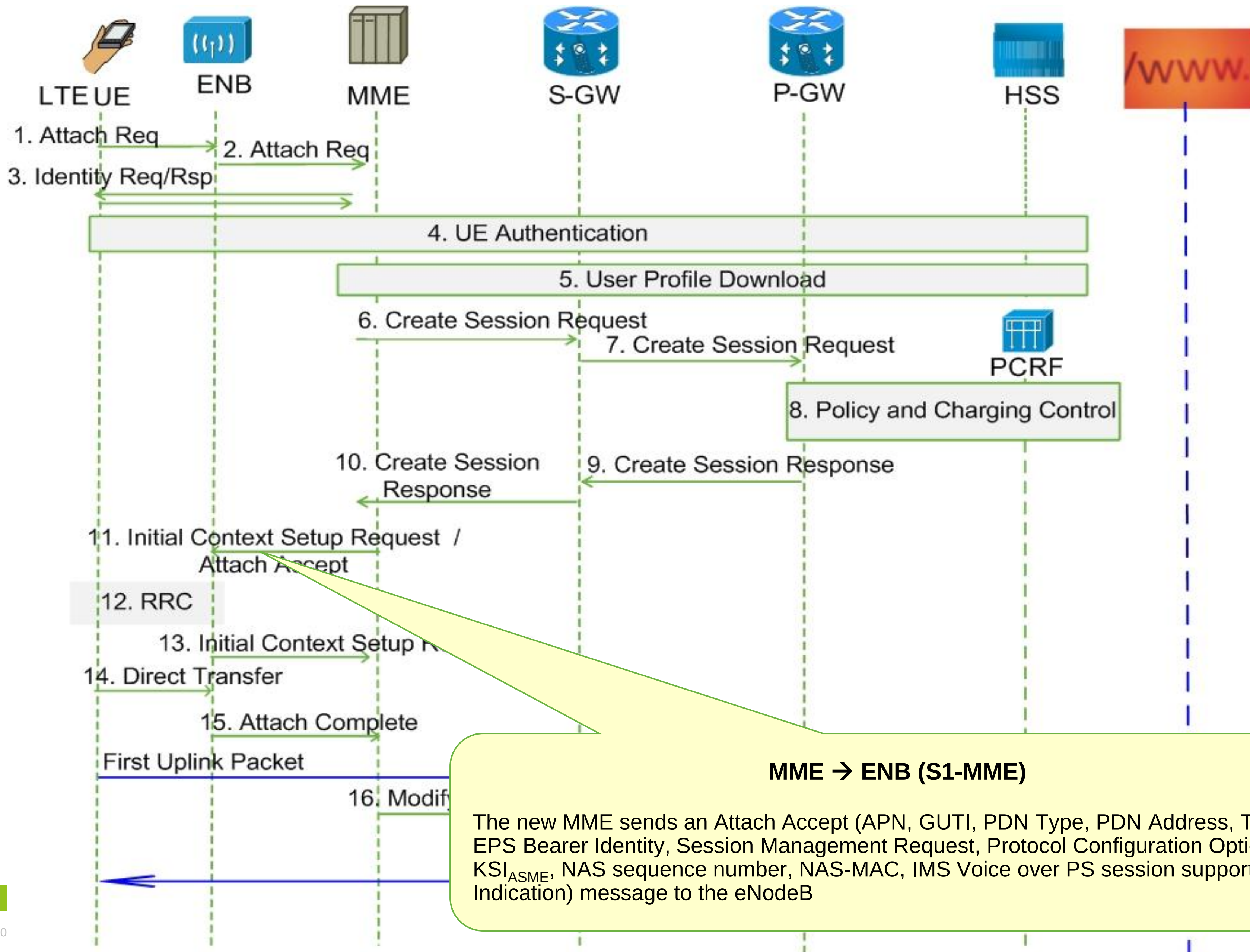
PGW → SGW (S5)

- The PDN GW returns a Create Session Response to the SGW
- PGW GW updates SGW with PGW TEID for Control and User plane
  - User IP address is contained in the Create Respose
    - IE's include

LTE Call Flow



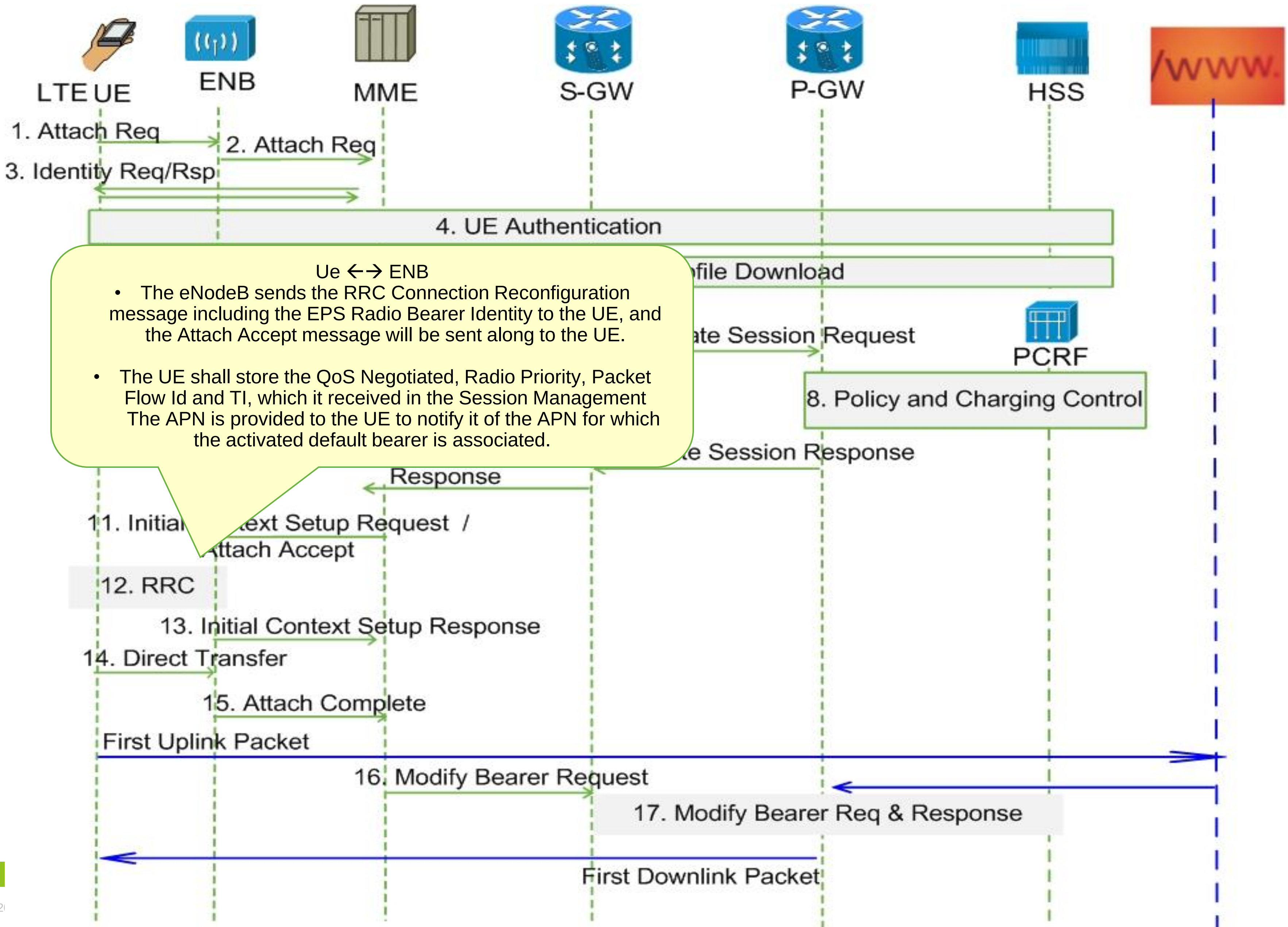
LTE Call Flow



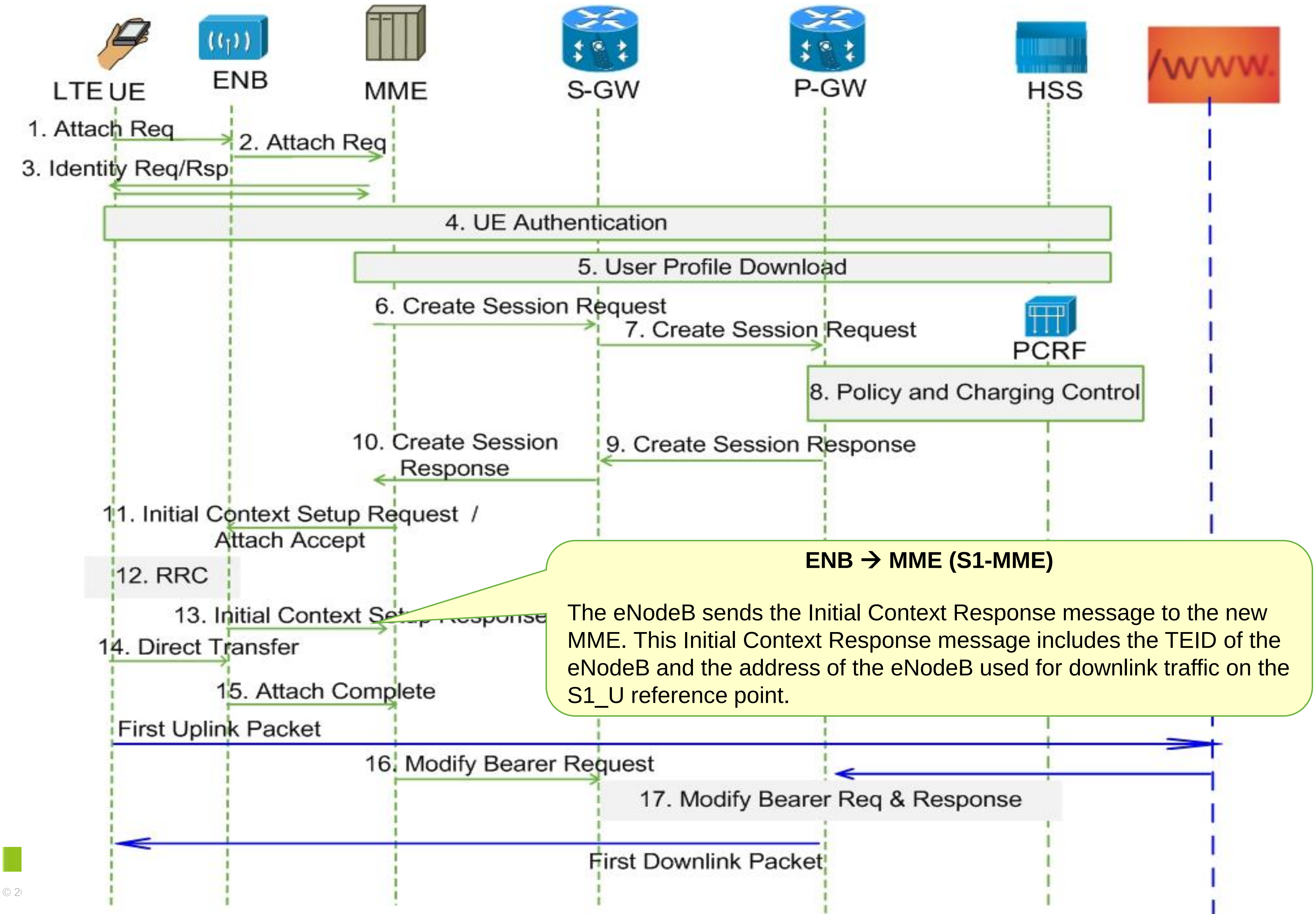
MME → ENB (S1-MME)

The new MME sends an Attach Accept (APN, GUTI, PDN Type, PDN Address, TAI List, EPS Bearer Identity, Session Management Request, Protocol Configuration Options, KSI_{ASME}, NAS sequence number, NAS-MAC, IMS Voice over PS session supported Indication) message to the eNodeB

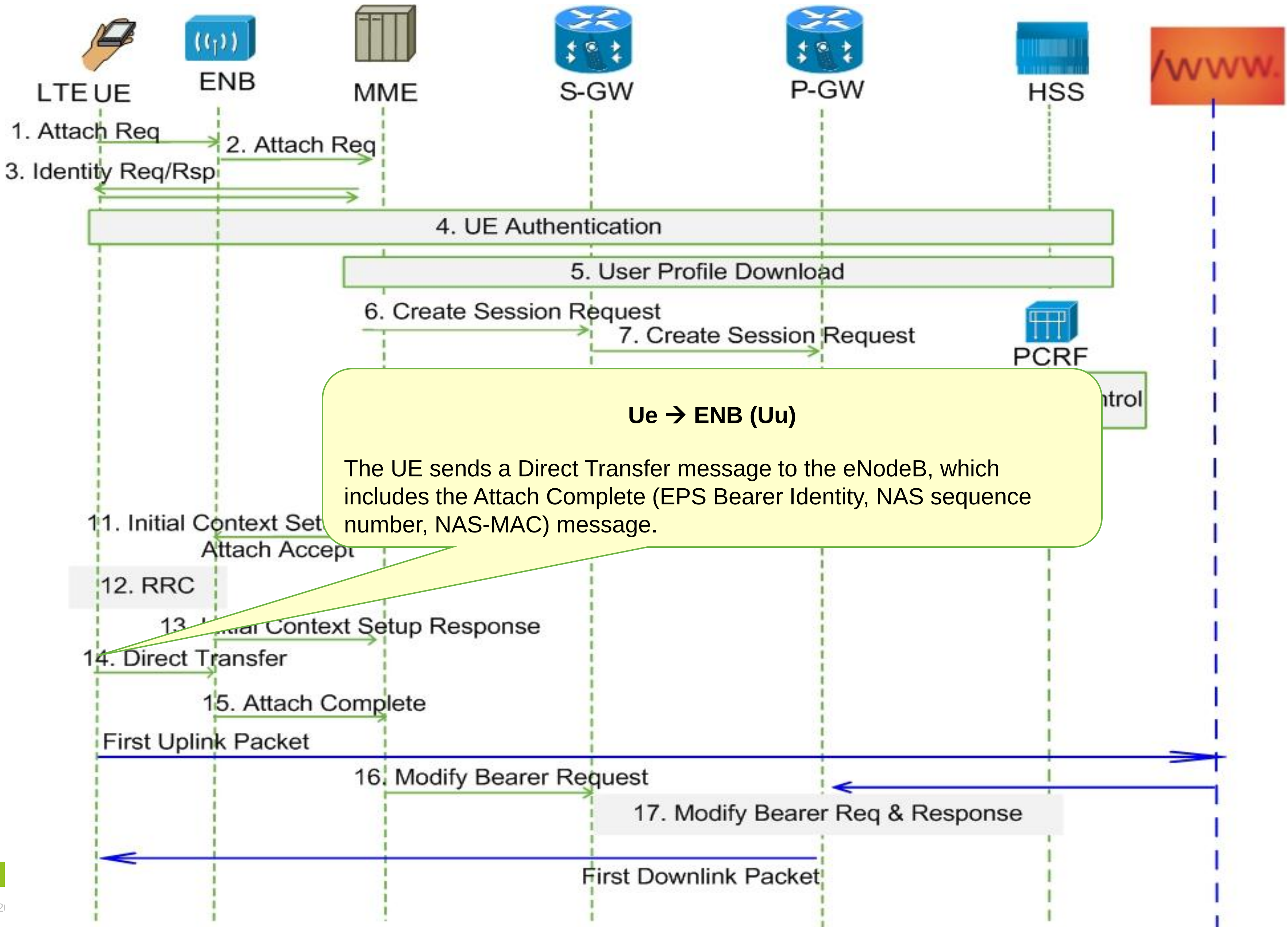
LTE Call Flow



LTE Call Flow



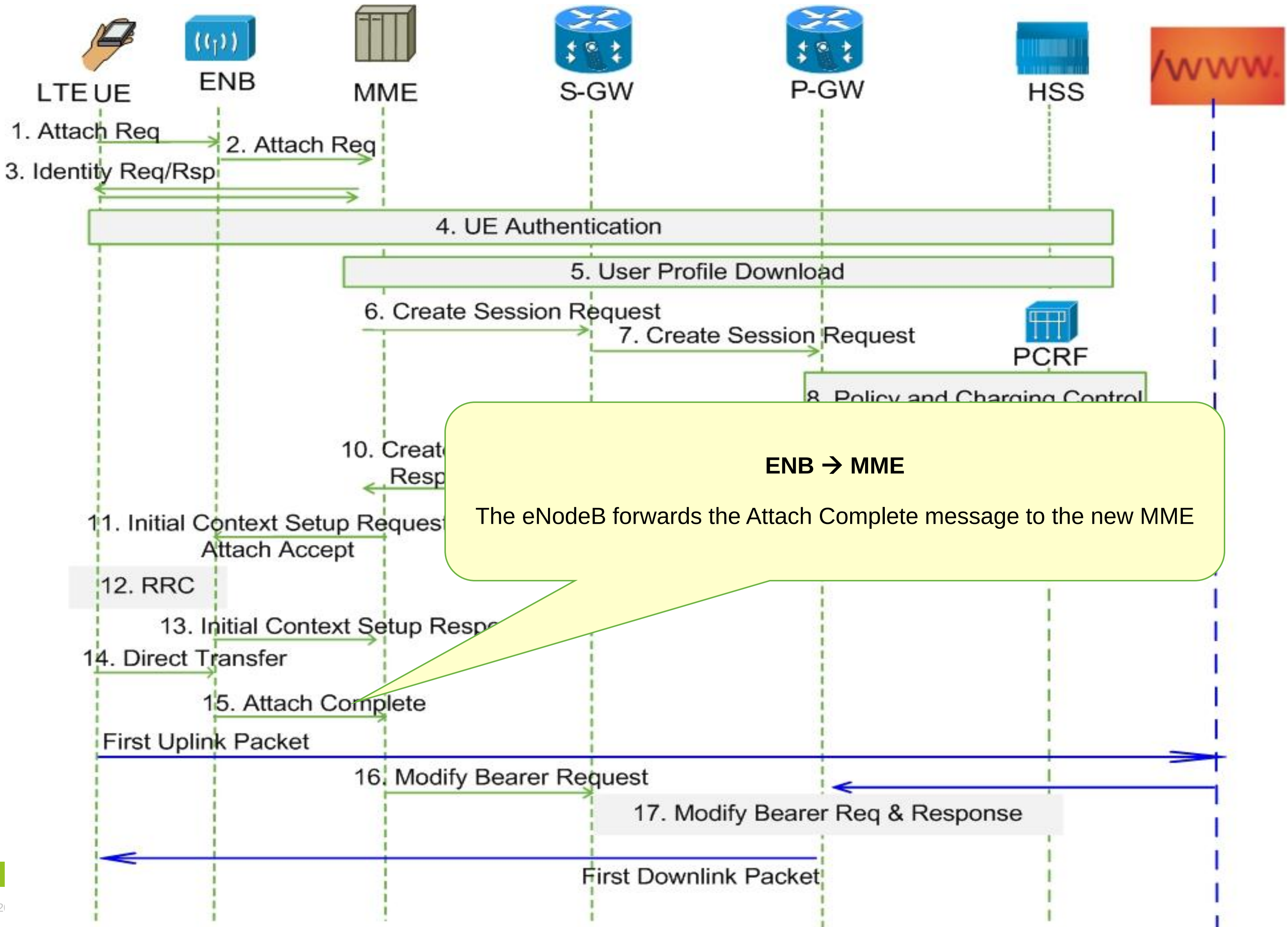
LTE Call Flow



Ue → ENB (Uu)

The UE sends a Direct Transfer message to the eNodeB, which includes the Attach Complete (EPS Bearer Identity, NAS sequence number, NAS-MAC) message.

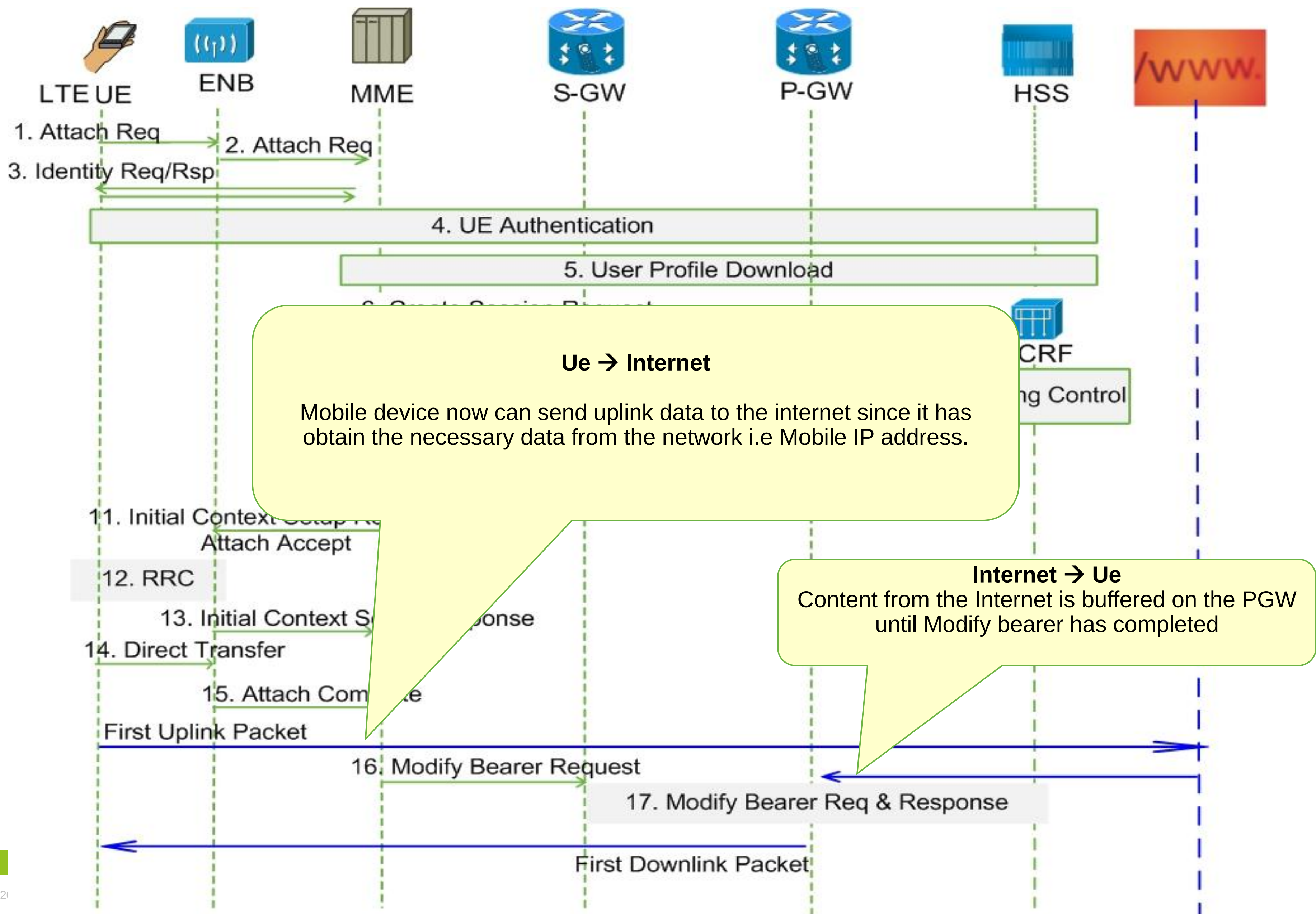
LTE Call Flow



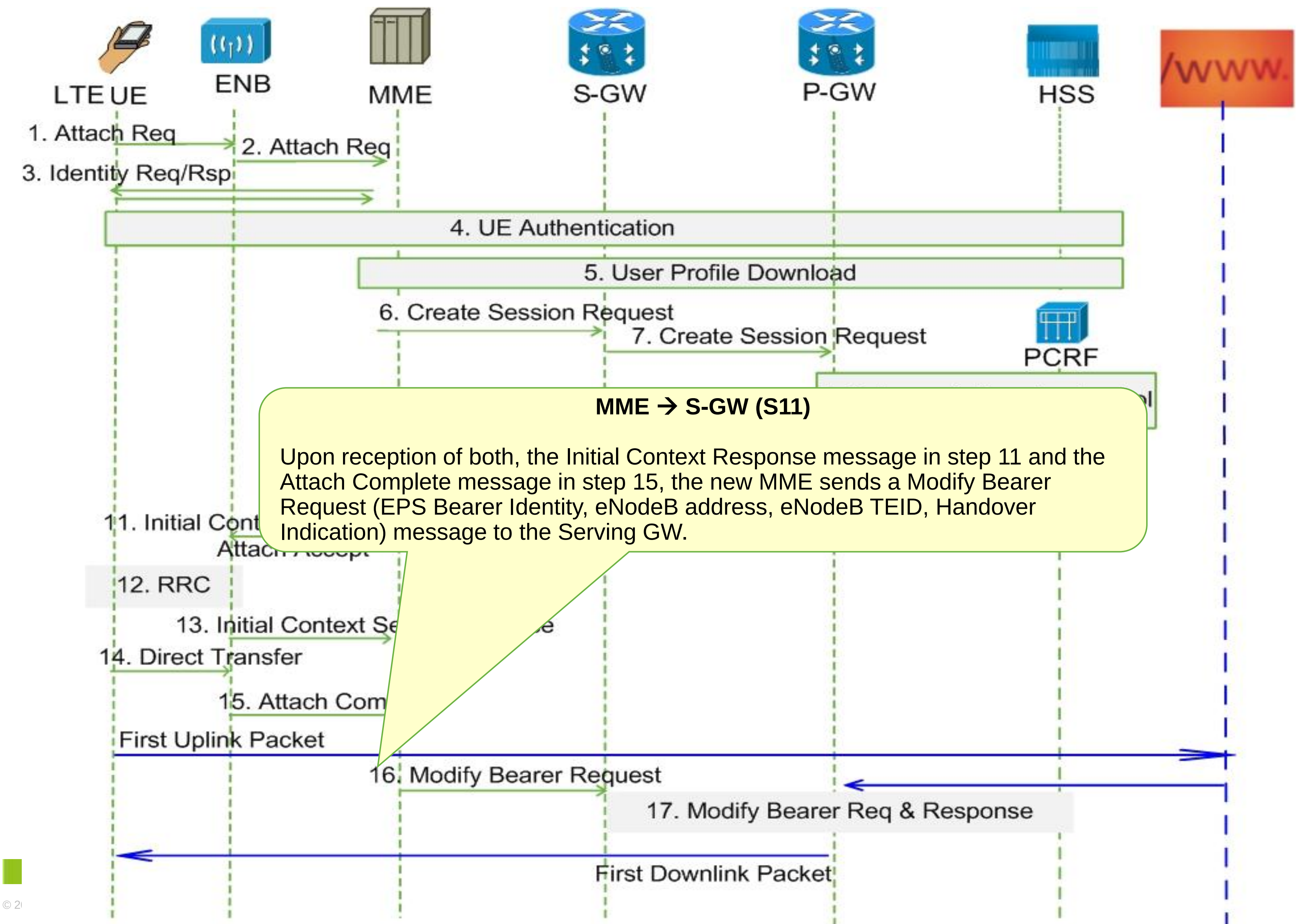
ENB → MME

The eNodeB forwards the Attach Complete message to the new MME

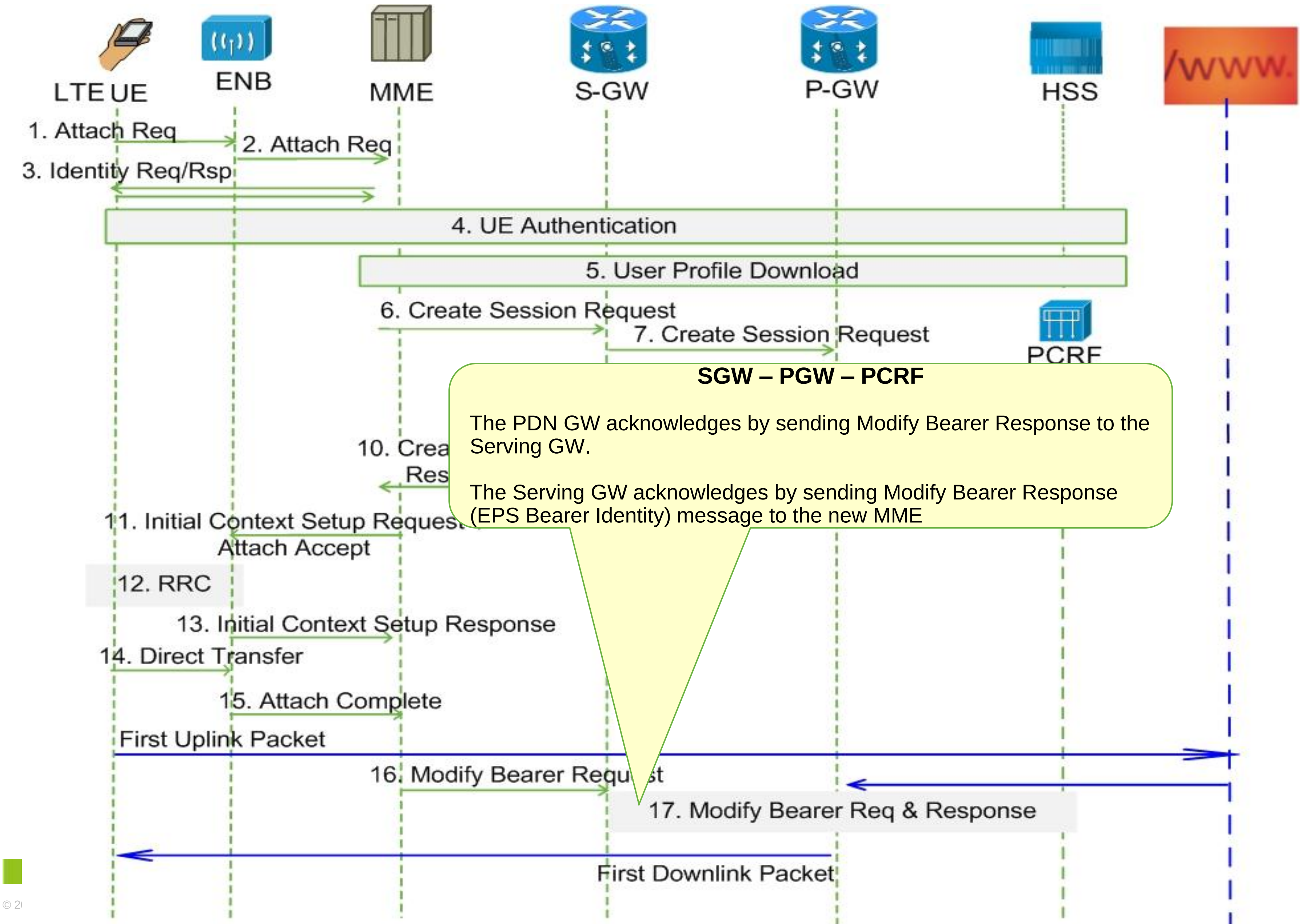
LTE Call Flow



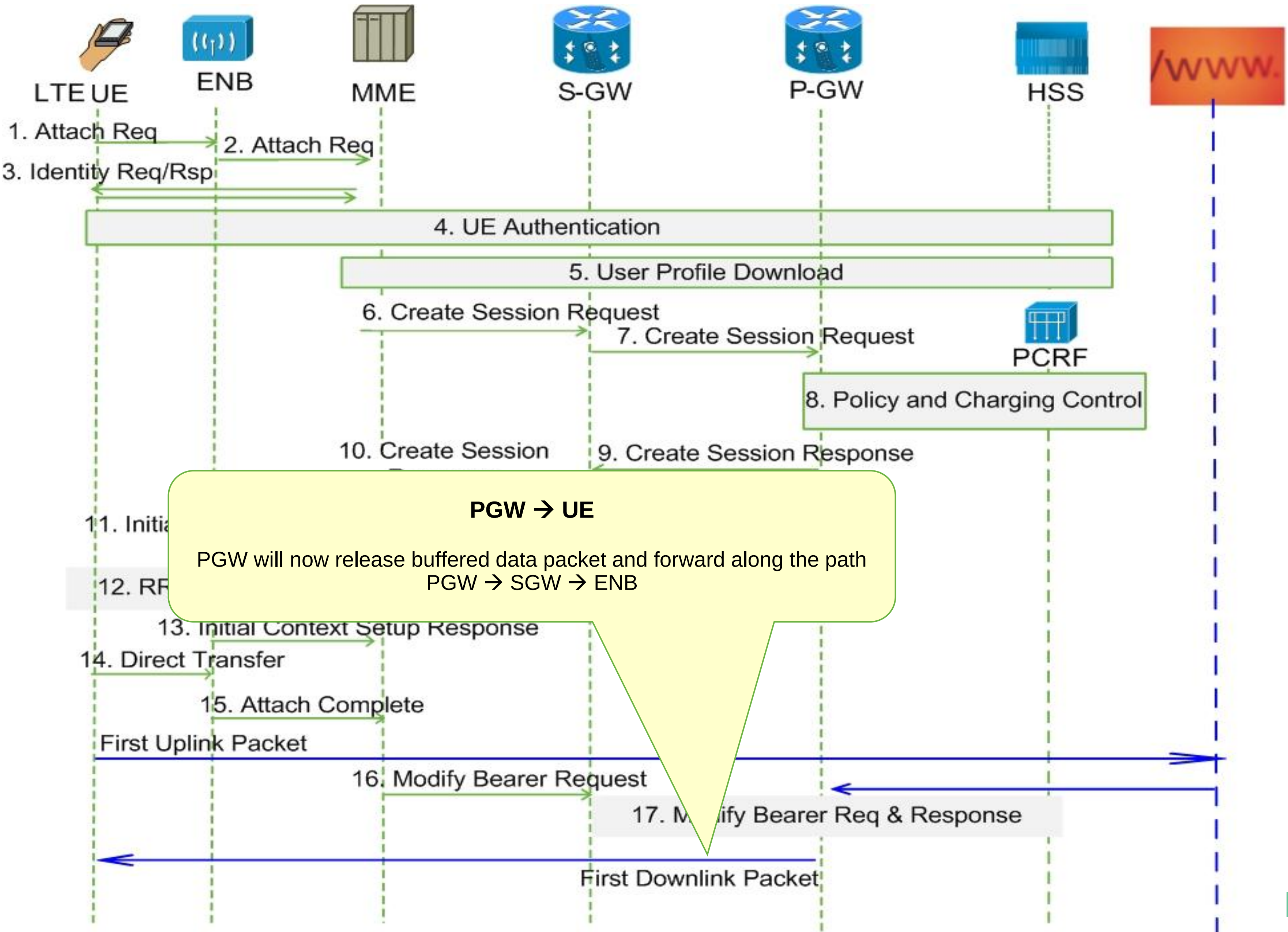
LTE Call Flow



LTE Call Flow



LTE Call Flow



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- Reference 3

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- Support pages:
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- http://www.cisco.com/en/US/products/ps11072/products_installation_and_configuration_guides_list.html

Trivia Question (select the correct answer)

What is predicted this year to exceed the world's population?

A. Smartphones will 'outnumber humans this year'

B. Mobile internet devices will 'outnumber humans this year'

C. Tablets will 'outnumber humans this year'

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Trivia Answer

What is predicted this year to exceed the world's population?

A. Smartphones will 'outnumber humans this year'

B. Mobile internet devices will 'outnumber humans this year'

C. Tablets will 'outnumber humans this year'

Correct Answer B.

A report from Cisco said the number of smartphones, tablets, laptops and internet-capable phones will outnumber humans in 2013.

That report said the amount of internet-connected devices will exceed 7 billion — the world's current population.

Mobile video already makes up more than half of the data transmitted worldwide. By 2017, it will make up two-thirds of it.

Smartphones make up 92 percent of global mobile data traffic, despite only 18 percent of the handsets in use globally.

Thank You for Your Time

Please Take a Moment to Complete the Evaluation

Thank you.