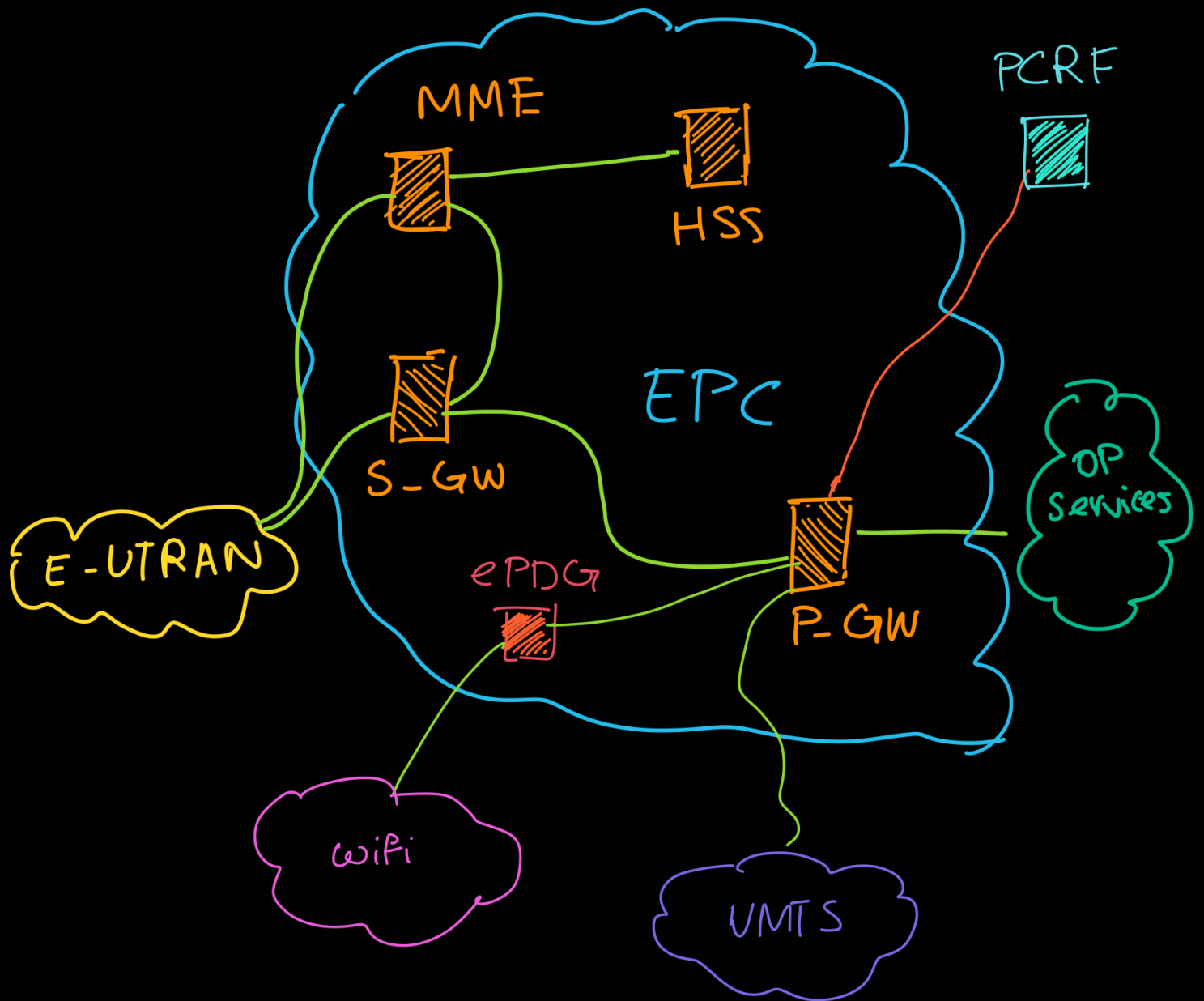


# EPC Architecture



MME : { selecting S-GW, P-GW  
functions related to UE's mobility.

\* UE just can connect to ONE S-GW at any time, but may connect to multiple P-GW, one for every packet data network that UE is interacting with.

S-GW: {

- Packet data routing.
- Mobility anchor
- LI
- like SGSN without mobility and session functionality

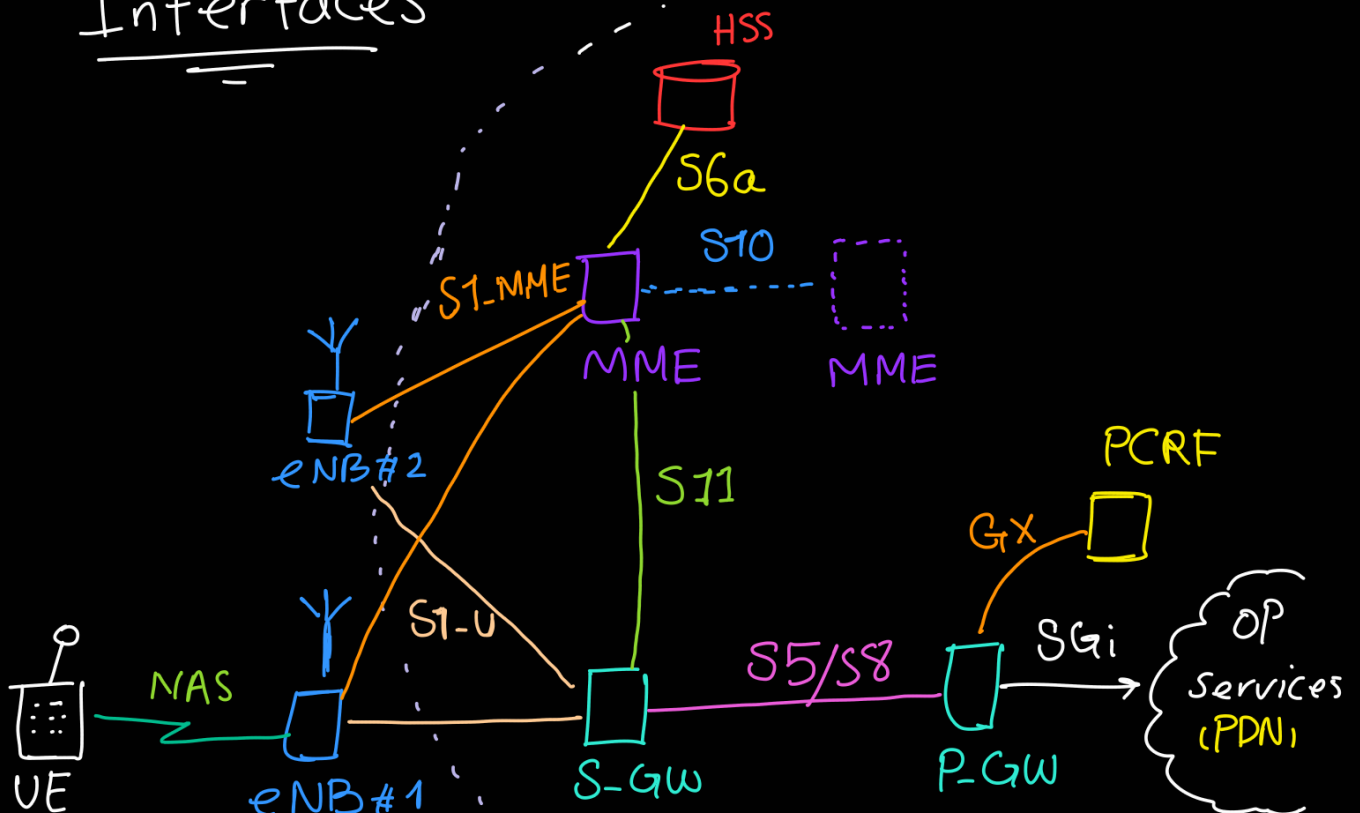
P-GW: {

- default router to UE
- anchoring user plane between 3GPP and non-3GPP access systems.
- charging, LI, policy enforcement.
- QoS and DSCP marking

PCRF: {

- Implements Policy and charging Enforcement Function (PCEF)

## Interfaces



\* For IMS, P-GW provides the list of P-CSCF addresses to UE.

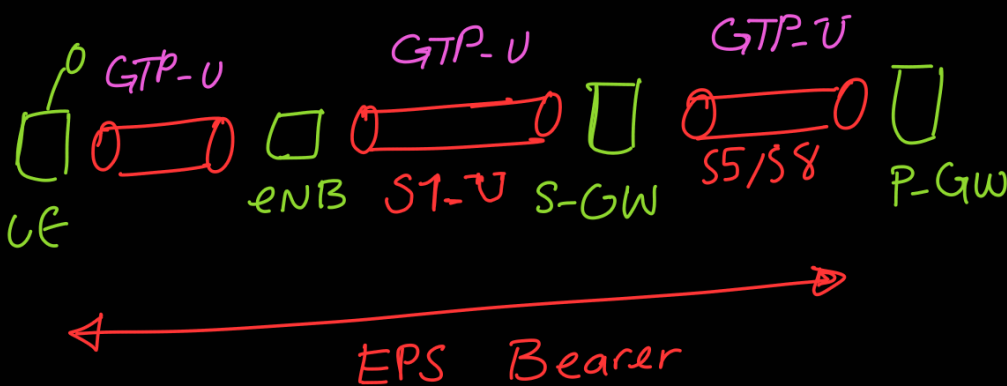
\* PCRF is main QoS control entity in the network. The policy rules indicate P-GW should process and grant resource reservation for given IP flow. PCRF makes final decision for QoS for the bearers.

### Protocols:

- S1-MME : S1AP / SCTP
- S1-U : GTP-U / UDP
- S11 : GTP-C / UDP
- S5/S8 : GTP-C, GTP-U / UDP
- S6a : Diameter / SCTP
- Gx : Diameter / SCTP

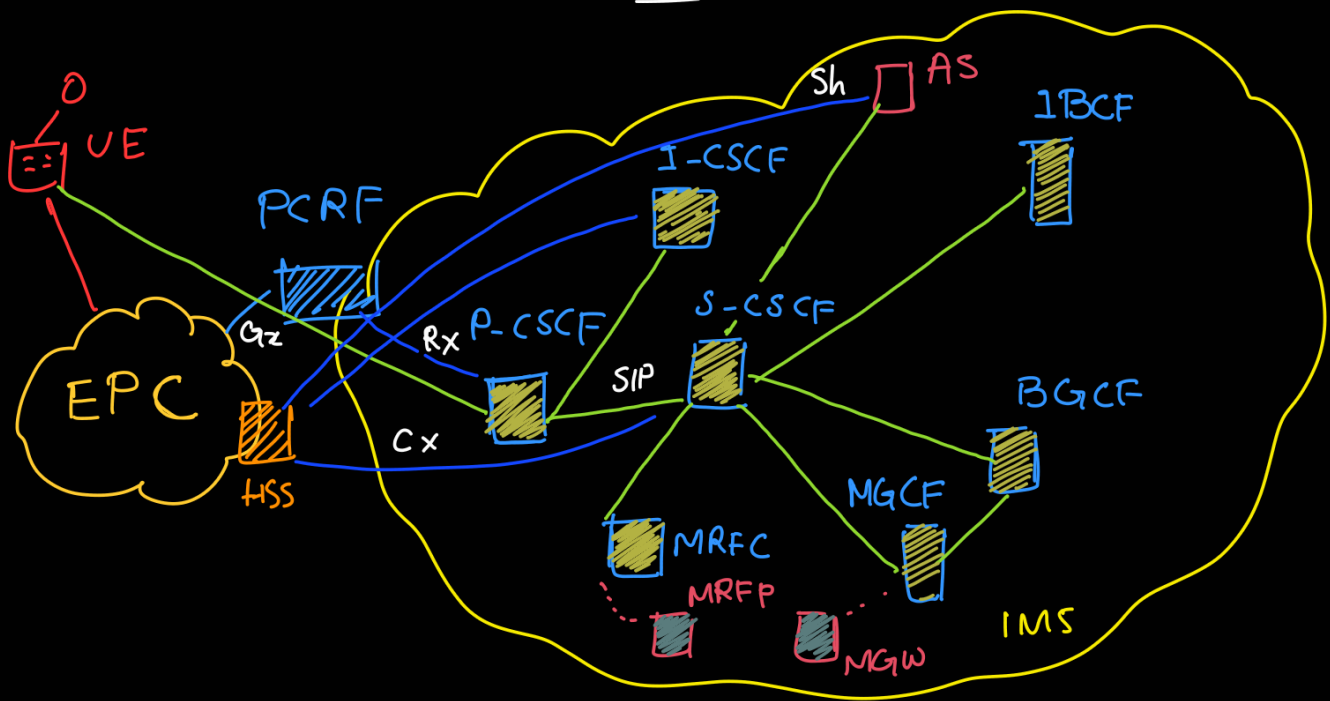
# GTP  $\equiv$  GTPv2

\* Interface between S-GW & P-GW can be based on PMIPv6 or GTP. If S5/S8 is PMIPv6, then user plane protocol is GRE.



( User Plane / User data )

# IMS Network

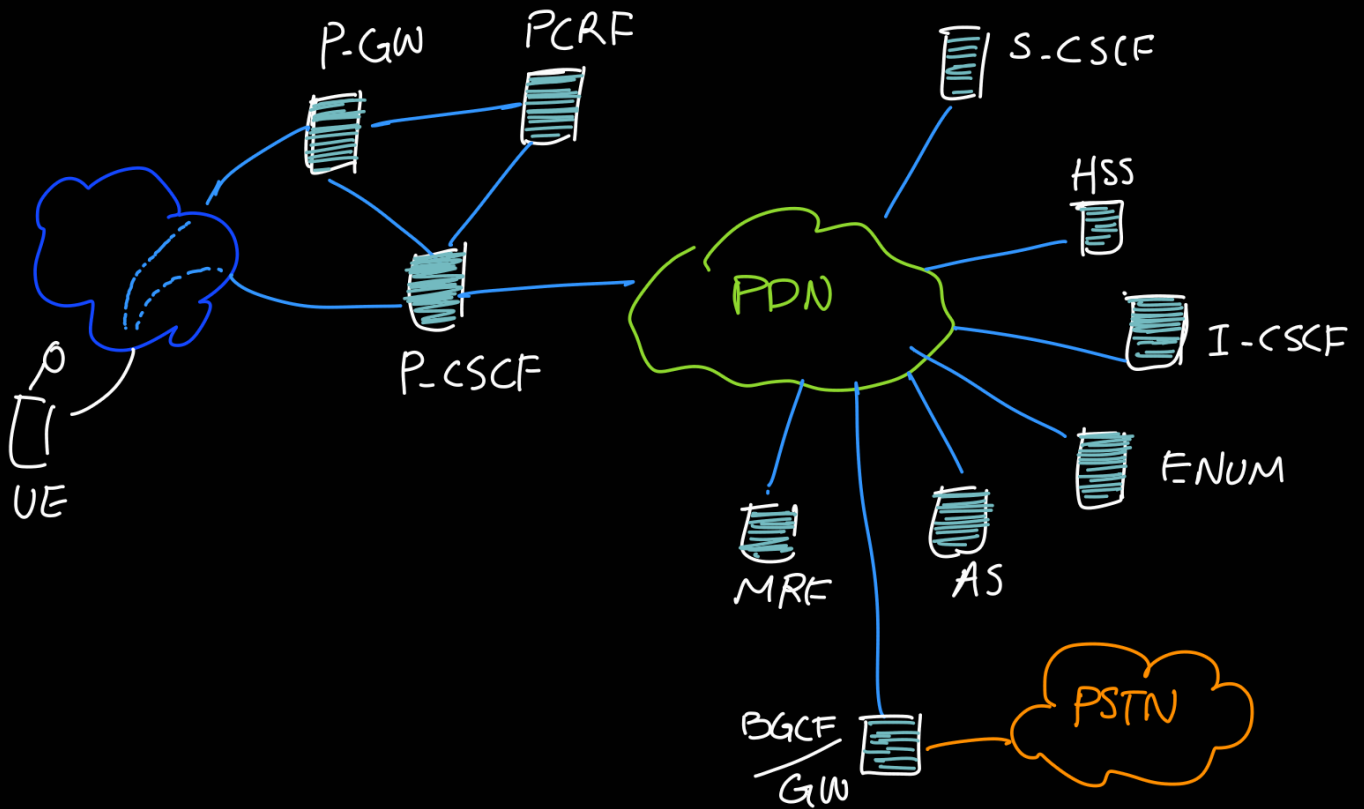


\* S-CSCF & I-CSCF communicate with HSS using Diameter based Cx interface. Also when AS needs subscriber data, it uses same interface to talk with HSS.

\* Other elements talk to each other via SIP signaling. Also media controllers talk to gateway via MegaCo based interface.

\* MRFP = Multimedia Resource Function Processor  
↳ Mix media streams, announcements...

We can simplify IMS Network like this ?



\* Large networks usually uses multiple HSS and distribute it. In this cases there is Subscription Locator Function (SLF) to locate the HSS holding user profile.

# Protocols

- RTP, RTCP/UDP → Media
- XCAP/HTTP/TCP → UT interface
- SIP/TCP, UDP → Signaling
- Diameter/SCTP
- H.248 - Megaco/TCP

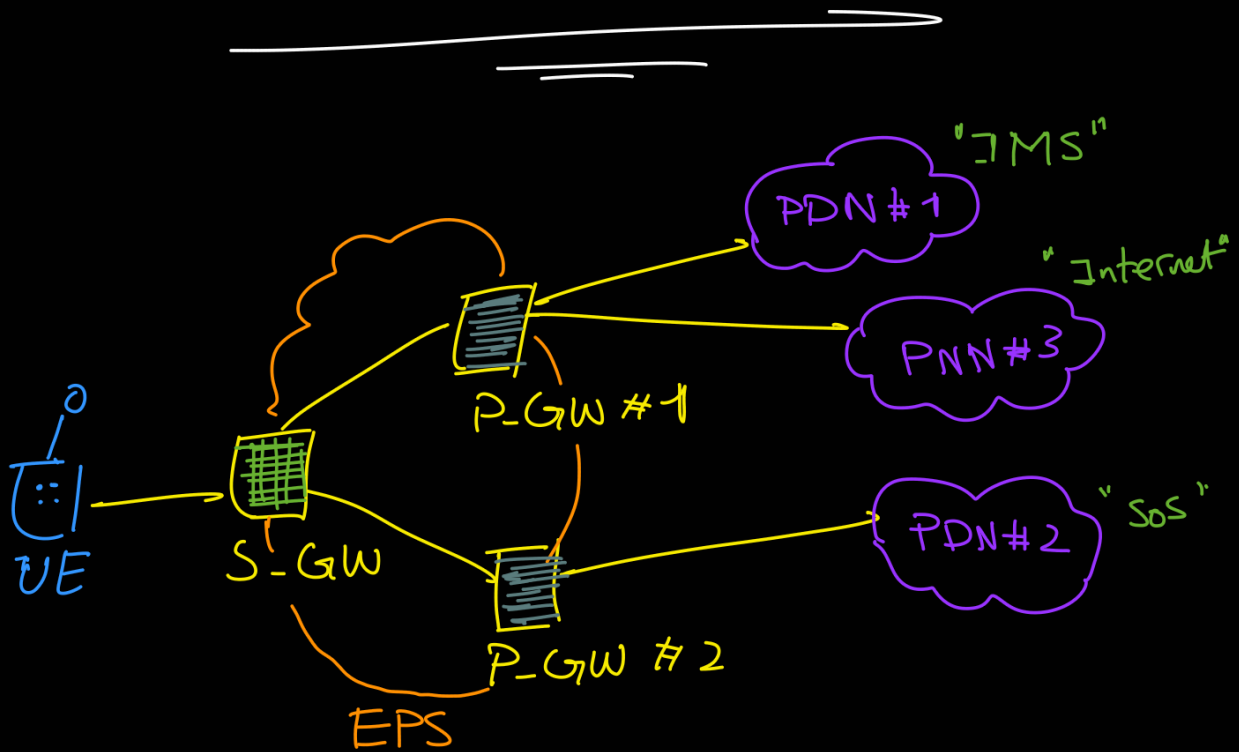
\* CSCF elements talk to each other via Mw interface which is SIP.

\* P-CSCF and UE interface is Gm, it's SIP.

\* P-CSCF and PCRF interface is Rx.

\* PGW and PCRF talks over Gx.

# PDN, APN and Bearer Connections



- \* Subscriber may subscribe to multiple PDN connections. Also it might have these connections through one or more P-GWs.
- \* A single PDN may support multiple Service Data Flows (SDFs).
- \* For each of PDNs, subscriber's HSS profile contains an APN that identifies PDN and suitable P-GW.

\* On initial attach MME uses APN provided by UE or default APN provided by the HSS to create default PDN connection.

## GBR and non-GBR bearers.

Guaranteed Bit Rate (GBR) bearers guaranteed that specific bit rate is always available on that bearer.

\* The default bearer when UE attaches to network is always a non-GBR.

\* Dedicated bearers may be GBR or non-GBR and can be set up at any time.



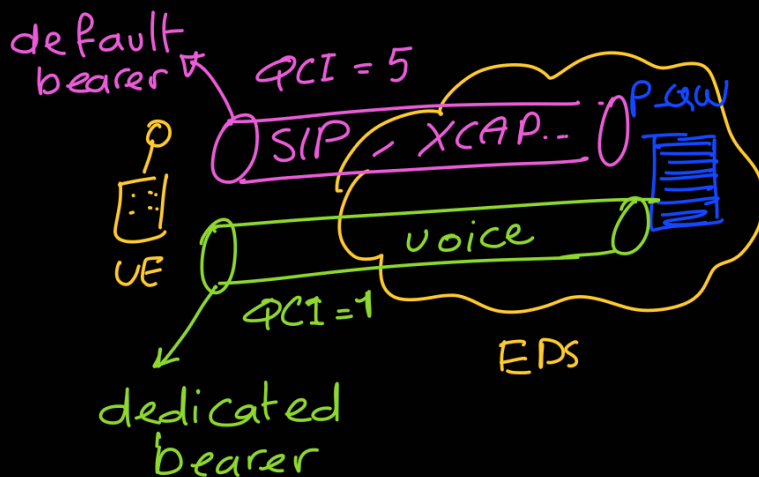
# QoS ?

- Parameters :
- QCI : QoS Class Identifier
  - ARP : Allocation and Retention Policy
  - GBR : Max bit rate
  - MBR : Averag Max bit rate
  - AMBR : Averag Max bit rate

\* Each EPS bearer is configured with specific QoS ( latency, throughput, priority ... ).

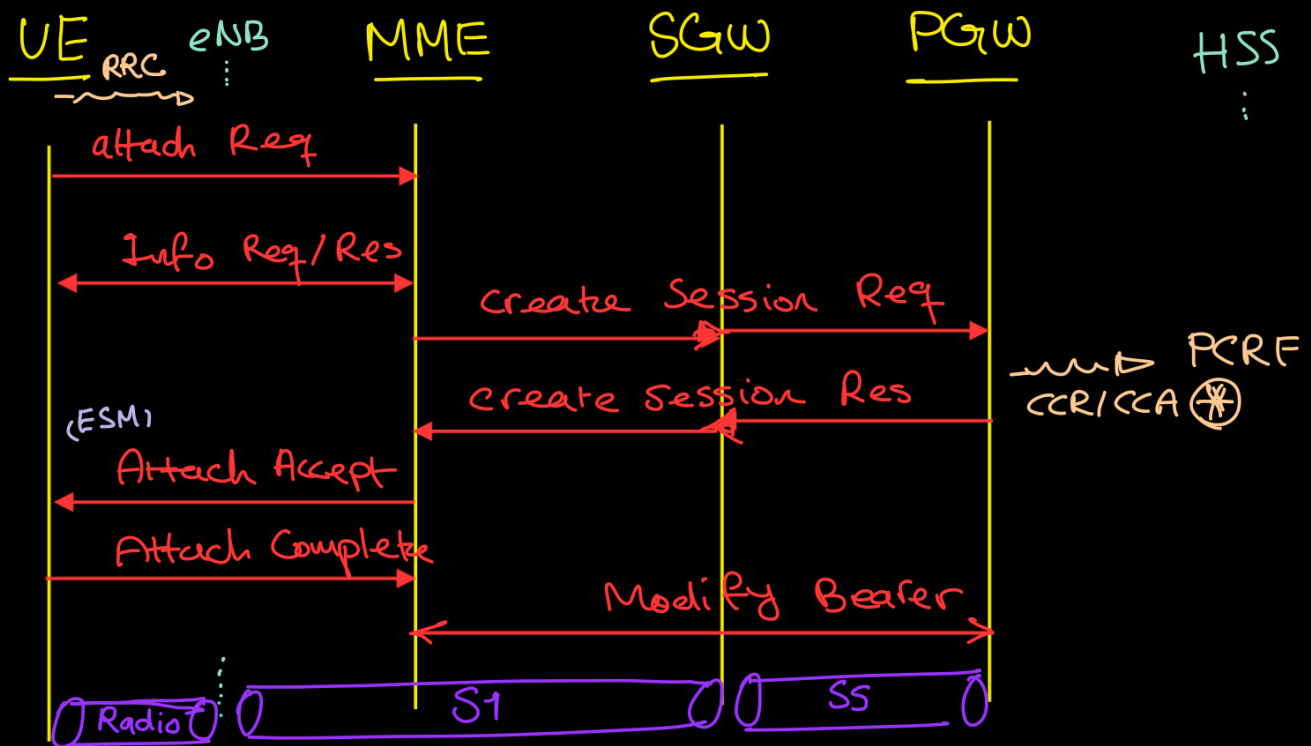
\* QCI maps to specific DiffServ Code Point (DSCP) through GTP tunnels.

\* QCI 1 = media , QCI 5 = Signaling



# Default Bearer Setup:

«high level»



⊛ CC-Request & CC-Answer Diameter messages to obtain authorized QCI.

✦ MME queries HSS for subscriber information using IMSI from subs, and HSS returns a list of supported feature along other subs. information like MSISDN, PDN-Type, APN, QoS profile ...

✦ MME does DNS query to determine which P-GW to use, then take care of signaling to establish S5/S8, S1-U and radio bearer.