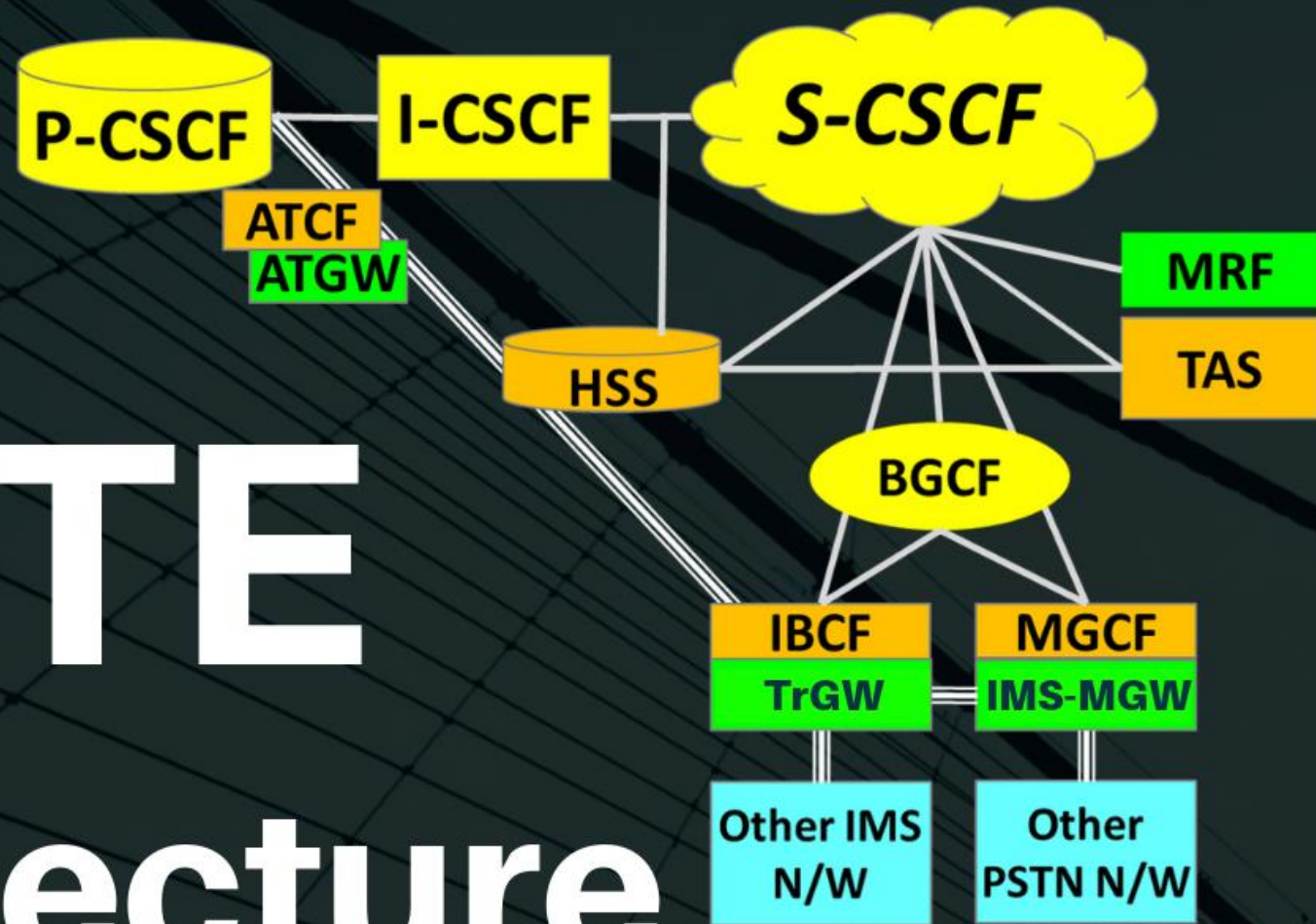


IMS VoLTE Architecture



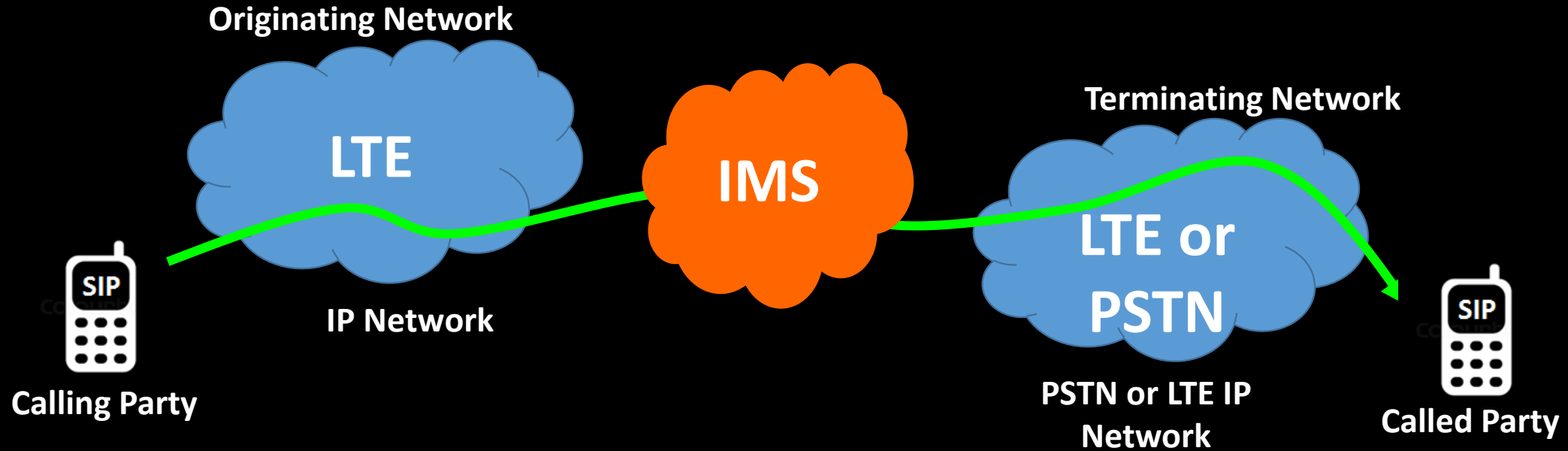
VoLTE

- VoLTE Fundamentals
- Handset Requirements
- LTE Network Support
- IMS Architecture
- CS Network Support
- QCI & Prioritization of VoLTE Traffic over Radio

Without a Solid foundation, you'll have trouble creating anything of value

Disclaimer : Views expressed in this blog or Video are strictly mine and not of my employers or Equipment Manufacturers

What is VoLTE



IMS enables a packet-based network to provide multiple services on single Control/Service Layers via different access network.

Key Drivers to IMS

- Access agnostic
- Services independent
- Open architecture
- Multi-device
- Vendor independent

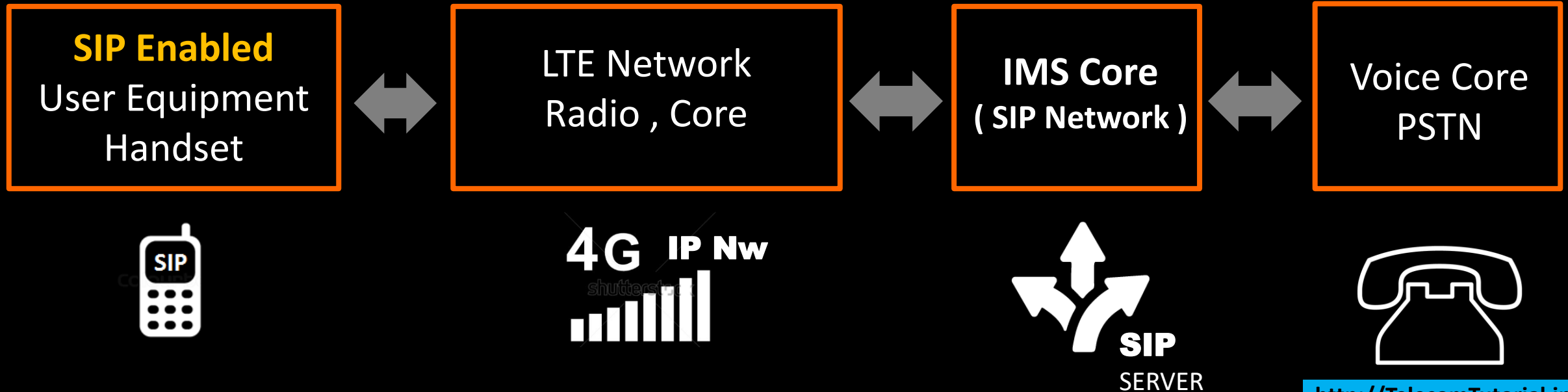
VoLTE Building blocks

VoLTE : Voice over LTE

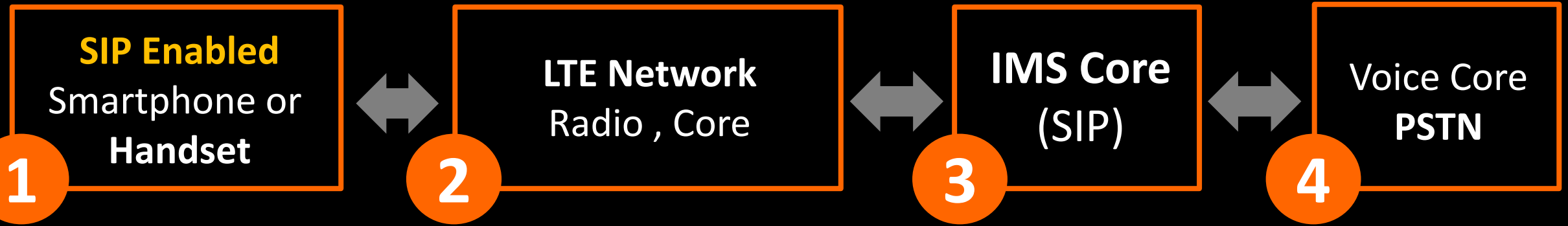
- Voice calls over a 4G LTE network
- LTE Packet Network used for carrying voice payload over all IP Network

VoLTE Benefits to users

- HD Voice
- Fast Call connection (0.25s)



VoLTE Network - Building blocks



• SIM Card (ISIM)



- ✓ IMPI
- ✓ IMPU



• Radio

- ✓ ENodeB

• Handset



- ✓ SIP-UA

• LTE Core

- ✓ MME, SGW, PGW
- ✓ HSS
- ✓ DNS
- ✓ PCRF

• SIP Servers

- ✓ P-CSCF
- ✓ I-CSCF
- ✓ S-CSCF

• Other IMS Core

- ✓ TAS
- ✓ BGW
- ✓ MRF

• Control Plane

- ✓ MSS
- ✓ MSC

• User Plane

- ✓ MGW

VoLTE Handset Components (User Equipment)

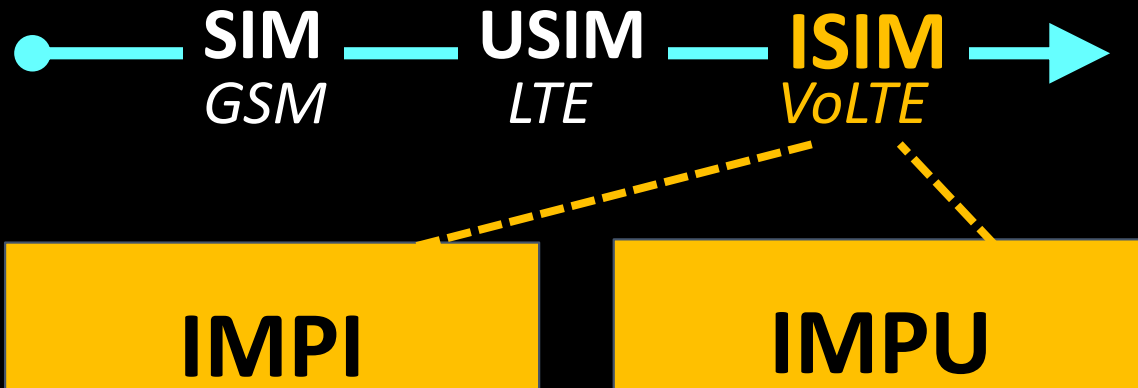


Universal Integrated
Circuit (UICC)



1

SIP User Agent (SIP-UA)



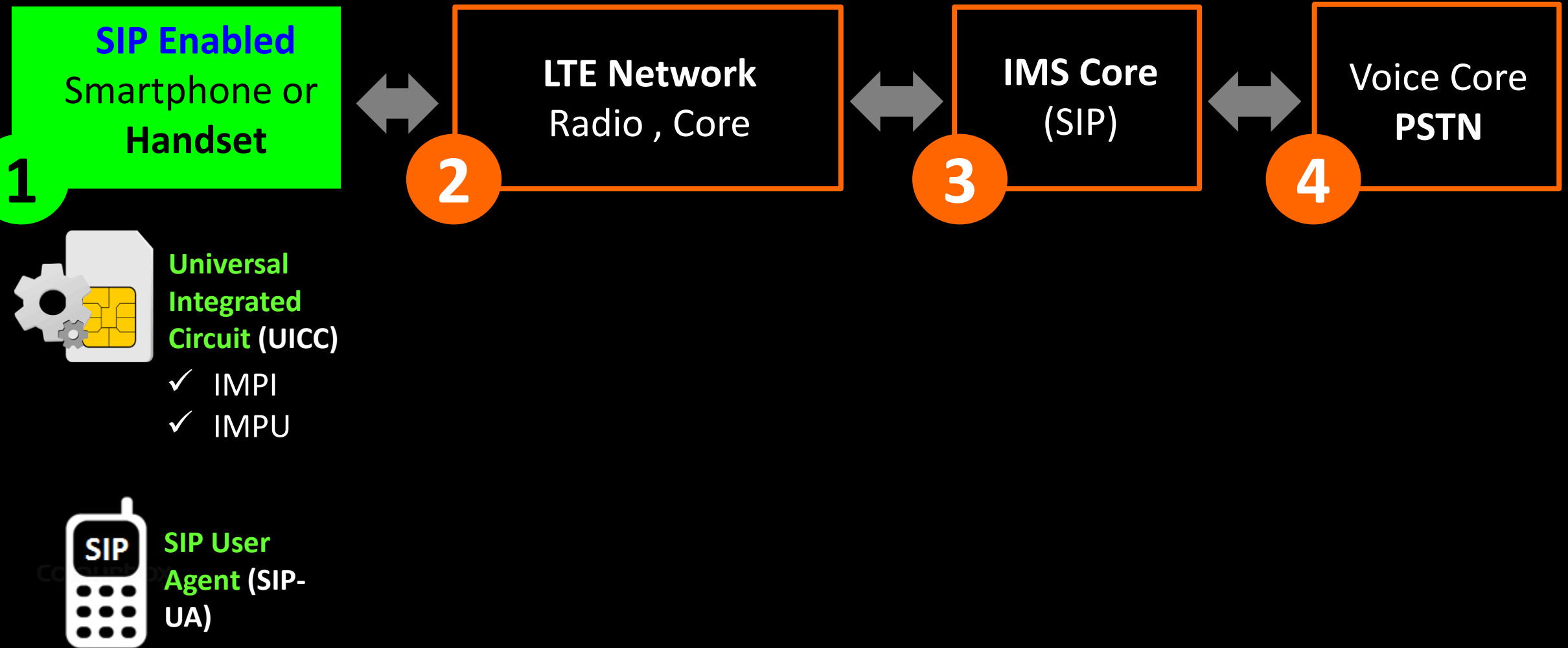
- Private Entity
- Global identity allocated by home network

- Public Identity
- Like a telephone No.
SIP URI , Ex : tel
:- +919810602654

- **SIP User Agent (SIP-UA)**

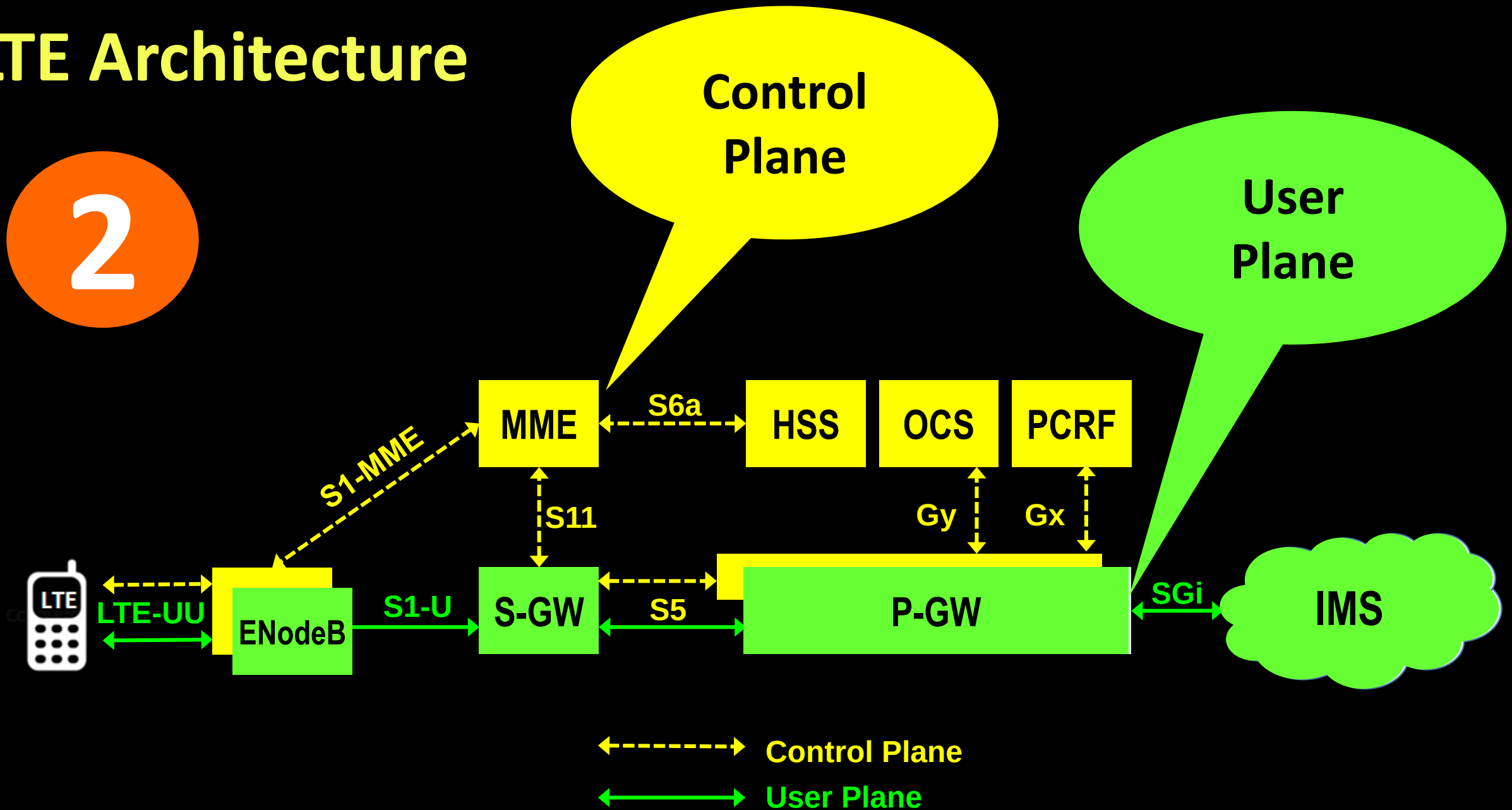
1. Resides in the UE
2. Transmit & receive SIP Messages
3. Provides telephony functionality
4. Can act as
 - User Agent Client (UAC) : send SIP request
 - User Agent Server (UAS) : As a server to receive requests and send response

VoLTE Building blocks

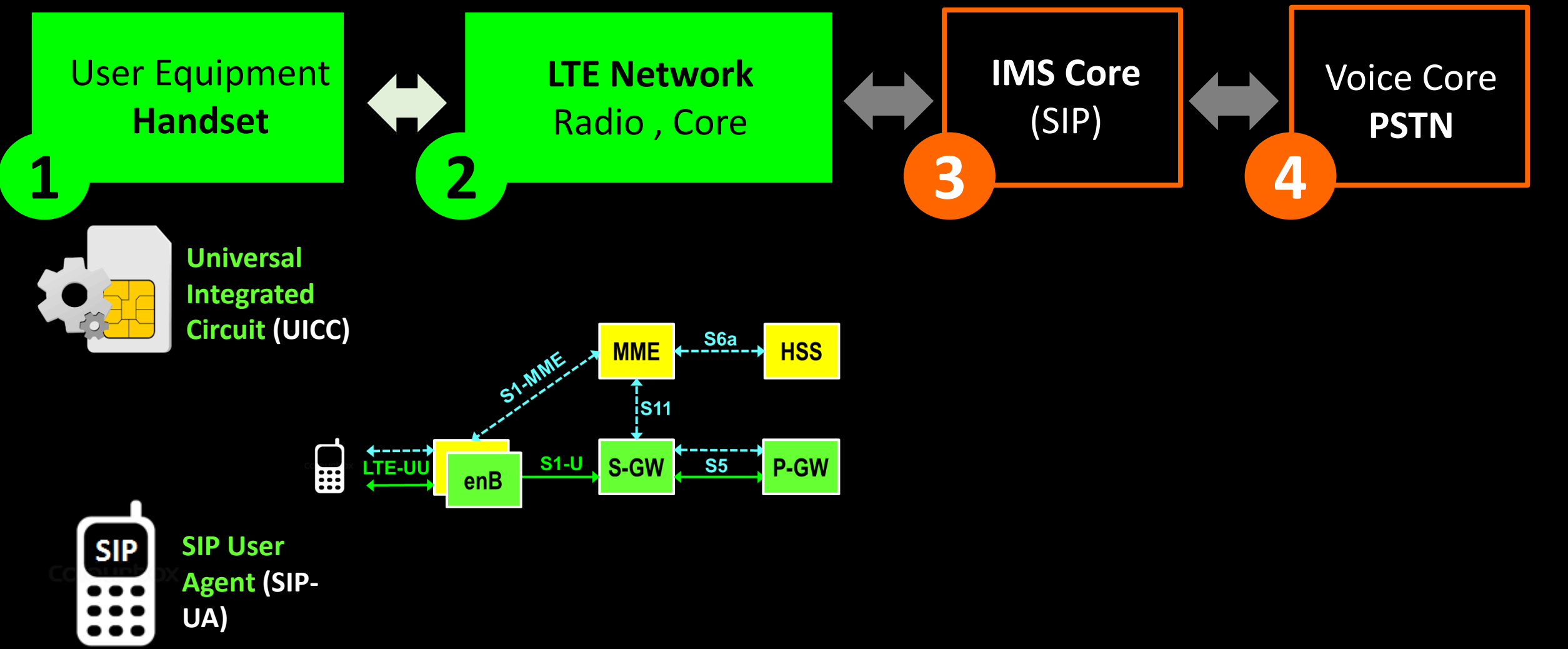


LTE Architecture

2

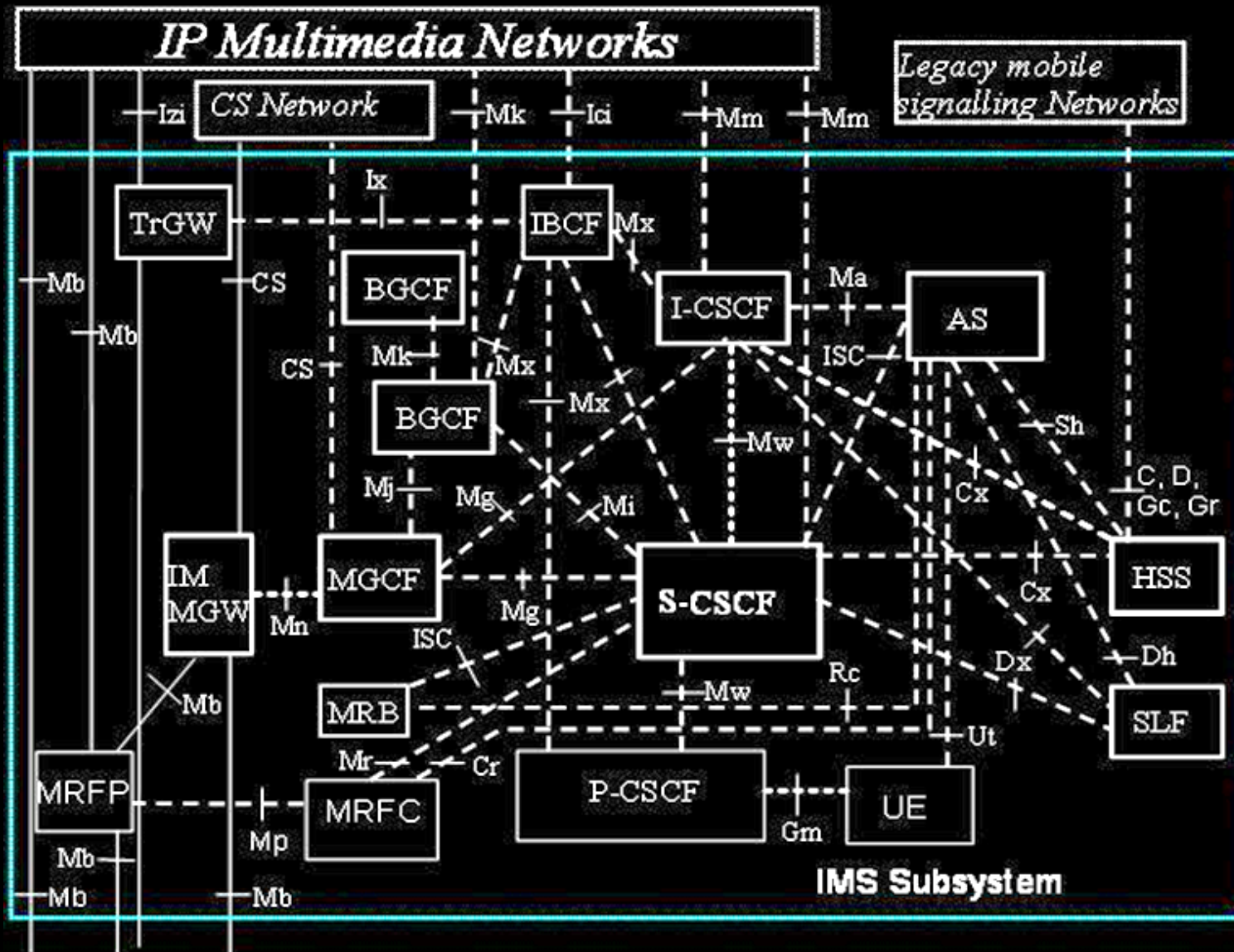


VoLTE Building blocks



IMS VoLTE Architecture & Specs

3



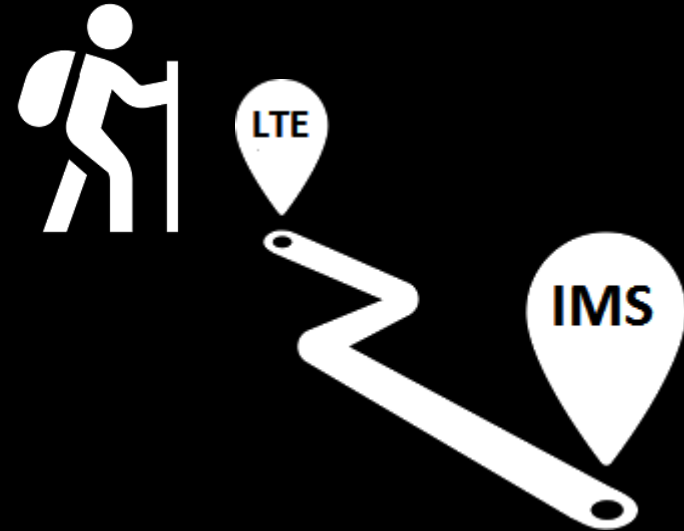
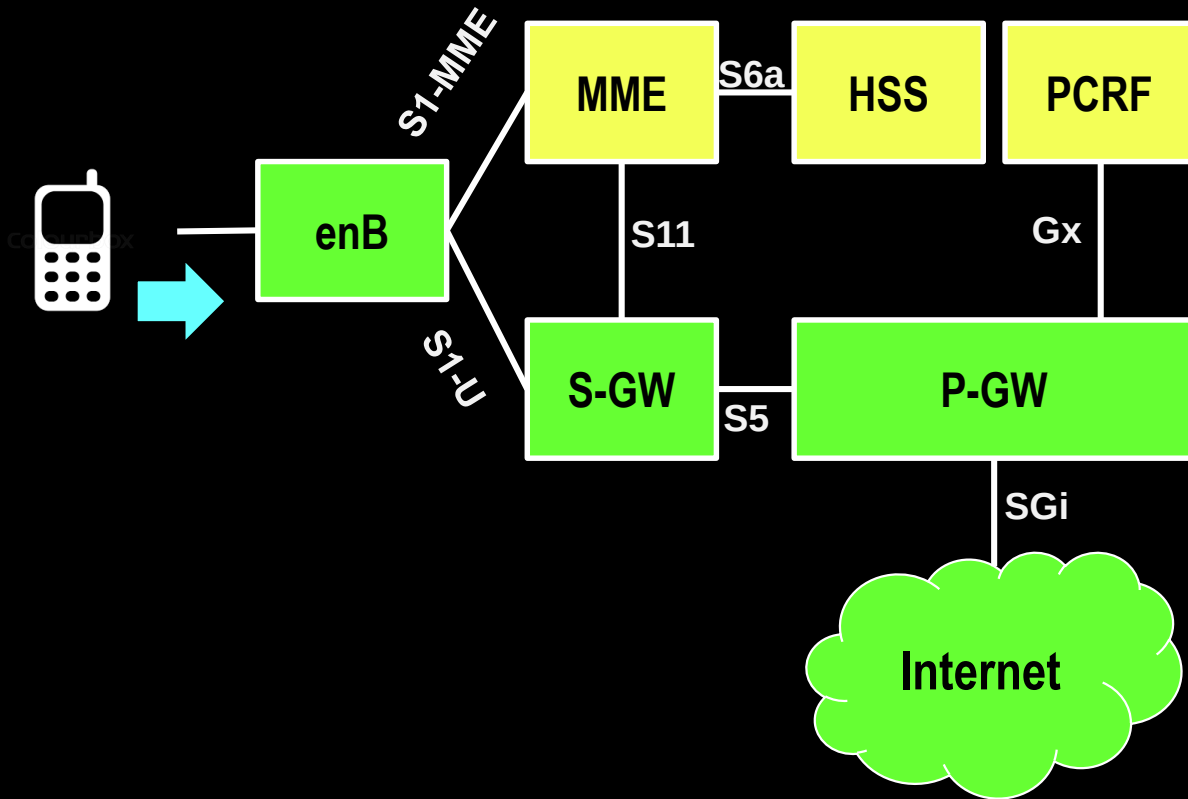
IMS SPECS

3GPP 23.228



- GSMA FCM.01
- GSMA IR.92

LTE to VoLTE Journey



eNB (EnodeB)

MME (Mobility Management Entity)

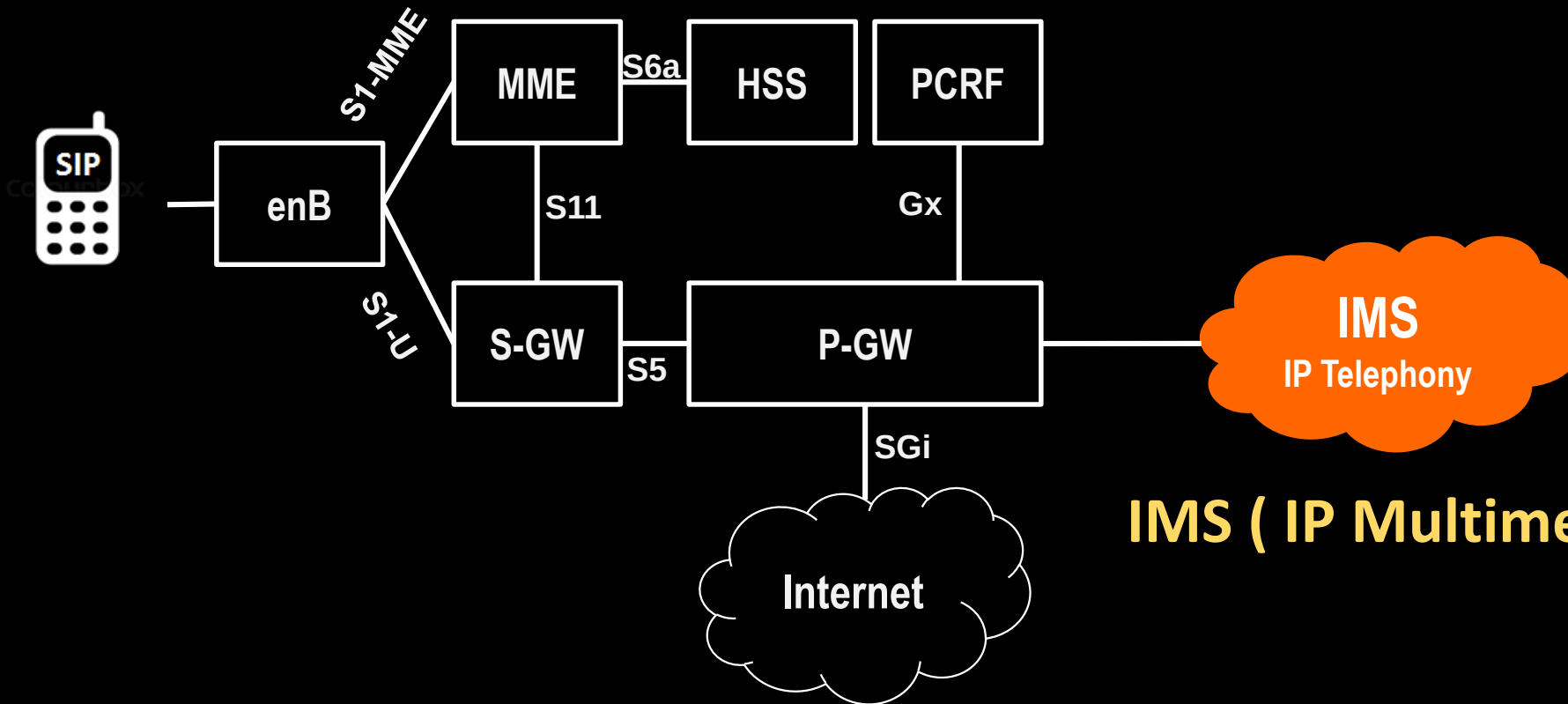
SGW (Serving Gateway)

HSS (Home Subscriber Server)

PCRF (Policy charging rules function)

PGW (Packet Gateway)

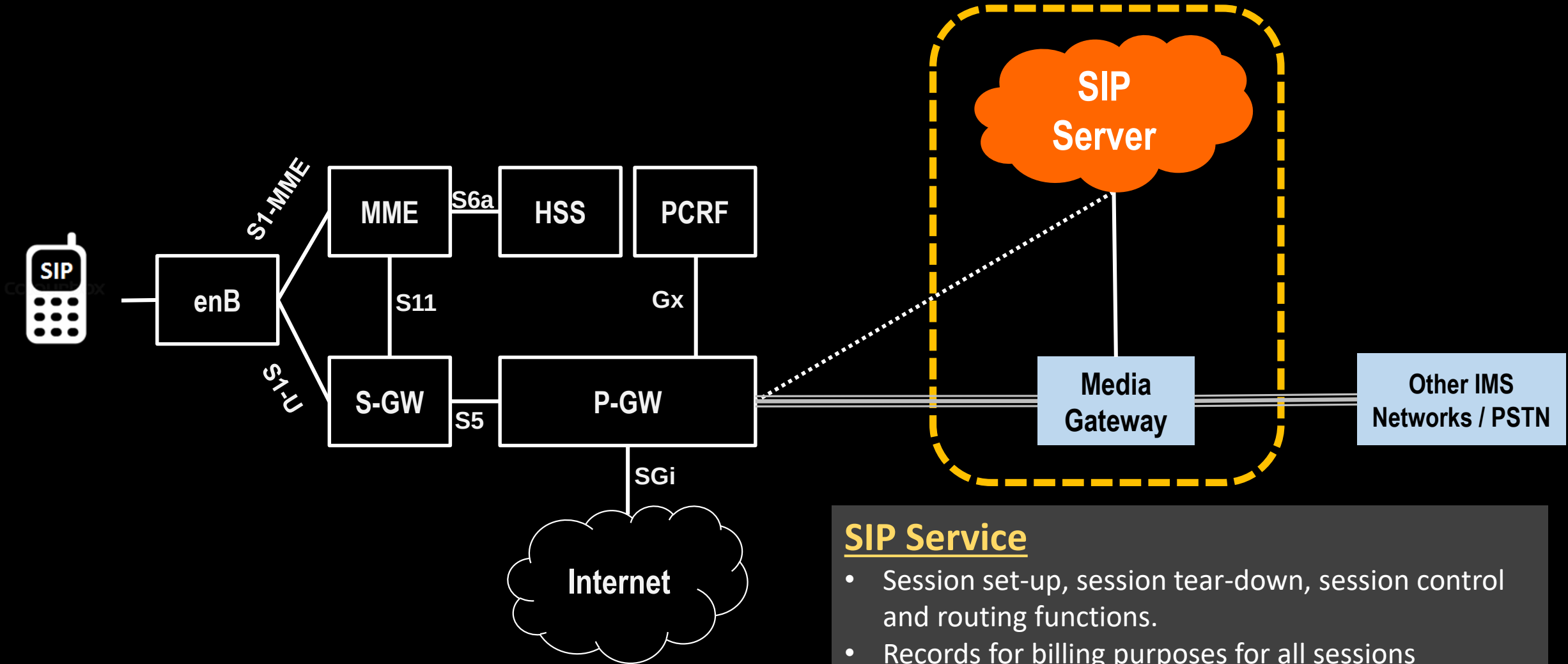
Here is IMS



IMS (IP Multimedia Subsystem)

SIP Server

IMS (IP Multimedia Subsystem)

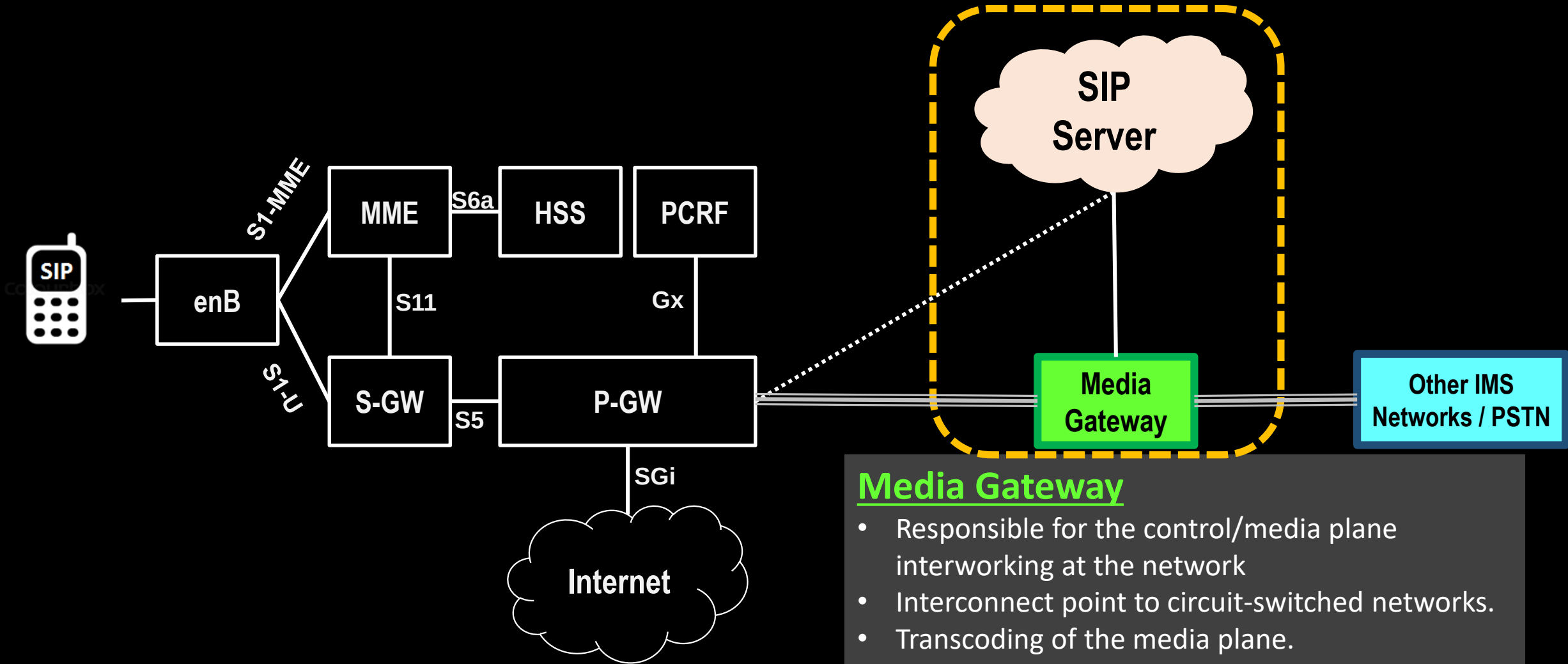


SIP Service

- Session set-up, session tear-down, session control and routing functions.
- Records for billing purposes for all sessions
- SIP registrar for VoLTE UEs

Media Gateway

IMS (IP Multimedia Subsystem)

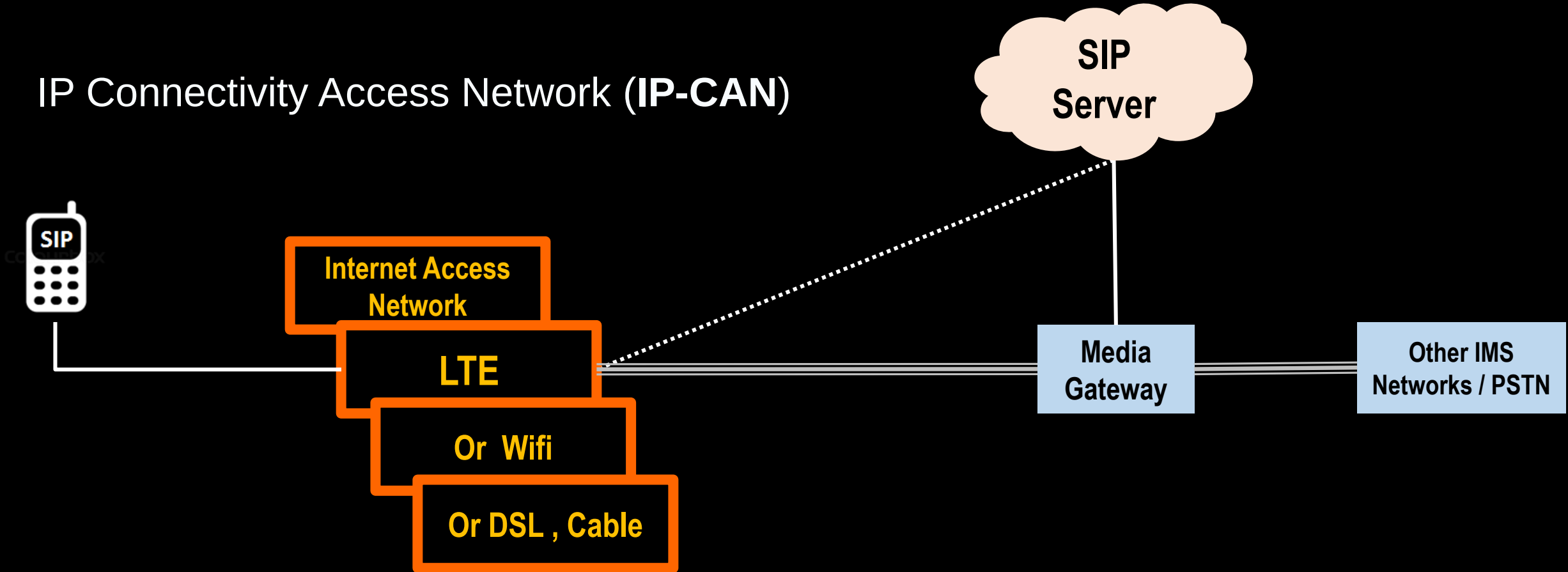


Media Gateway

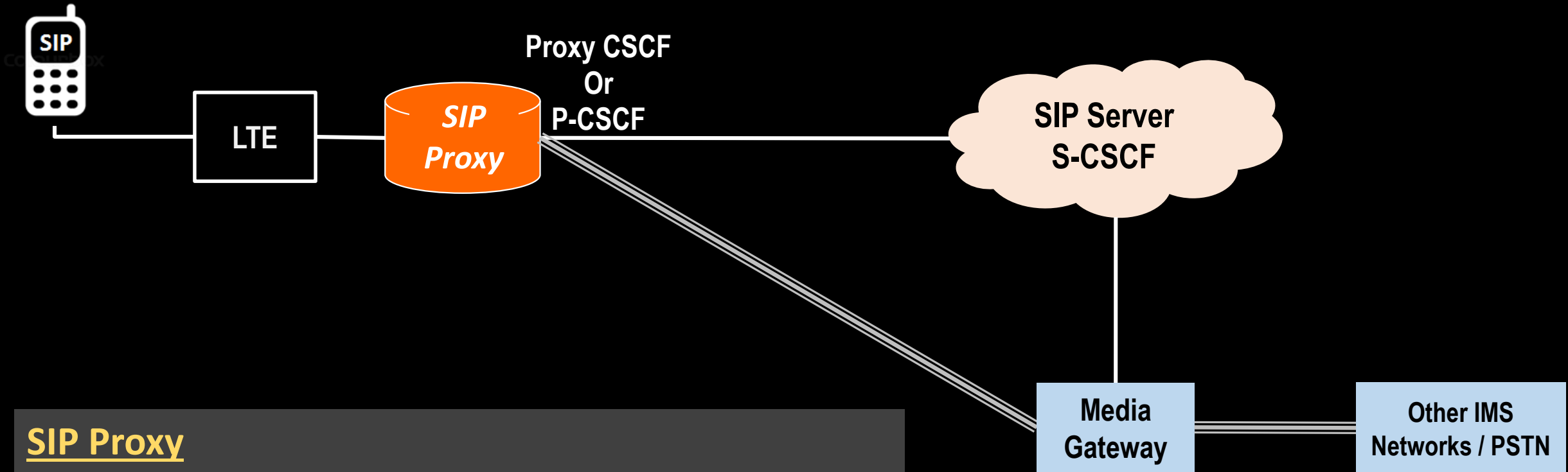
- Responsible for the control/media plane interworking at the network
- Interconnect point to circuit-switched networks.
- Transcoding of the media plane.
- Interconnect to other IMS Networks

Role of IPCAN

IP Connectivity Access Network (**IP-CAN**)



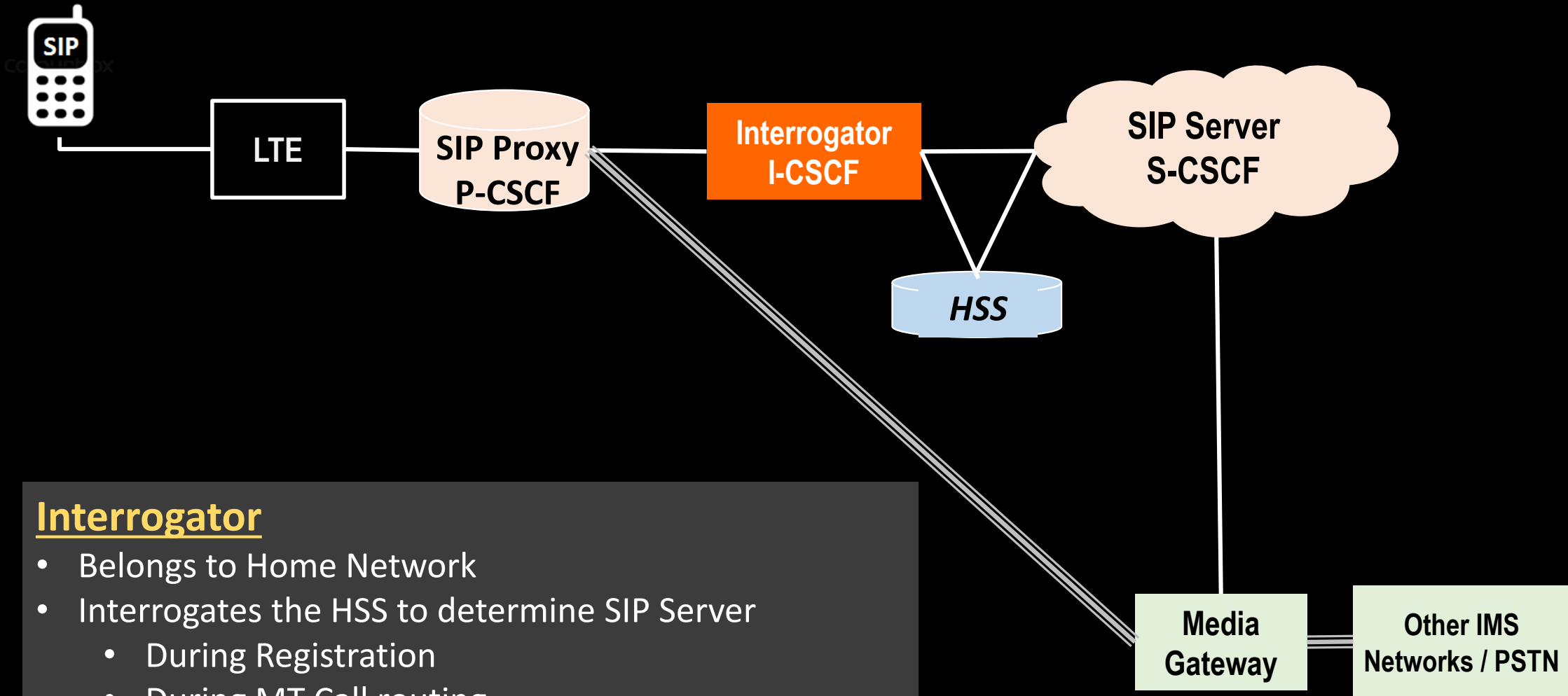
The Proxy



SIP Proxy

- First Point of Entry point to IMS Network
- Typically Belongs to VPLMN
- Function : Integrity of SIP Messages , Ensures the security , Authenticates & identity of the UE
- Find out Home SIP Server & Routes Traffic to same

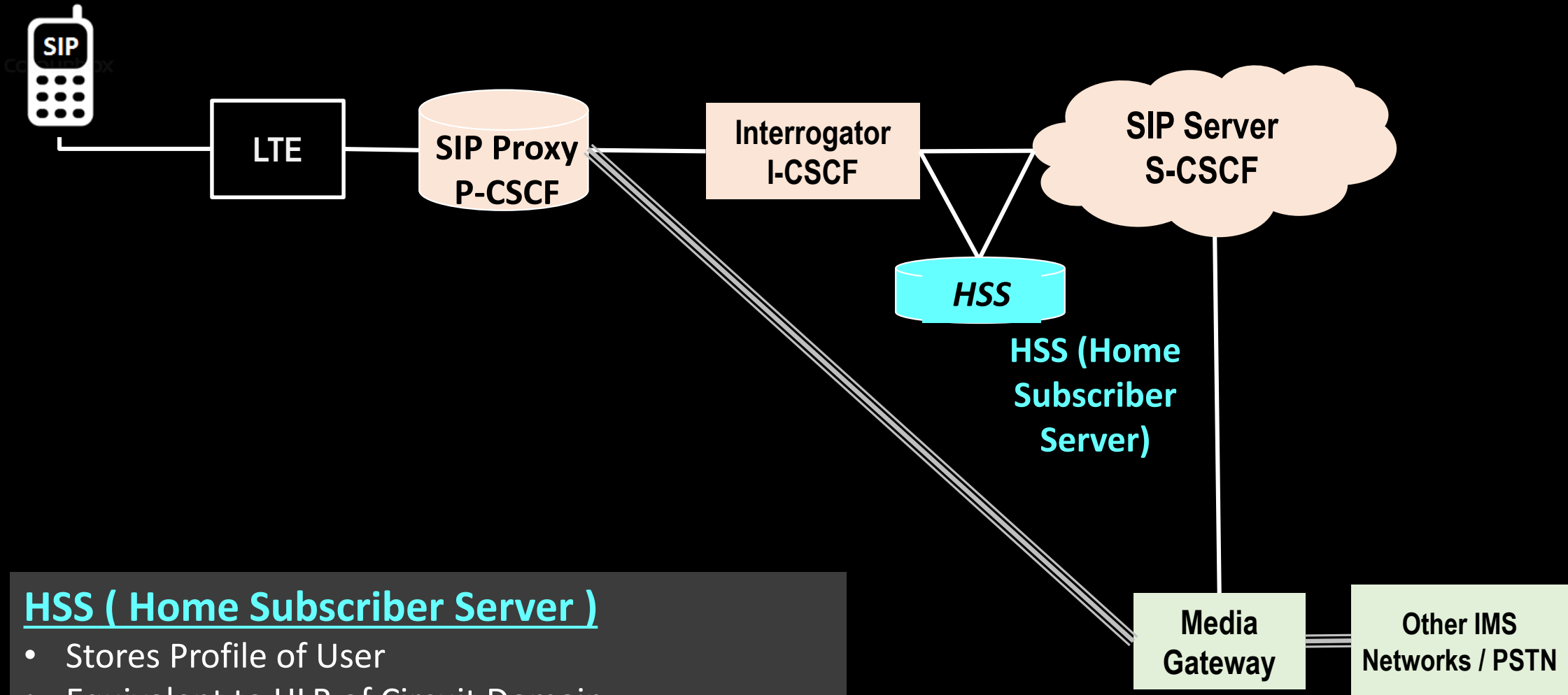
The Interrogator



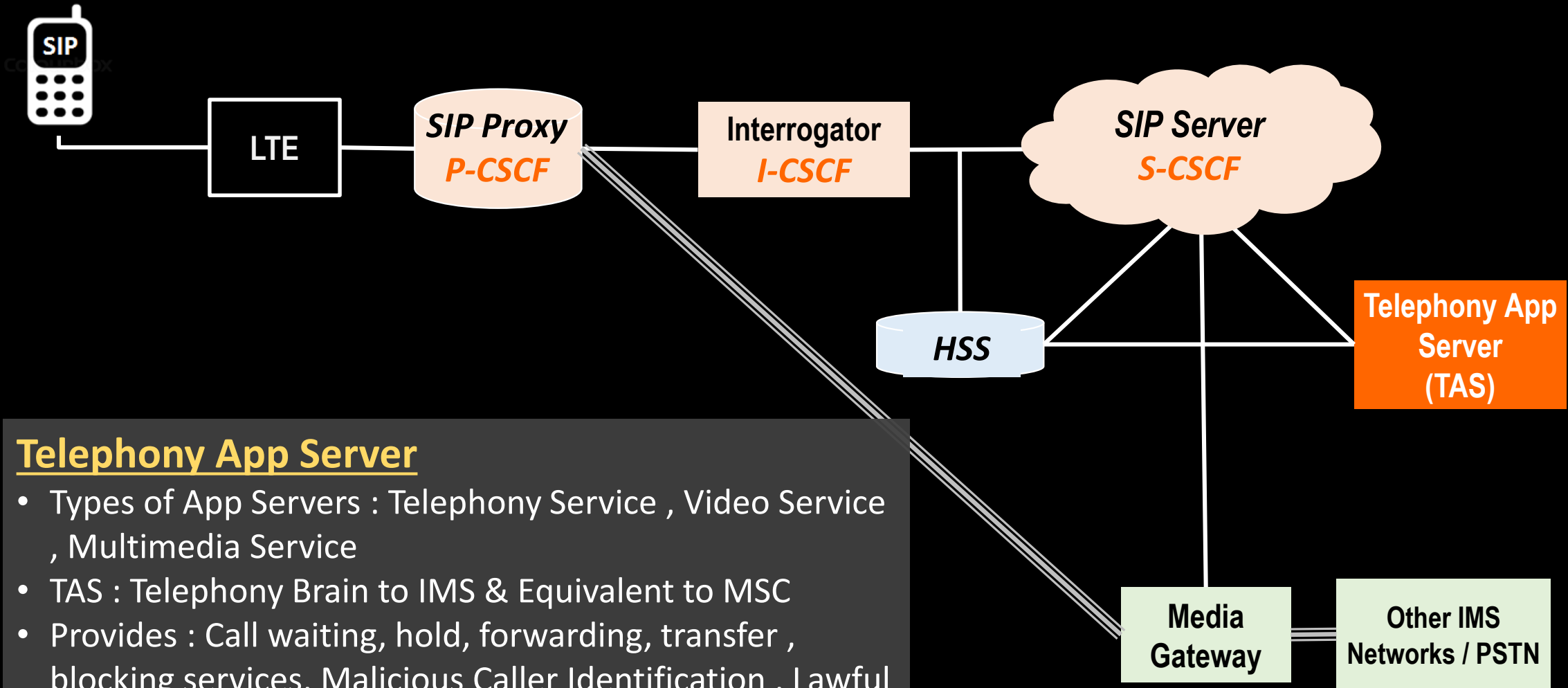
Interrogator

- Belongs to Home Network
- Interrogates the HSS to determine SIP Server
 - During Registration
 - During MT Call routing

HSS (Home Subscriber Server)



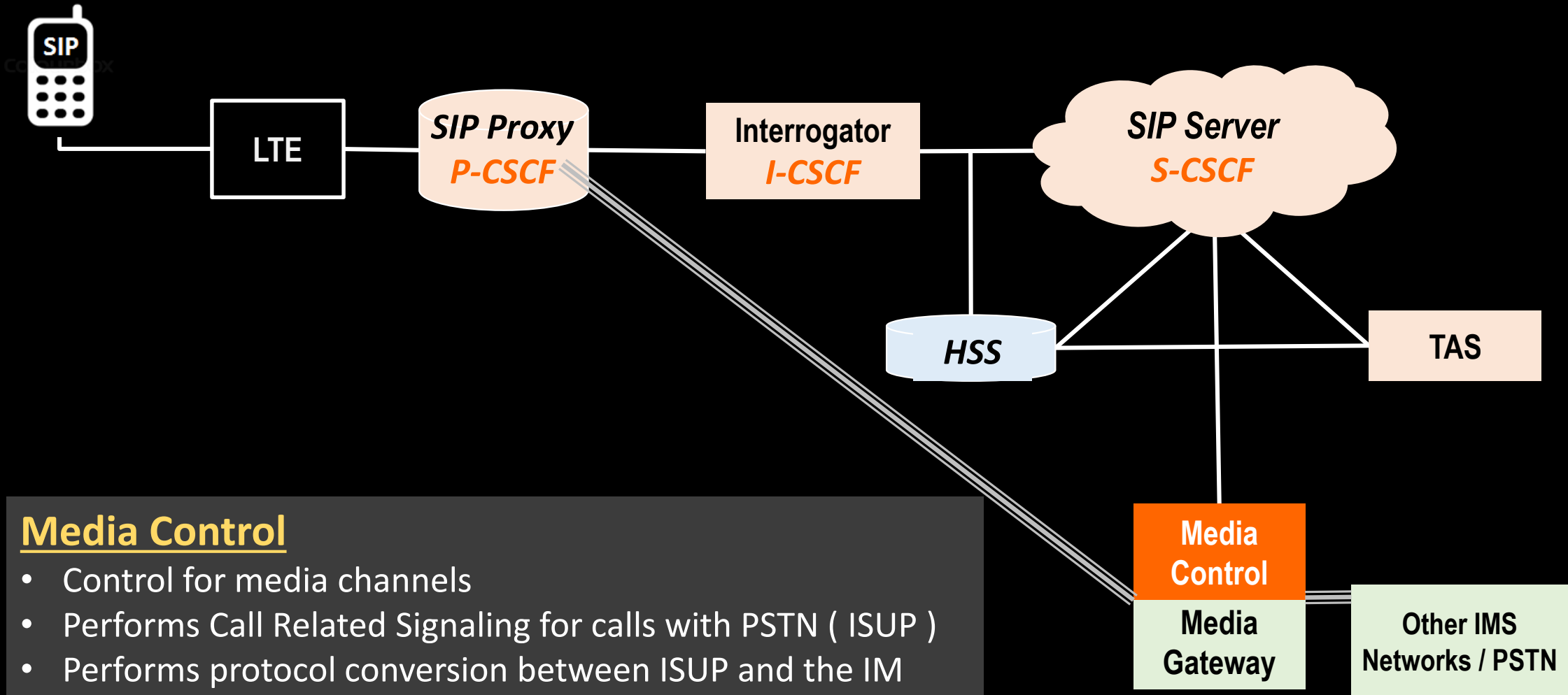
The Telephony App Server (TAS)



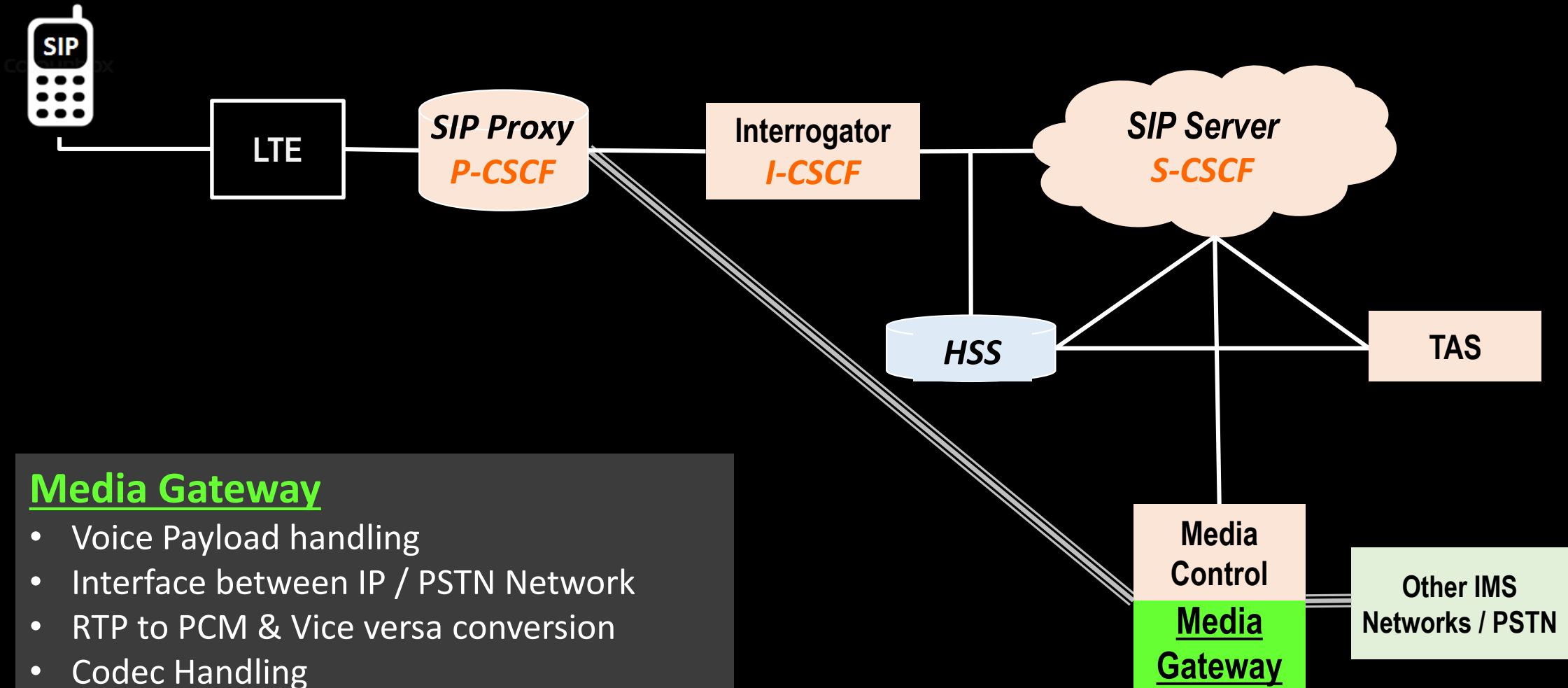
Telephony App Server

- Types of App Servers : Telephony Service , Video Service , Multimedia Service
- TAS : Telephony Brain to IMS & Equivalent to MSC
- Provides : Call waiting, hold, forwarding, transfer , blocking services, Malicious Caller Identification , Lawful interception , Announcements , Conference

Media Control



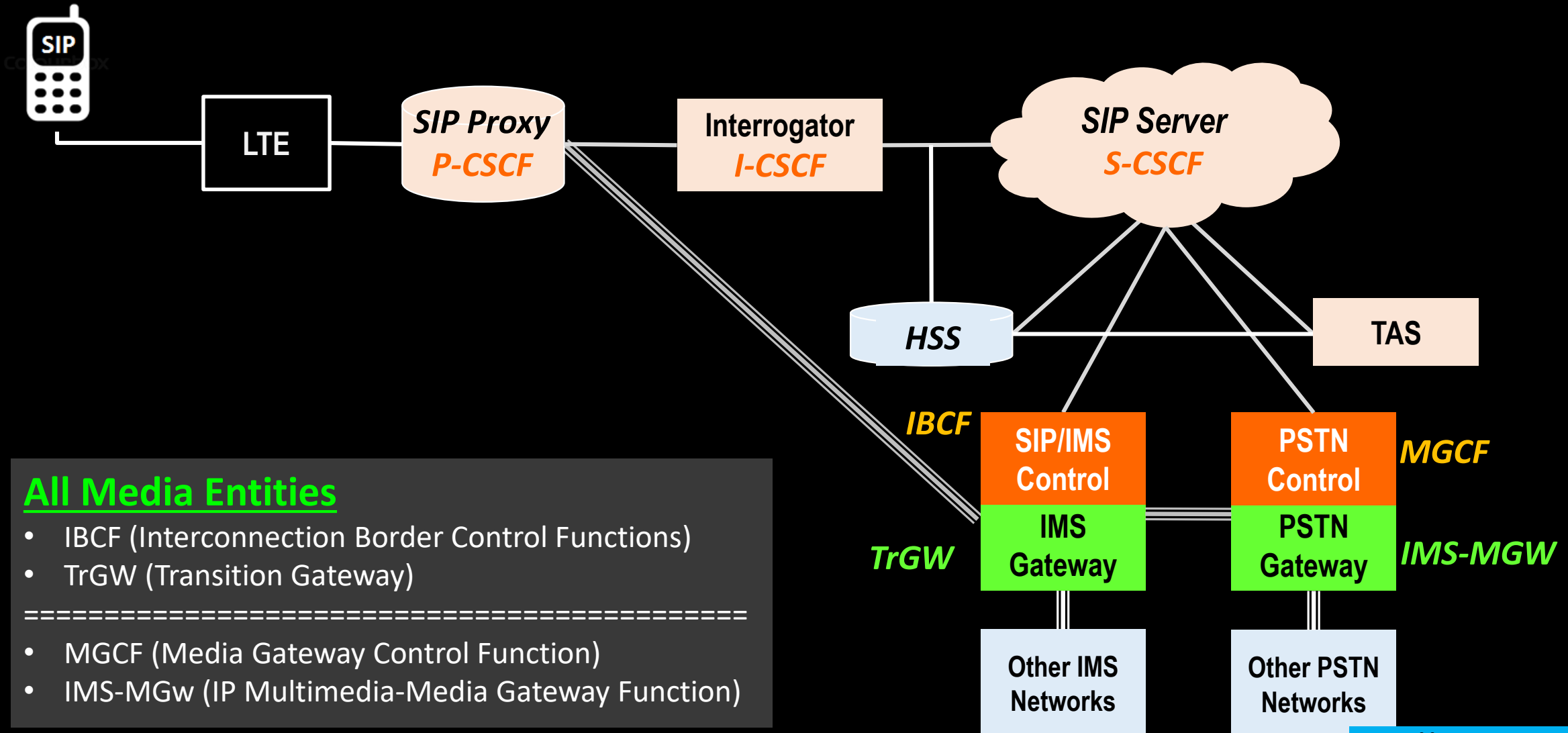
Media Gateway



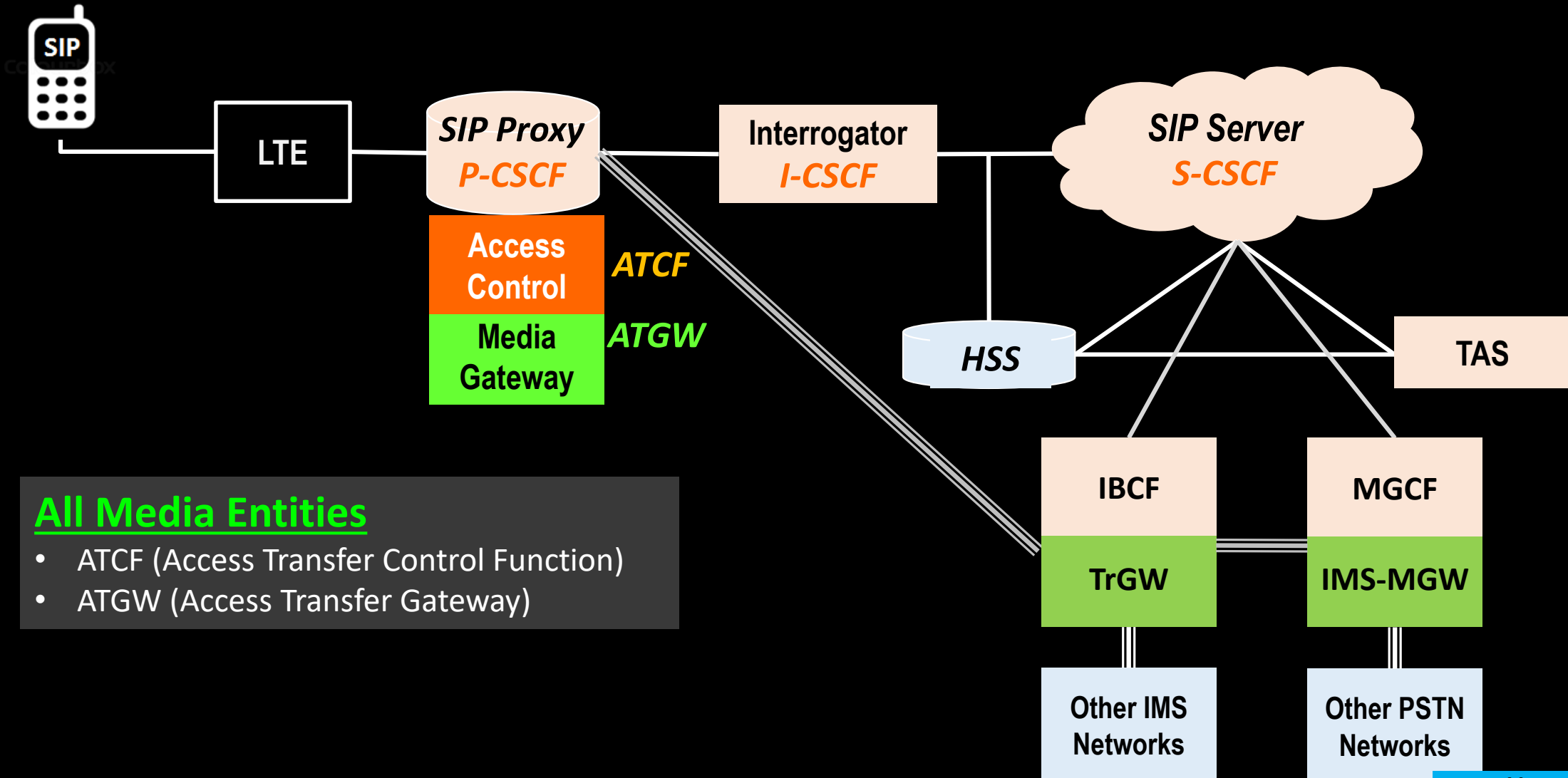
Media Gateway

- Voice Payload handling
- Interface between IP / PSTN Network
- RTP to PCM & Vice versa conversion
- Codec Handling
- Echo cancellation

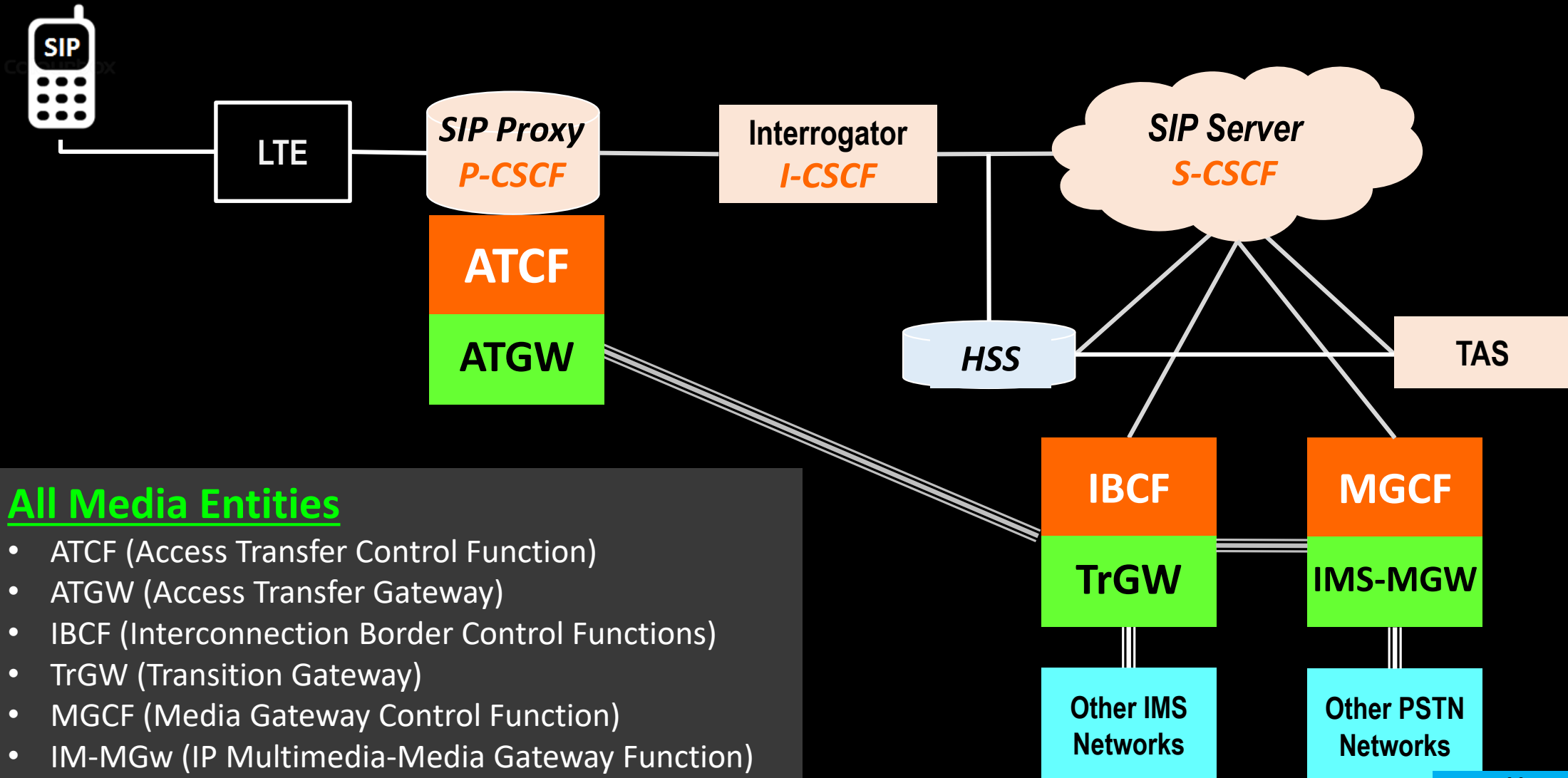
(IBCF & TrGW) , (MGCF & IMS-MGW)



ATCF & ATGW



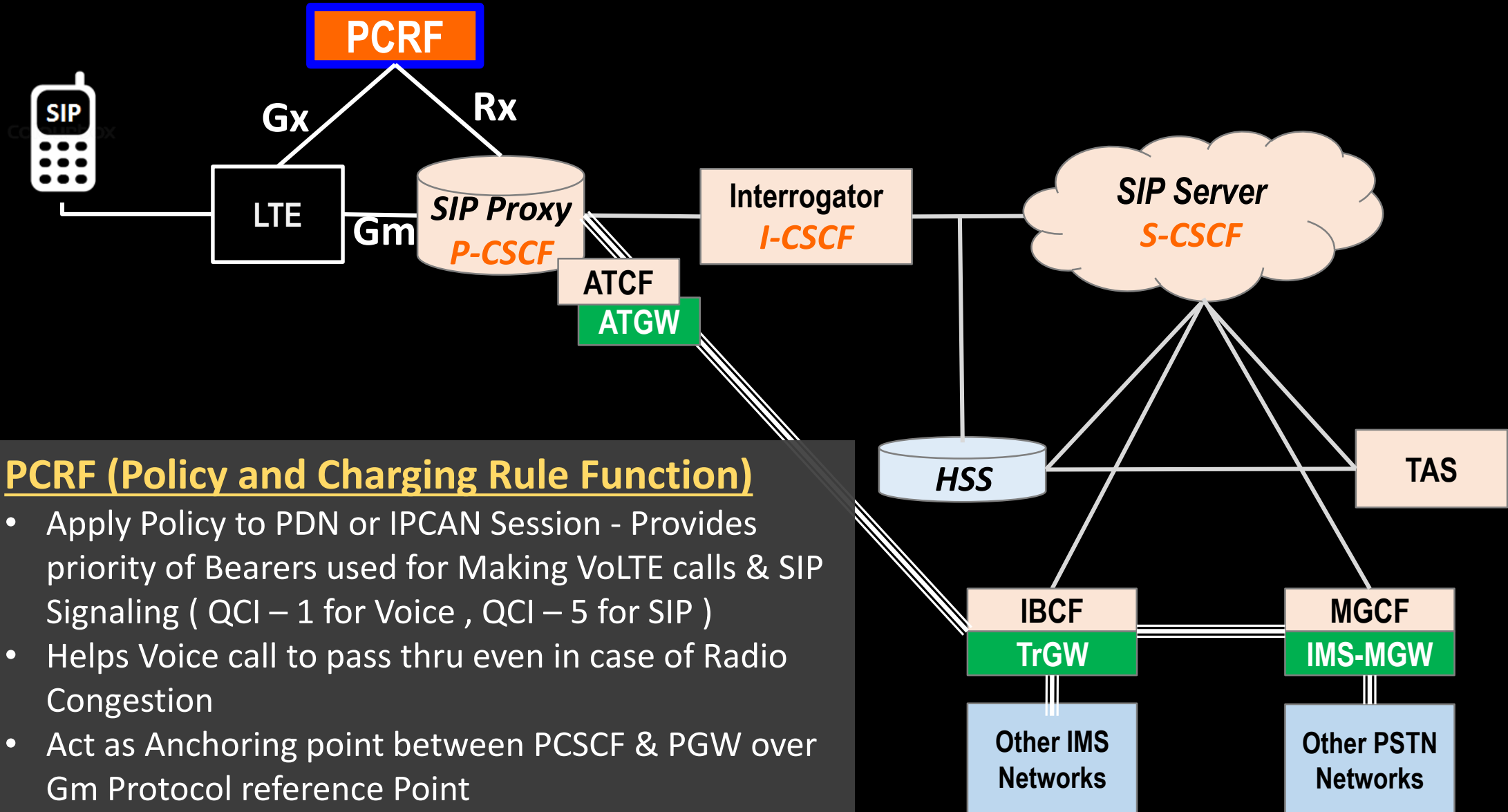
All Media Entities



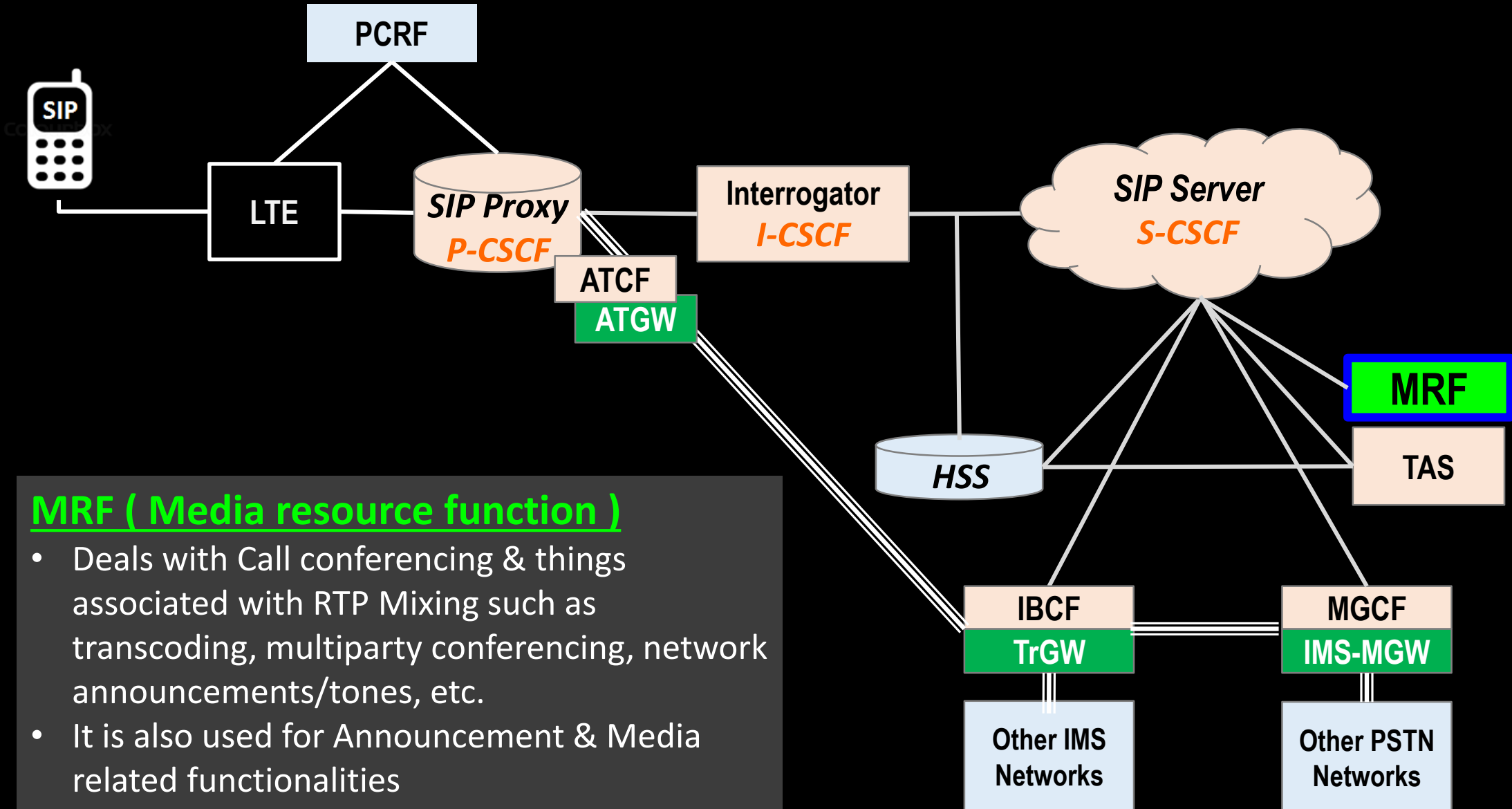
All Media Entities

- ATCF (Access Transfer Control Function)
- ATGW (Access Transfer Gateway)
- IBCF (Interconnection Border Control Functions)
- TrGW (Transition Gateway)
- MGCF (Media Gateway Control Function)
- IM-MGw (IP Multimedia-Media Gateway Function)

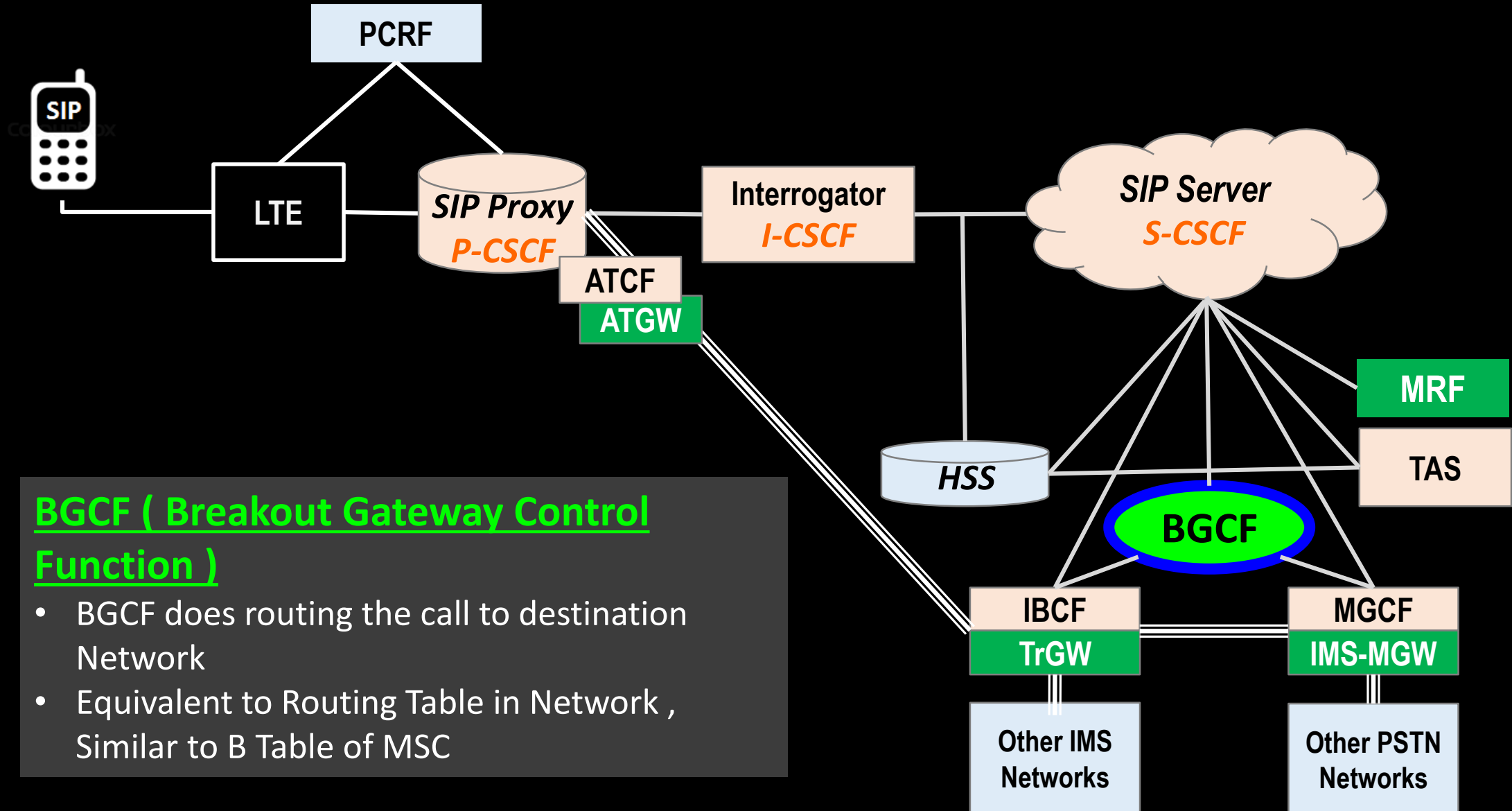
PCRF (Policy and Charging Rule Function)



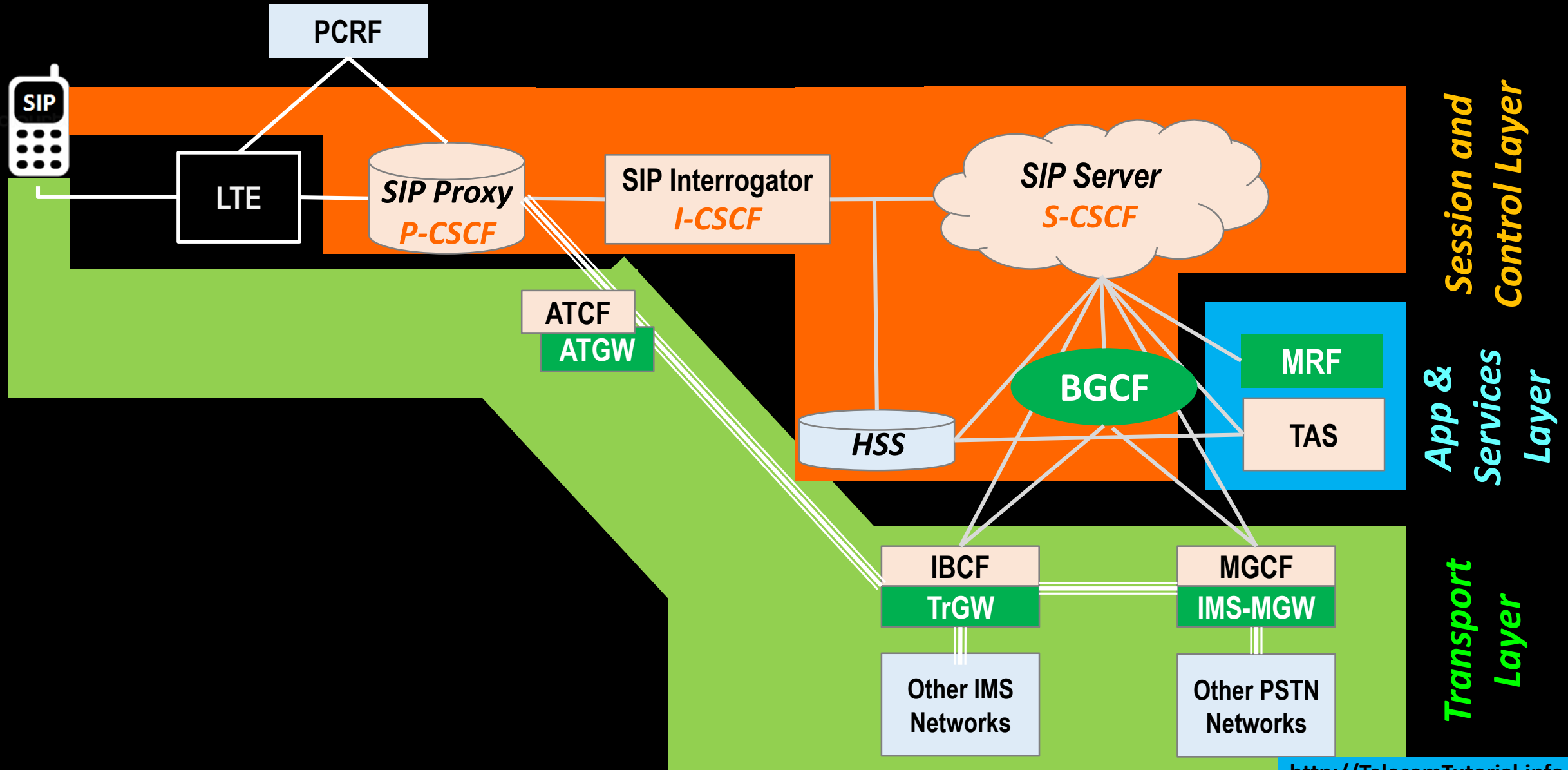
MRF (Media Resource Function)



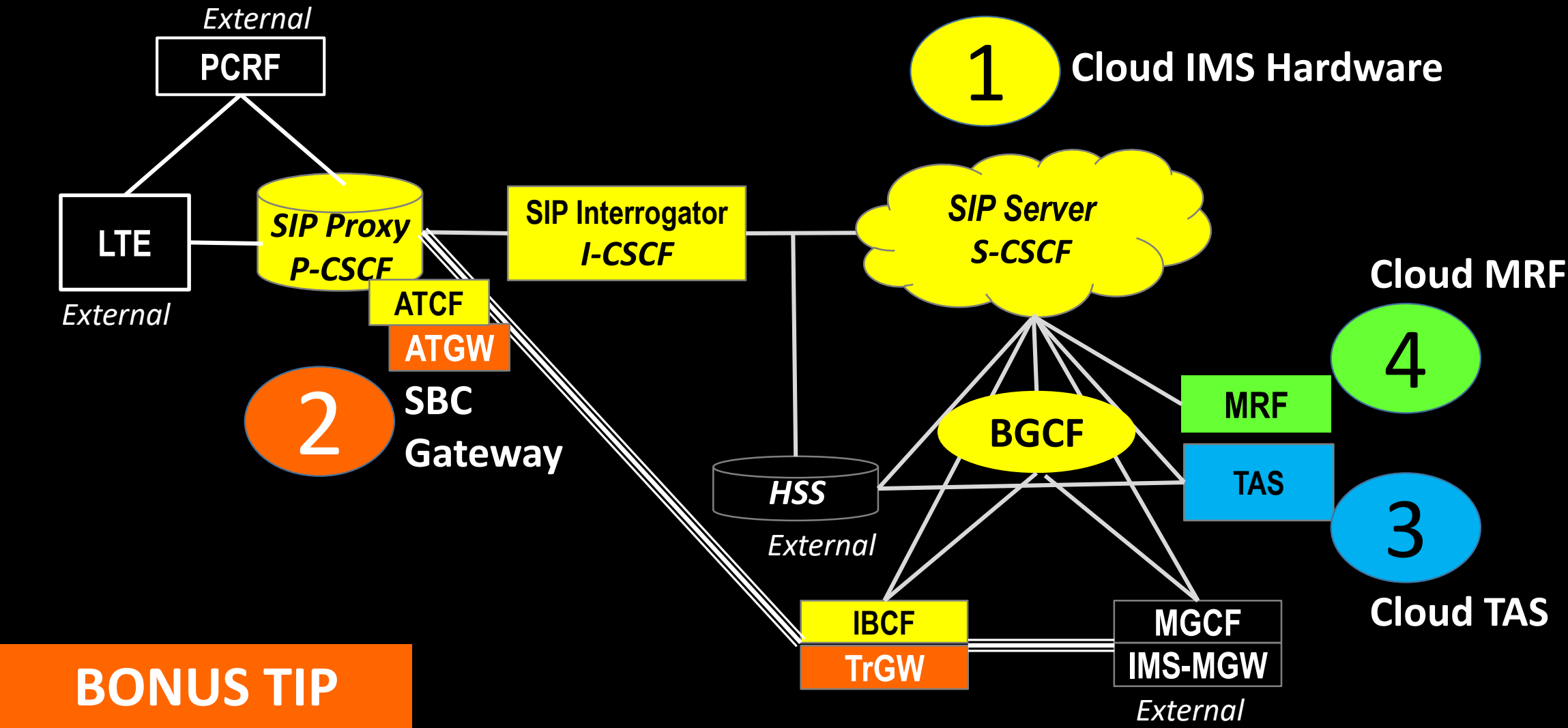
BGCF .. B Number routing Table



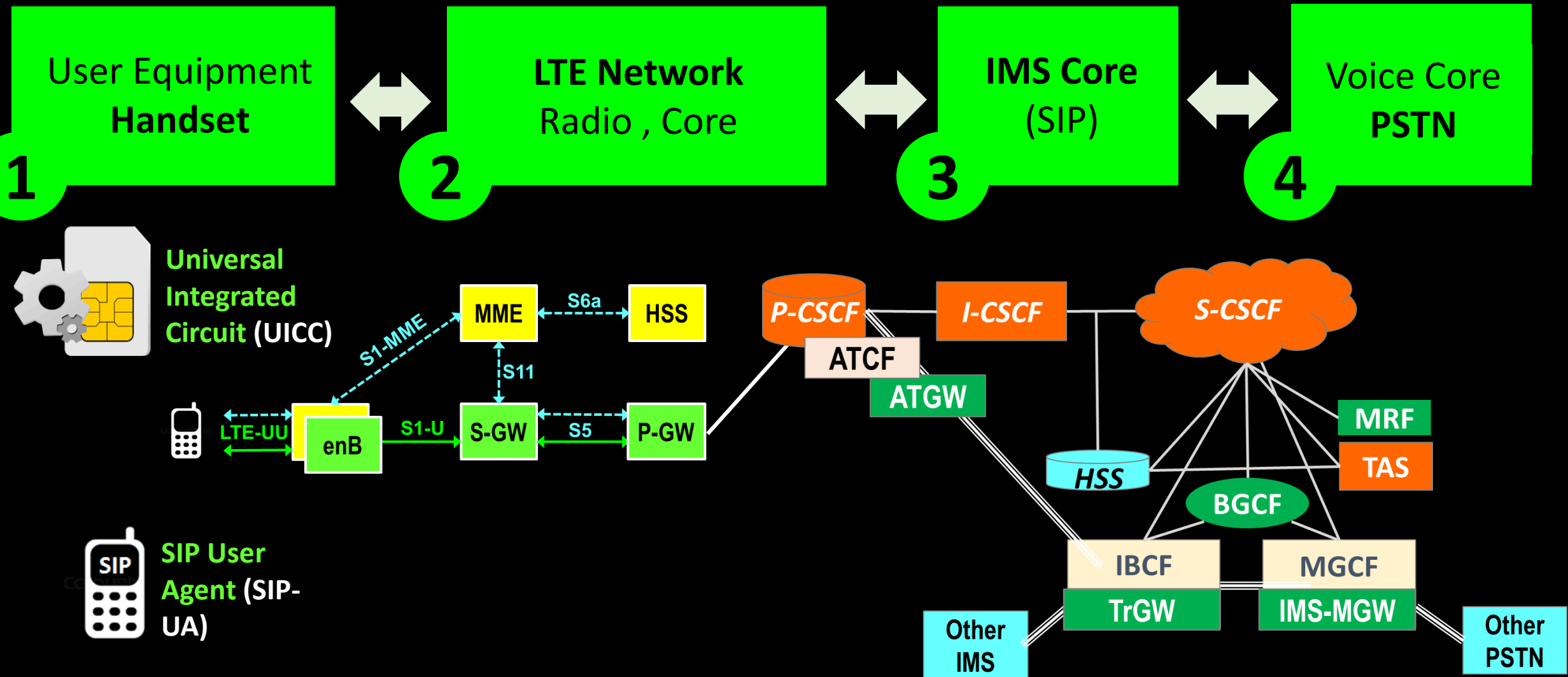
Complete VoLTE IMS Picture



Practical deployment



The Big Picture ..



What if LTE Radio is Congested ??

Priority	QCI	Resource Type	Packet Delay Budget	Packet Error Loss Rate	Example Services
1	5	non-GBR	100ms	10^{-6}	Volte , IMS Signaling
2	1	Guaranteed Bit Rate (GBR)	100ms	10^{-2}	Volte , Conversational Voice
3	3		50ms	10^{-3}	Real Time Gaming, V2X messages
4	2		150ms	10^{-3}	Volte , Conversational Video (Live Streaming)
5	4		300ms	10^{-6}	Non-Conversational Video (Buffered Streaming)
6	6	non-GBR Best Effort	300ms	10^{-6}	Internet Services , Video (Buffered Streaming) TCP-Based (for example, www, email, chat, ftp, p2p and the like)
7	7		100ms	10^{-3}	
8	8		300ms	10^{-6}	
9	9		300ms	10^{-6}	

Changes in Core Network to support VoLTE

- Default & dedicated Bearer Enable
- IMS APN IP Pool
- PGW - SBC / PCSCF Reachability
- Disable Gy for IMS

**Packet Core
SGW / PGW**



- Sv Link – SRVCC
- IMS APN SGW / PGW Selection
- Paging Policy - VoLTE Calls
- QCI – 1,5 Testing & Validation

**Packet Core
MME**



- Sv Link – SRVCC
- IMS & MGW – IP Reachability
- Break in & Break out Calls Config
- Common Codec between MSS & IMS

**Voice Core
MSS / MSC**

BONUS TIP

BONUS TIP



I don't have I-SIM in my Network ?

Do existing 3G or LTE customer using USIM need to go for SIM Swap for availing VoLTE Services ?

USIM itself can be used to Avail VoLTE Services , Deriving the IMPU and IMPI for authentication can be done by VoLTE stack/client residing on the UE (**ISIM is not Mandatory**)



Derived

IMPI :- <IMSI>@ims.mnc<3-digit MNC>.mcc<3-digit MCC>.3gppnetwork.org

Derived

IMPU :- <MSISDN>@ims.mnc<3-digit MNC>.mcc<3-digit MCC>.3gppnetwork.org

Thanks



Vikas Shokeen

Vikas.Shokeen@gmail.com

VISIT MY WEBSITE

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FOR



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