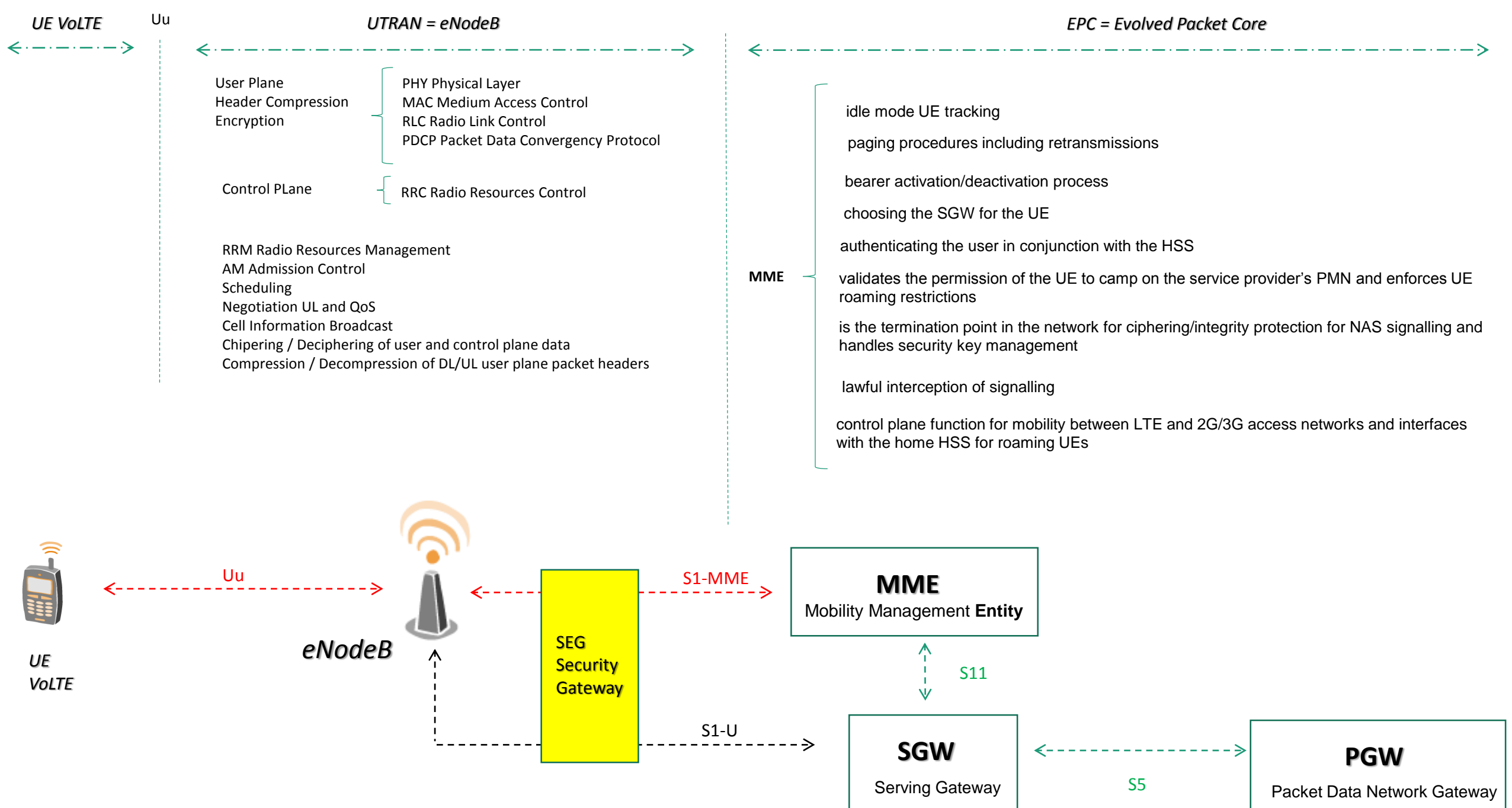


VoLTE reference architectures

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VoLTE reference architecture

Voice over LTE (Long Term Evolution)



EPC = Evolved Packet Core

IMS CORE = IP Multimedia Subsystem

PCRF

- provides policy control decisions and flow based charging controls
- determines how a service data flow shall be treated in the enforcement function
- ensure that the user plane traffic mapping and treatment is in accordance with the user's profile

PWG

- connectivity between the UE and external packet data networks.
- entry and exit point of traffic for the UE
- policy enforcement
- packet filtering for each user
- charging support
- lawful interception and packet screening

H-PCRF
Policy Charging and Rules Function

Rx ←
S9 ←
Gx ←

MME
Mobility Management Entity

S6a

**Diameter Agent
DRA/DEA**

S6a
Cx
Sh

HSS
Home Subscriber Server

HSS

network database that holds both static and dynamic data elements related to subscribers

provides user profile information to the MME and IMS core during UE attach and IMS registration.

S11

Gx

SGW
Serving Gateway

S5

PGW
Packet Data Network Gateway

SGW

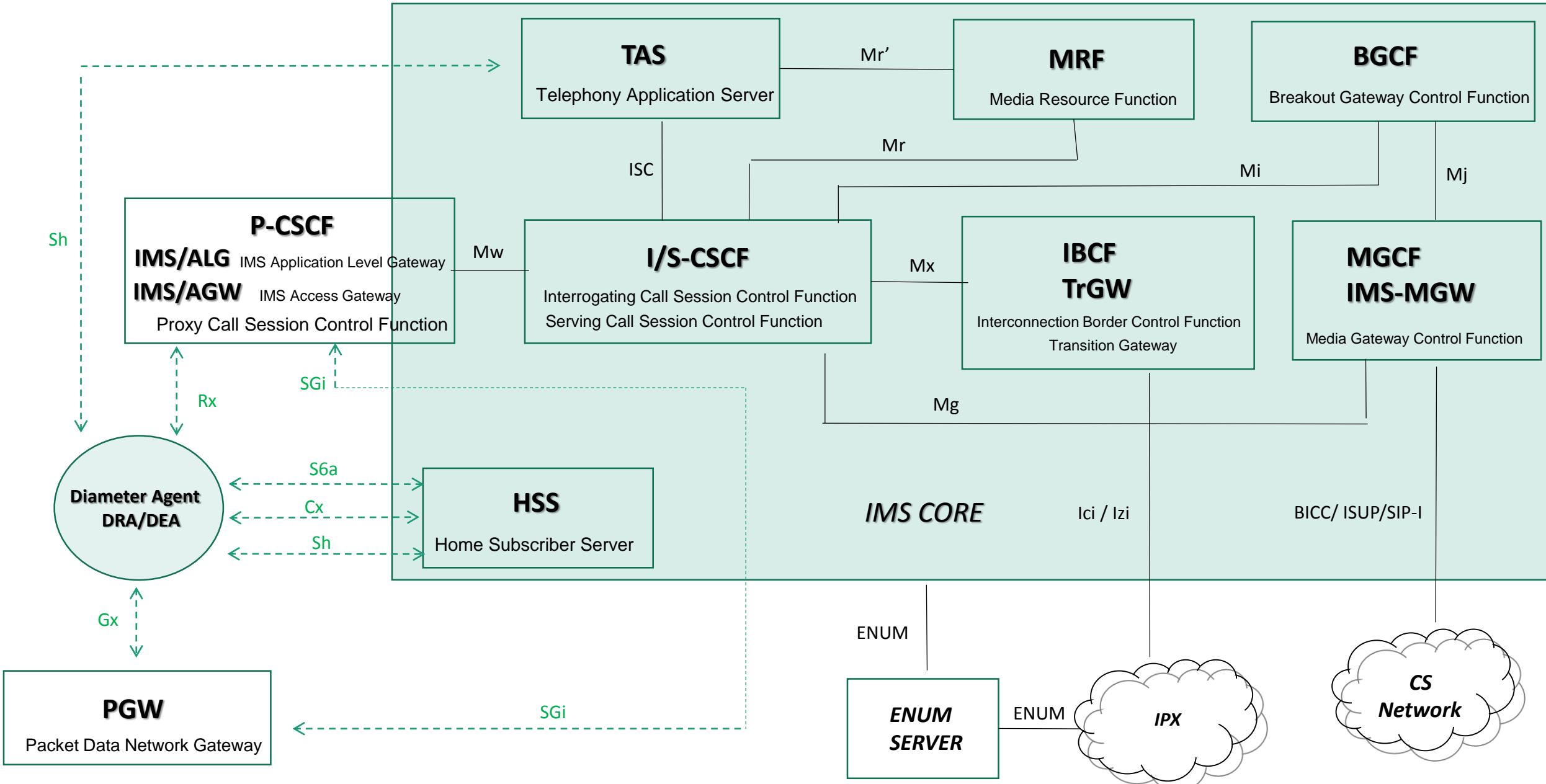
routes and forwards user data packets

anchor for mobility between LTE and other 3GPP technologies

for idle state UEs, the SGW terminates the DL data path and triggers paging when the DL data arrives for the UE

manages and stores UE contexts and performs replication of the user traffic in case of lawful interception

IMS CORE = IP Multimedia Subsystem



P-CSCF

- is the initial point of contact for session signalling for the IMS-enabled VoLTE UE
- behaves as a SIP proxy by forwarding SIP messages between the UE and the IMS Core Network
- maintains the security associations between itself and the VoLTE UE
- incorporates the Application Function aspect of PCC to enable binding of the IMS session with the bearer for applying dynamic policy and receiving notifications of bearer level events
- may be implemented in an Access Session Border Controller which may also incorporate the IMS-ALG/IMS-AGW.

I-CSCF

- is the contact point within an operator's network for all connections destined to a user of that network
- on IMS registration, it interrogates the HSS to determine which suitable S-CSCF to route the request for registration
- for mobile terminating calls, it interrogates the HSS to determine which S-CSCF the user is registered on

S-CSCF

- provides session set-up
- provides session tear-down
- session control and routing functions
- generates records for billing purposes for all sessions under its control
- invokes Application Servers based on IFCs received from the HSS
- acts as SIP registrar for VoLTE UEs that the HSS and I-CSCF assign to it
- queries the HSS for the applicable subscriber profiles and handles calls involving these end points once they have been registered

TAS

- is an IMS Application Server providing support for a minimum set of mandatory MultiMedia Telephony (MMTel) services as defined by 3GPP e.g. supplementary service functionality, and profiled within GSMA PRD

MRF

- is a common media resource function, for use by IMS Application Servers and I/S-CSCFs, to provide media plane processing independent of application types, e.g transcoding, multiparty conferencing, network announcements/tones, etc. under the control of IMS Application Servers (VoLTE AS) as well as basic media processing functions to CSCFs
- The control plane interfaces to MRFs are defined by the 3GPP references Mr, Mr', and Cr interfaces (SIP/SDP and XML encoded media service requests) while the media plane interfaces to MRFs are defined by 3GPP reference Mb for RTP/RTCP transport

**IMS / ALG
IMS / AGW**

- is located with the P-CSCF
- is responsible for the control/media plane at the access point to the IMS network
- provides functions for Gate Control & Local NAT, IP realm indication and availability, Remote NAT traversal support, Traffic Policing, QoS Packet Marking, IMS Media Plane Security, etc.

**MGCF
IMS-MGW** is responsible for the control/media plane interworking at the network interconnect point to circuit-switched networks
This includes interworking to CS Networks based on BICC/ISUP/SIP-I and may include transcoding of the media plane

BGCF is responsible for determining the next hop for routing of SIP messages
this determination is based on information received within the SIP/SDP and routing configuration data (which can be internal configuration data or ENUM/DNS lookup)
for CS Domain terminations, the BGCF determines the network in which CS domain breakout is to occur and selects the appropriate MGCF
for terminations in peer IMS networks, the BGCF selects the appropriate IBCF to handle the interconnect to the peer IMS domain.
may also provide directives to the MGCF/IBCF on which Interconnect or next network to select
such directives may be given by inclusion of a route header pointing to the next network ingress node

**IBCF
TrGW** is responsible for the control/media plane at the network interconnect point to other PMNs
may be implemented in an Interconnect Session Border Controller

Additional Network Functionality

Diametr Agent is a network element that controls Diameter signalling, enabling the seamless communication and control of information between network elements within LTE or IMS networks and across network borders
reduces the mesh of Diameter connections that negatively impacts network performance, capacity and management

ENUM enables translation of E.164 numbers to SIP URIs using DNS to enable message routing of IMS sessions
in the above figure, a single ENUM Server is shown that is accessible from either PMN as well as IPX

IPX IP Packet Exchange transit network providing an interconnect capability between PMNs










**SEG
Security Gateway** may be used to originate and terminate secure associations between the eNodeB and the Evolved Packet Core network
IPsec tunnels are established with pre-shared security keys, which can take a number of different formats
IPsec tunnels enforce traffic encryption, for added protection, according to the parameters exchanged between the two parties during tunnel setup
enables secure communications between the eNodeB and EPC across the S1-MME, S1-U and X2 interfaces

VoLTE reference interfaces

Voice over LTE (Long Term Evolution)

LTE-Uu Interface (UE – eNodeB)	<p>LTE-Uu is the radio interface between the eNodeB and the User Equipment</p>
S1-MME Interface (UE – MME)	<p>S1-MME is the control plane interface between EUTRAN and MME. The protocols used over this interface are the Non-access stratum protocols (NAS)</p>
S1AP Interface (eNodeB – MME)	<p>S1AP is the S1 application protocol between the EUTRAN and MME</p>
S1-U Interface (eNodeB – SGW)	<p>S1-U is the interface between EUTRAN and the S-GW for per-bearer user plane tunnelling and inter-eNodeB path switching during handover the transport protocol over this interface is GPRS Tunnelling Protocol-User plane (GTPv1-U)</p>
X2 Interface (eNodeB – eNodeB)	<p>X2 is the interface between eNodeB's and is used for X2-based Handover and some Self-Organising Network (SON) capabilities</p>
S5 Interface (SGW – PGW)	<p>the S5 interface provides user plane tunnelling and tunnel management between SGW and PGW the SGW and PGW may be realized as a single network element in which case the S5 interface is not exposed</p>
S6a Interface (HSS – MME)	<p>the interface enables the transfer of subscription and authentication data for authenticating/authorizing user access</p>
S9 Interface (H-PCRF – V-PCRF)	<p>the S9 interface provides policy and charging rules and QoS information between the Home PMN and the Visited PMN in order to support PCC roaming related functions protocol used on the S9 interface is Diameter S9 interface is optional and deployed by bilateral agreement between the Home and Visited Operators The policy and charging rules for roaming subscribers may be realised by local configuration data in the Visited PCRF</p>
S10 Interface (MME – MME)	<p>the S10 interface provides for MME – MME information transfer and is used to enable MME relocation protocol used on the S10 interface is GPRS Tunnelling Protocol-Control plane (GTPv2-C)</p>

S11 Interface (MME – SGW)	<p>S11 interface is between the MME and S-GW to support mobility and bearer management protocol used on the S11 interface is GPRS Tunnelling Protocol-Control plane (GTPv2-C)</p>
Gx Interface (PCRF – PGW)	<p>Gx interface is between the PCRF and the PGW, allowing the PCRF direct control over the policy enforcement functions of the PGW protocol used on the Gx interface is Diameter</p>
Rx Interface (PCRF – P-CSCF)	<p>Rx interface is between the appropriate Application Function (the P-CSCF in the case of VoLTE) and the PCRF allowing the Application Function to request the application of an appropriate policy for a session protocol used on the Rx interface is Diameter</p>
SGi Interface (PGW – P-CSCF)	<p>SGi interface is between the PGW and the P-CSCF within the IMS Network the Gm reference point from the UE to P-CSCF is tunnelled within SGi for VoLTE services SGi is IP-based and is defined within 3GPP</p>
Cx Interface (I/S-CSCF – HSS)	<p>Cx interface is between the I/S CSCF and HSS to enable IMS registration and passing of subscriber data to the S-CSCF protocol used on the Cx interface is Diameter</p>
Sh Interface (VoLTE AS – HSS)	<p>Sh interface is between the VoLTE Application Server and HSS to enable service and subscriber related information to be passed to the Application Server or stored in the HSS protocol used on the Sh interface is Diameter</p>
Gm Interface (UE – P-CSCF)	<p>Gm interface is between the UE and the P-CSCF and enables connectivity between the UE and the IMS network for registration, authentication, encryption, and session control protocol used on the Gm interface is SIP/SDP</p>
Ut Interface (UE – VoLTE AS)	<p>Ut interface is between the UE and the VoLTE Application Server and allows user configuration of the supplementary services specified for VoLTE service protocol used on the Ut interface is XCAP</p>
Mx Interface (x-CSCF – IBCF)	<p>Mx interface is between CSCF and IBCF used for the interworking with another IMS network protocols used on the Mx interface are SIP and SDP</p>

Mw Interface (x-CSCF – x-CSCF)	 <p>Mw interface is between a x-CSCF and another x-CSCF within the IMS core network (e.g. P-CSCF to I/S-CSCF) protocols used on the Mw interface are SIP and SDP</p>
Mg Interface (xCSCF – MGCF)	 <p>Mg reference point allows the MGCF to forward incoming SIP/SDP messages that the MGCF has interworked from the CS Network to the CSCF protocols used on the Mg interface are SIP and SDP</p>
Mi Interface (xCSCF – BGCF)	 <p>Mi reference point allows the Serving CSCF to forward the SIP/SDP messages to the Breakout Gateway Control Function for the purpose of MGCF selection for interworking with CS networks protocols used on the Mi interface are SIP and SDP</p>
Mj Interface (BGCF – MGCF)	 <p>Mj reference point allows the Breakout Gateway Control Function to exchange SIP/SDP messages with the BGCF for the purpose of interworking with CS networks protocols used on the Mj interface are SIP and SDP</p>
ISC Interface (S-CSCF –TAS)	 <p>ISC interface is between S-CSCF and Telephony Application Server and is used to interact with the MMTel supplementary services implemented on the TAS protocol used on the ISC interface is SIP</p>
Mr Interface (S-CSCF – MRF)	 <p>Mr interface is between the S-CSCF and the MRF to allow interaction with the media resource for specific supplementary services (e.g. conference call) protocol used on the Mr interface is SIP/SDP</p>
Mr' Interface (TAS – MRF)	 <p>Mr' interface is between the Telephony Application Server and the MRF to allow interaction with the media resource for specific supplementary services (e.g. conference call) protocol used on the Mr' interface is SIP/SDP</p>
Cr Interface (TAS – MRF)	 <p>Cr interface is between the Telephony Application Servers and the MRF. And is used for sending/receiving XML encoded media service requires (Cr) which are served by the MRF</p>
Mb Interface (media bearer)	 <p>Mb interface is the media bearer plane between UEs and network elements that interact with the bearer (e.g. MRF) protocol is based on symmetric RTP/RTCP over UDP</p>

Ici Interface (IBCF – IBCF)

Ici interface is between an IBCF and another IBCF or I-CSCF belonging to a different IMS network
protocols used on the Ici interface are SIP and SDP

Izi Interface (TrGW – TrGW)

Izi interface is between a TrGW and another TrGW or media handling node belonging to a different IMS network
protocols used on the Izi interface are RTP and MSRP