

IMS: A Mobile Device Perspective

Introduction

Most discussions of IMS refer to the all-IP network and the massive levels of convergence it will deliver: convergences of access technologies, services and control functions. In describing the IMS subsystem itself, most of the attention is given to the large-scale upgrades required near the heart of the network.

However, developers working on cellular devices require a different viewpoint than those working at higher layers of the protocol stack. In that light, this article presents a brief overview of the IMS subsystem from the perspective of the mobile device.

IMS Architecture

The IMS-capable LTE network can be described as the combination of User Equipment (UE), transport, control functions and applications. Figure 1 depicts a simplified view of the related network from the point of view of the UE.

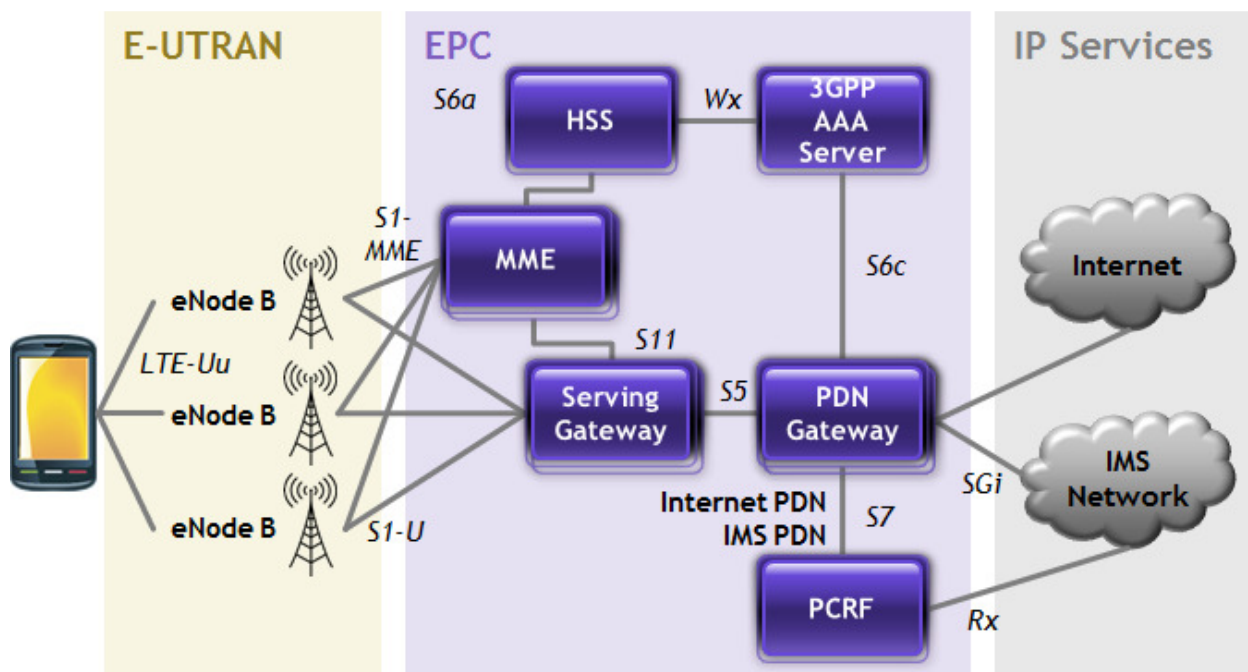


Figure 1 - IMS with the LTE Evolved Packet Core

The UE

The UE is the terminal of the IMS architecture. In IMS-capable systems, the UE contains a Session Initiation Protocol (SIP) *user agent* or *UA* and a *Universal Integrated Circuit Card (UICC)*.

In general, the SIP UA can be thought of as providing typical telephone functionality (e.g. dial, answer, hold, transfer, etc.) via two separate roles:

- UAC (User Agent Client) – Sends SIP requests
- UAS (User Agent Server) – Receives requests and sends SIP responses

SIP itself is a protocol (defined in the IETF's RFC 3261) used for IMS signaling and session negotiation. It is not used for actual media data transport; this is handled by a separate protocol called *Real-time Transport Protocol (RTP)*.

The UICC is a smart card that contains one or more applications. In an IMS-capable system the most relevant application is the *IP Multimedia Services Identity Module (ISIM)*. It includes a permanently allocated global identity called the *IP Multimedia Private Identity (IMPI)*, the home operator's domain name and the *IP Multimedia Public Identity (IMPU)*, which is used to request communication with another user. A unique concept in IMS is that a single device may have multiple IMPUs, and multiple devices may share an IMPU.

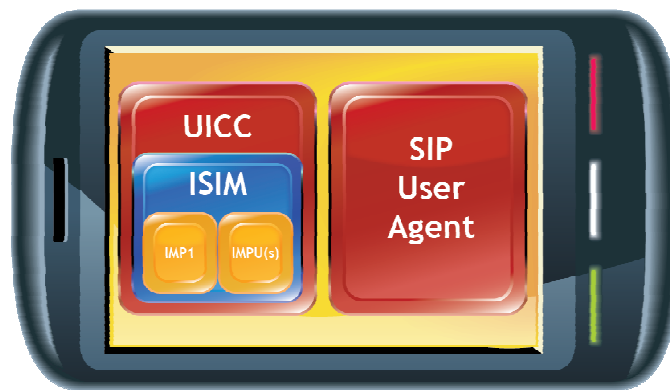


Figure 2 - The IMS-capable UE

The Evolved Packet Core (EPC)

The EPC used in LTE includes the backhaul/backbone and the access network. The EPC implements an expansive upgrade to networking in order to support IMS, but from the limited perspective of the UE the important entities include the *Public Data Network Gateway (PDG or PDN-GW)* and the *Policy and Charging Rules Function (PCRF)*.

The PDN-GW offers access to public digital networks. In a typical IMS-ready network, separate PDN-GWs offer access to the Internet and the IMS network. In LTE networks, the PDN-GW also serves as a mobility anchor point for users moving between LTE services and non-3GPP services.

The PCRF determines what types of traffic (e.g. games, VoLTE) are allowed under what conditions, and also determines how to account for this traffic for billing purposes.

The IMS Core

The IMS core provides session and media control. Much has been written about this complex and detailed subsystem, but looking at it from the UE's point of view, key elements include:

- Media gateways
- Home Subscriber Server (HSS) - a database that maintains user profile and location information and is responsible for name/address resolution
- Subscriber Location Function (SLF) – tracks and assigns HSSs in a home network
- Media Gateway Control Function (MGCF) – controls media gateways, converts codecs where necessary and may serve as a breakout to a circuit-switched network.
- Breakout Gateway Control Function (BGCF) - If an MGCF does not include the breakout to a circuit-switched network, that functionality is performed by the BGCF
- Call Session Control Function (CSCF) - controls multimedia sessions and is made up of three separate entities:
 - Proxy CSCF (P-CSCF) - the initial point of contact from any SIP User Agent, acting as the UE's proxy for the entire network
 - Serving CSCF (S-CSCF) - a decision point as to whether or not the user's SIP messages will be forwarded to application servers
 - Interrogating CSCF (I-CSCF) - initiates the assignment of a user to an S-CSCF (by querying the HSS) during registration, acting as the IMS core's proxy to each individual user

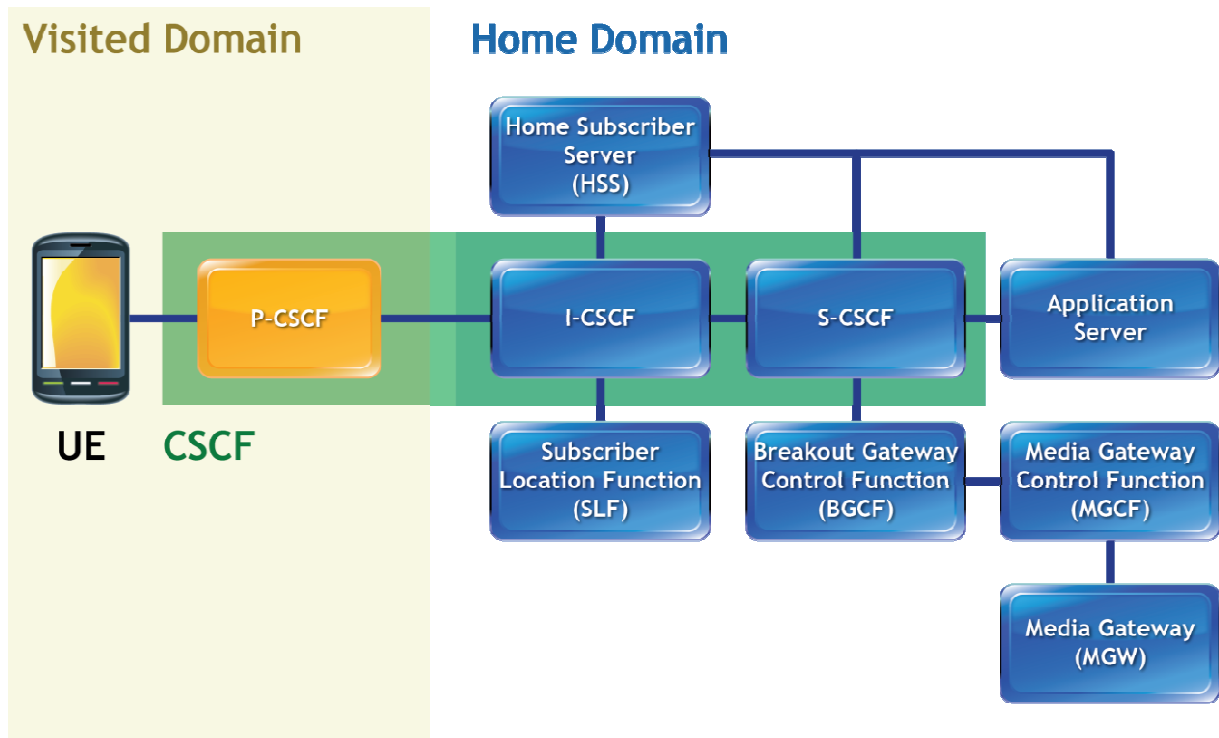


Figure 3 - Interaction between the CSCF, HSS and other elements

Conclusion

IMS is more complex than can be discussed in a short overview, especially when considering the impact of this subsystem on delivering tomorrow's voice services using Voice over LTE (VoLTE).

This article provided a brief introduction to the IMS network, targeted toward RF engineers who are or may be working on mobile device design. To learn more about the subscriber-side perspective of the IMS-ready network, the protocols involved or the implementation of VoLTE, please visit www.spirent.com to download informational papers: [IMS Architecture from the Perspective of LTE User Equipment](#) and [IMS Procedures and Protocols: The LTE User Equipment Perspective](#).