

S-72.333 Postgraduate Course in Radio Communications.

Interoperability between 3G and WLAN using IMS

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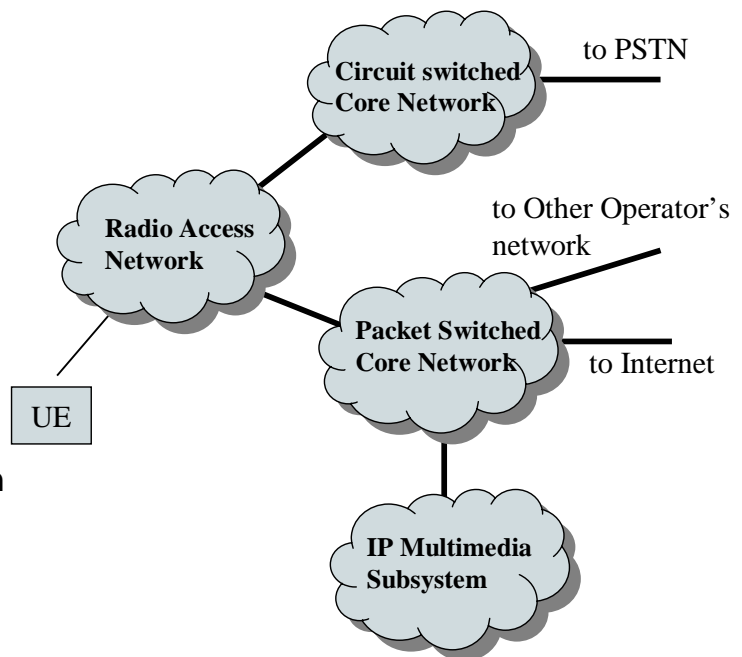


Presentation outline

- Introduction to IMS
- Benefits & Drivers of IMS
- History of IMS
- Protocol Stacks in 2G/3G and IMS
- High-level network Architecture
- Functional entities in IMS

What is IMS (IP Multimedia Subsystem) ?

- IMS is a new concept that enhances the functionality of packet switched mobile network.
- IMS is specified in the 3GPP Release 5 (2002). The basic architecture is described in 3GPP TS 23.002 (<http://www.3gpp.org>)
- Basically, IMS helps to handle any IP-based services and applications in mobile IP-based network.
- IMS is based on the utilisation of SIP Protocol

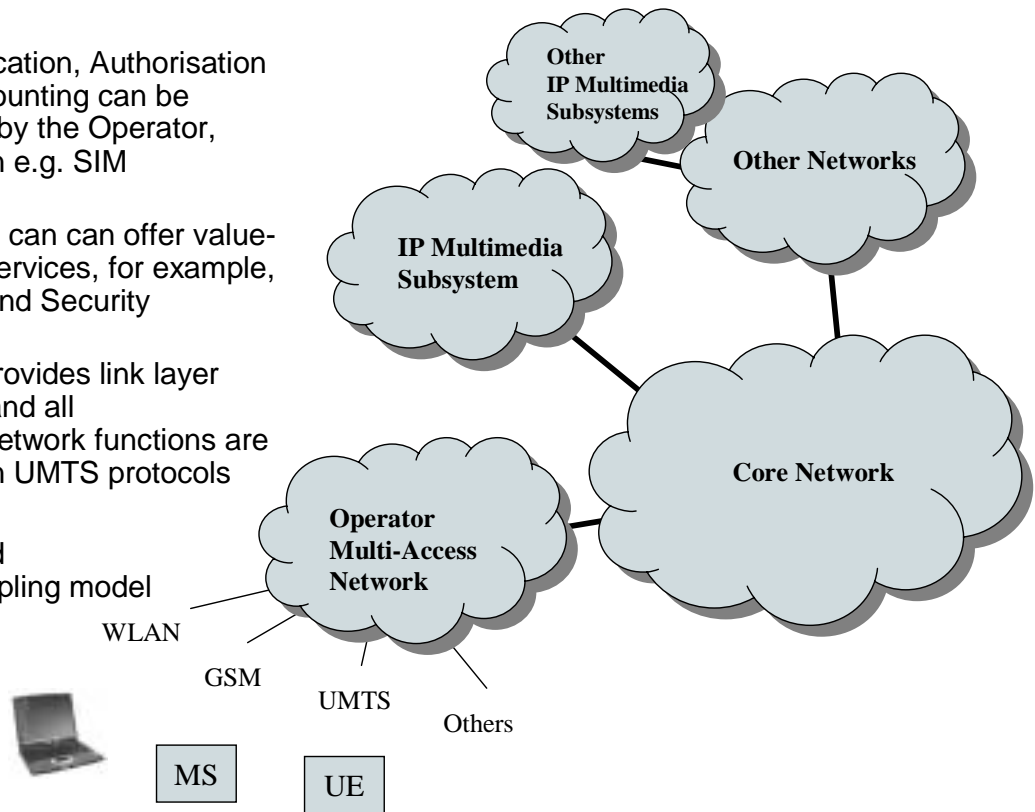


Benefits of the IMS

- IMS is access independent
 - IMS can co-operate with any mobile network (or fixed) that includes Packet Switched functionality. Examples of such systems are GPRS, UMTS, WLAN, CDMA2000, etc. Furthermore, IMS can be seen as a co-operation enabler between various networks and systems.
- Easy service implementation
 - IMS can enable or ease the implementation of any IP based services or applications. Examples of such services include Voice over IP (VoIP), Push to talk Over Cellular (PoC), Multiparty Gaming, Video/Audio Conferencing, Content Sharing, etc
- Support for mobility
 - IMS can be used to combine terminal mobility (as provided by mobile network) and user mobility (as provided by IMS using SIP).

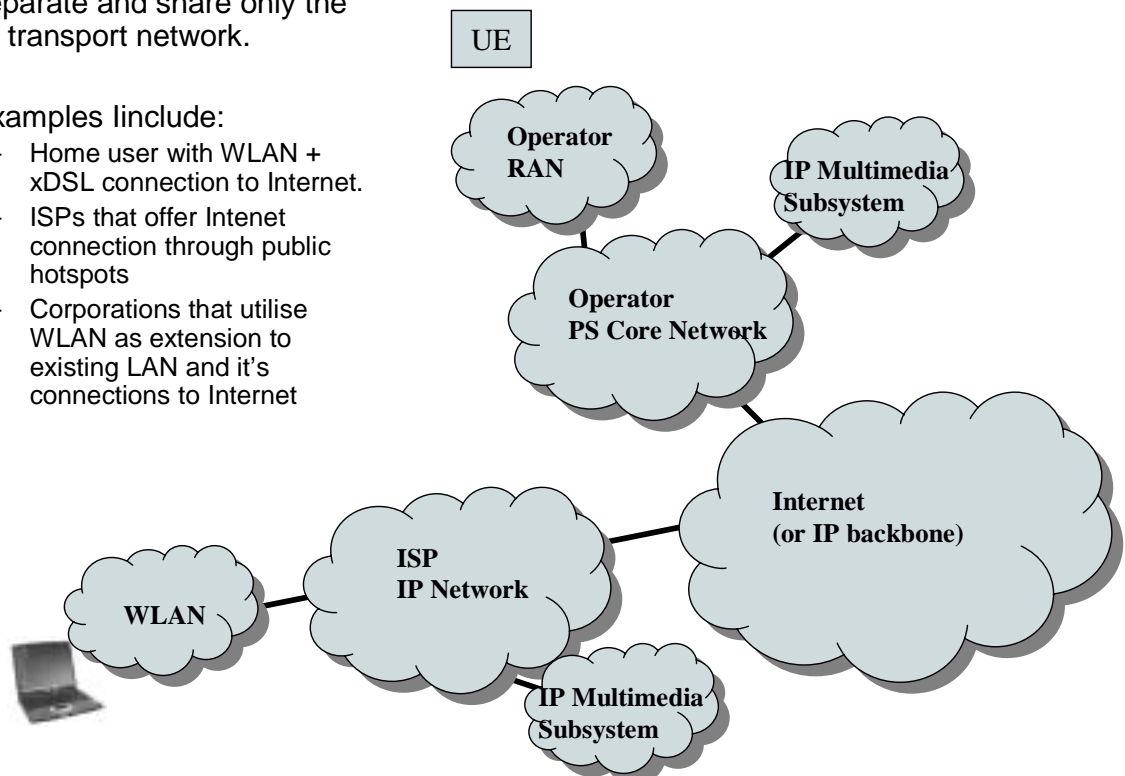
Scenario 1: Tight coupling between WLAN and 3G

- Authentication, Authorisation and Accounting can be handled by the Operator, based on e.g. SIM
- Operator can offer value-adding services, for example, in QoS and Security
- WLAN provides link layer service and all control/network functions are based on UMTS protocols
- So called tight-coupling model



Scenario 2: Loose coupling between WLAN and 3G

- 3G and WLAN networks are separate and share only the IP transport network.
- Examples include:
 - Home user with WLAN + xDSL connection to Internet.
 - ISPs that offer Internet connection through public hotspots
 - Corporations that utilise WLAN as extension to existing LAN and it's connections to Internet



3GPP Evolution

Digital system

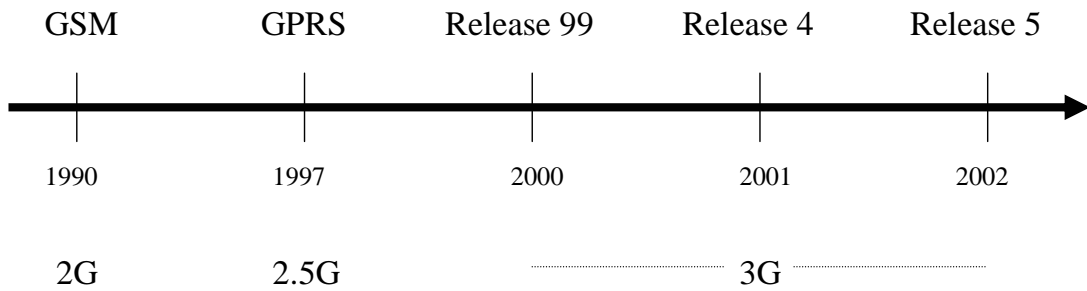
TDMA air interface

Packet Switched Core Network
Support for IP-based services

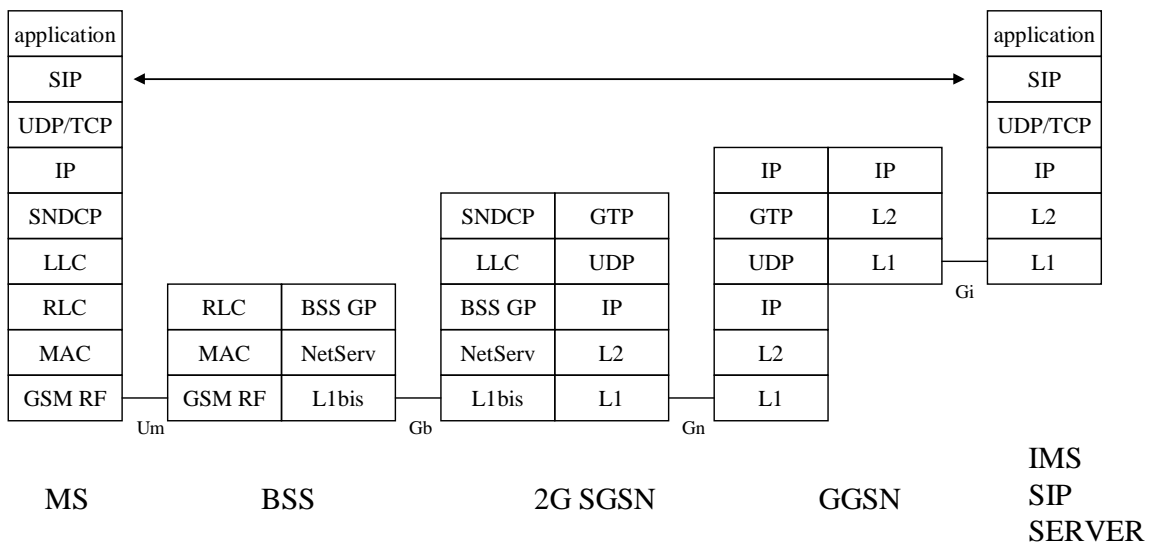
CDMA based air interface

Separation of User and Control Plane, GERAN

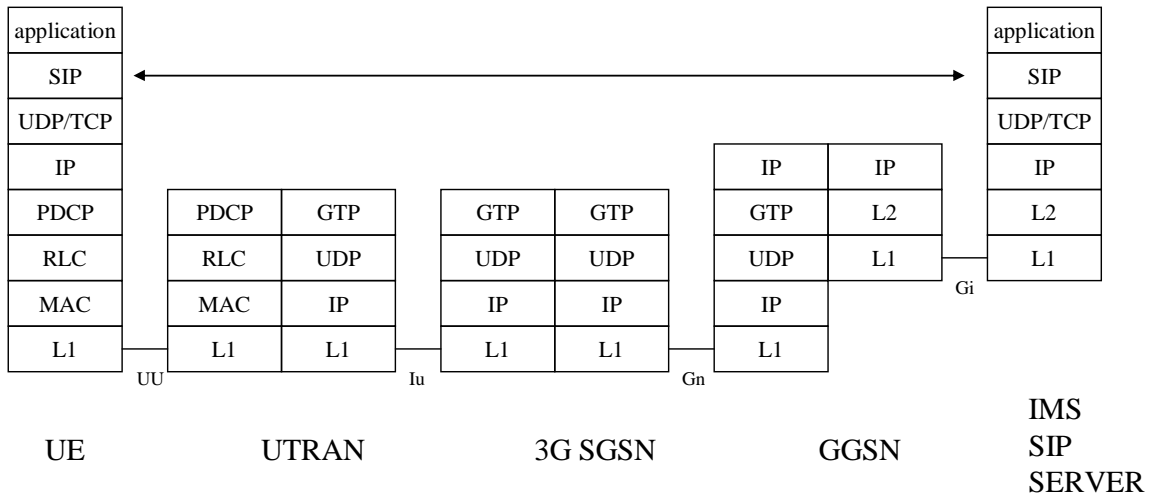
Introduction of IP Multimedia Subsystem



Protocol Stack for 2G

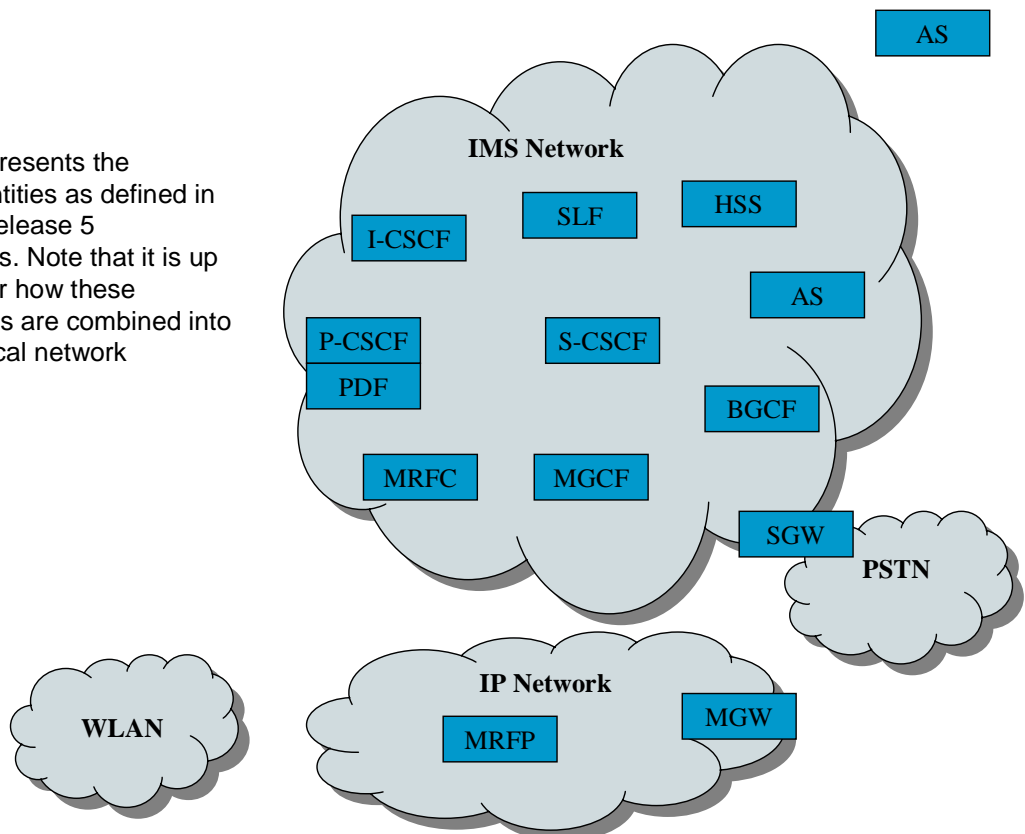


Protocol Stack for 3G



Functional Entities in the IMS environment

This figure presents the functional entities as defined in the 3GPP Release 5 specifications. Note that it is up to the vendor how these functionalities are combined into actual physical network elements



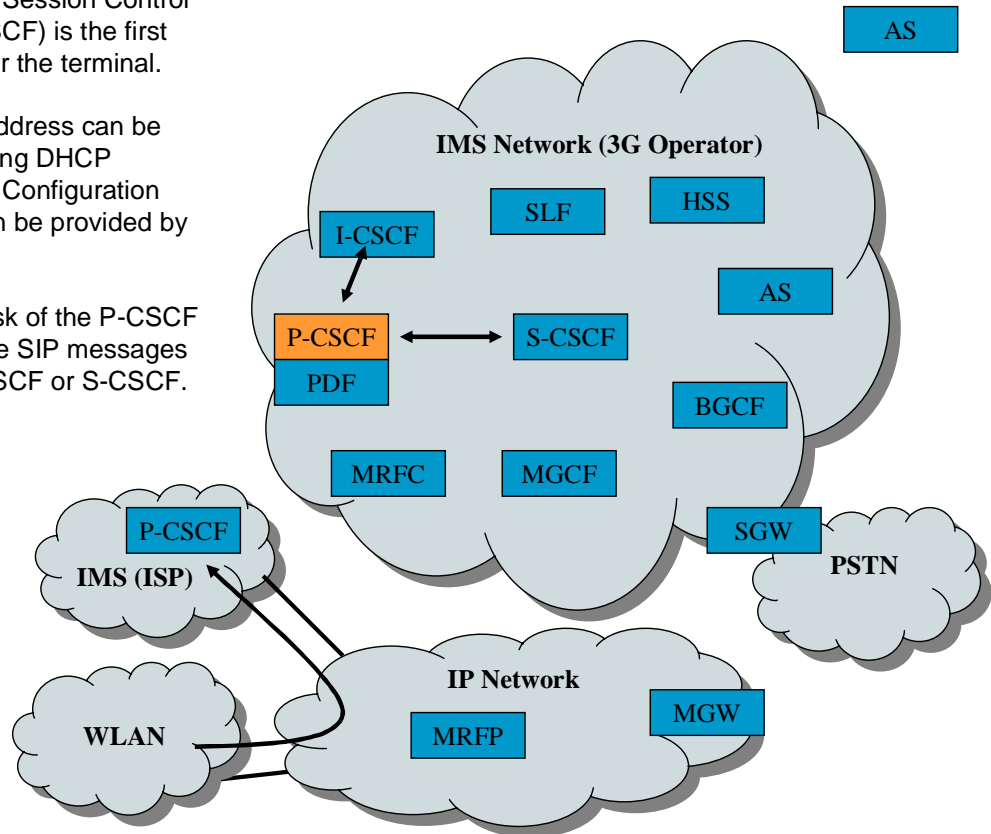
Functional Entities in the IMS environment

The Proxy Call Session Control Function (P-CSCF) is the first contact point for the terminal.

The P-CSCF address can be obtained by using DHCP (Dynamic Host Configuration Protocol), it can be provided by GGSN.

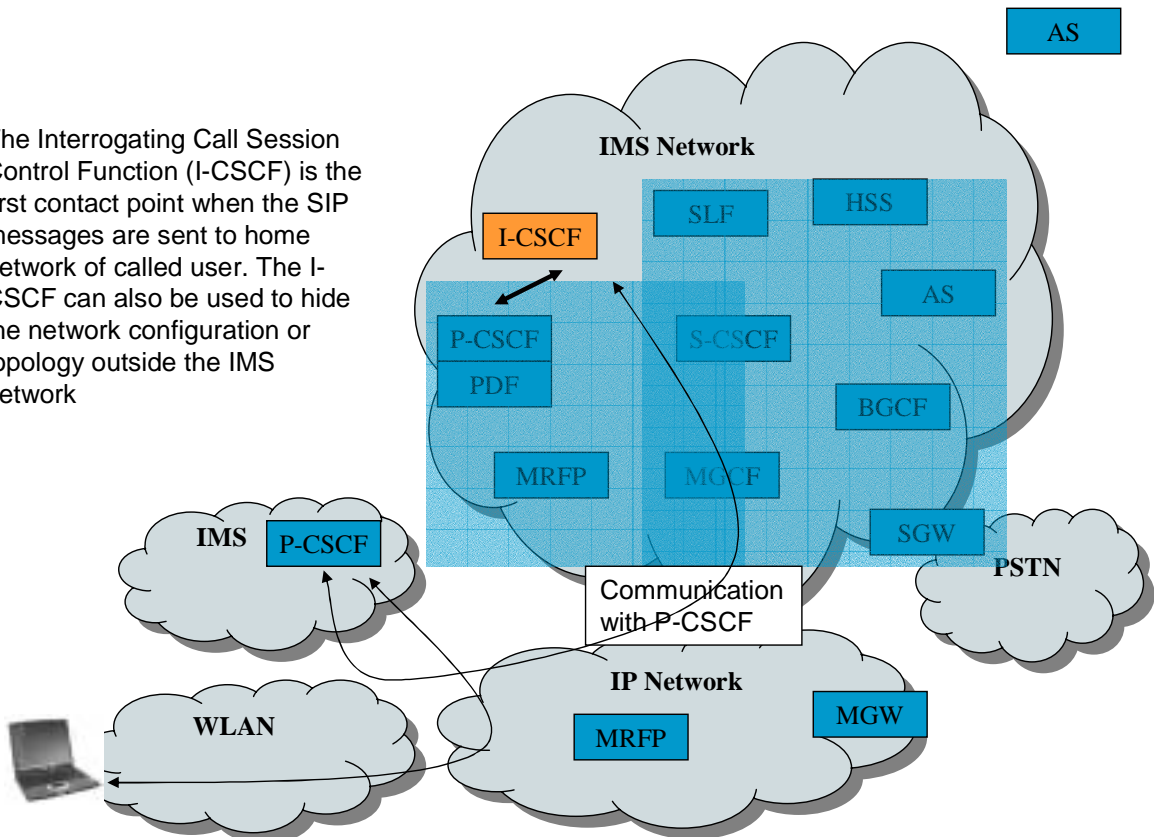
The primary task of the P-CSCF is to forward the SIP messages to Internet, I-CSCF or S-CSCF.

It also handles tasks related to Security Associations, Authorisation and QoS management.



Functional Entities in the IMS environment

The Interrogating Call Session Control Function (I-CSCF) is the first contact point when the SIP messages are sent to home network of called user. The I-CSCF can also be used to hide the network configuration or topology outside the IMS network

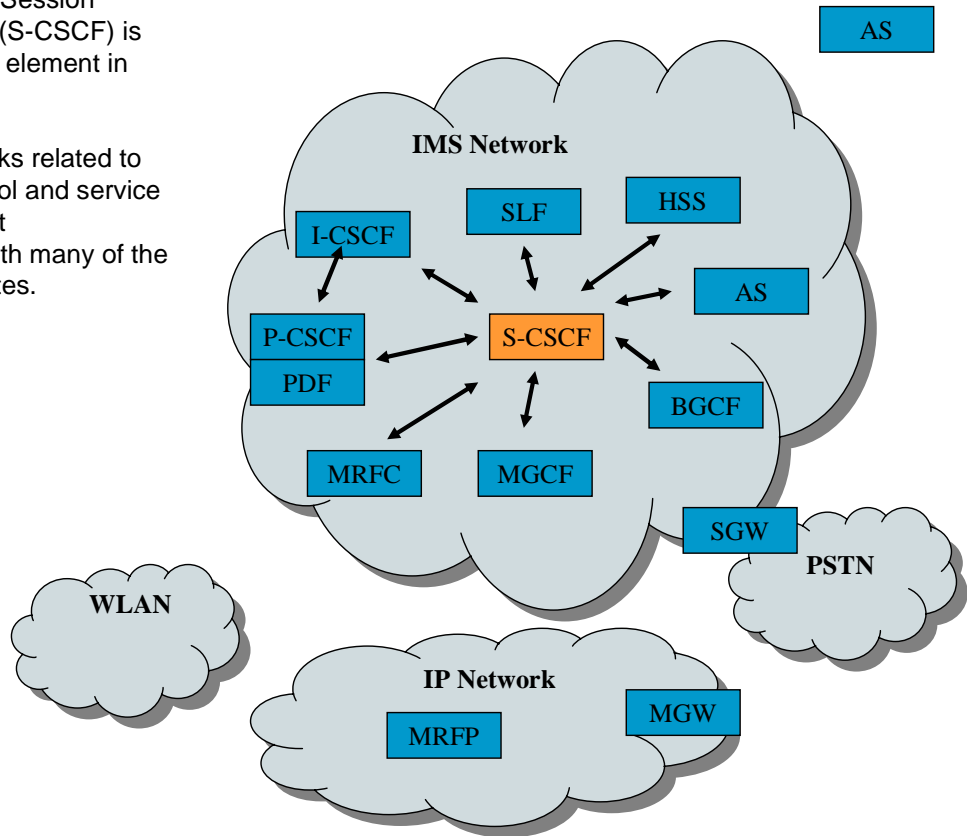


Functional Entities in the IMS environment

The Serving Call Session Control Function (S-CSCF) is central and a key element in IMS.

It has various tasks related to the session control and service implementation. It communicates with many of the IMS network entities.

Among its tasks, it routes the SIP messages in their destinations, Interacts with HSS register and supports wide range of services by requesting and processing various service-related information.

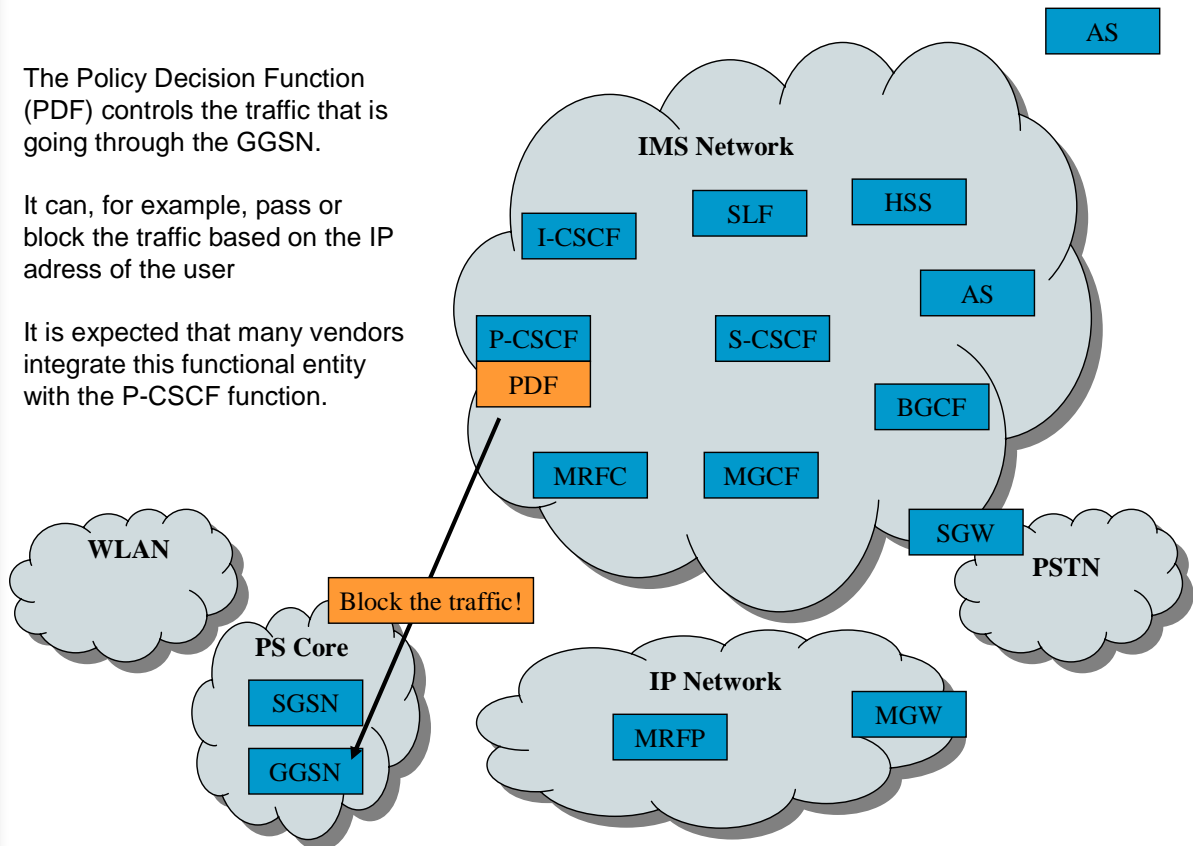


Functional Entities in the IMS environment

The Policy Decision Function (PDF) controls the traffic that is going through the GGSN.

It can, for example, pass or block the traffic based on the IP address of the user.

It is expected that many vendors integrate this functional entity with the P-CSCF function.

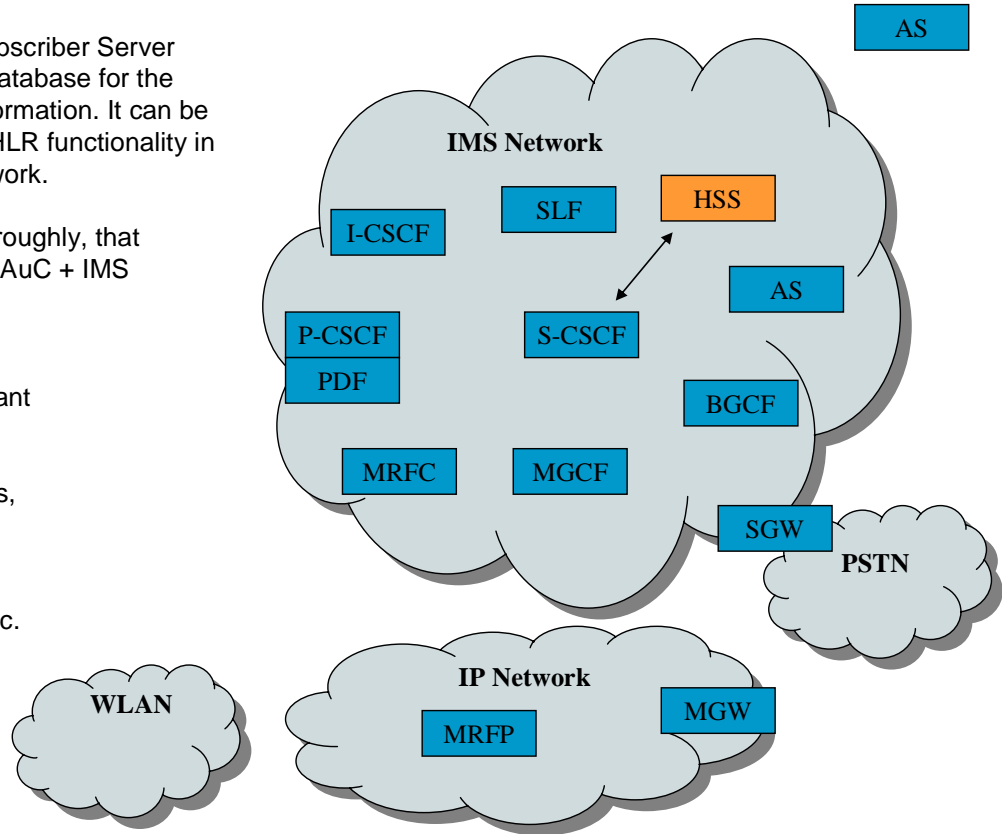


Functional Entities in the IMS environment

The Home Subscriber Server (HSS) is the database for the subscriber information. It can be compared to HLR functionality in the GSM Network.

We can state roughly, that HSS = HLR + AuC + IMS support

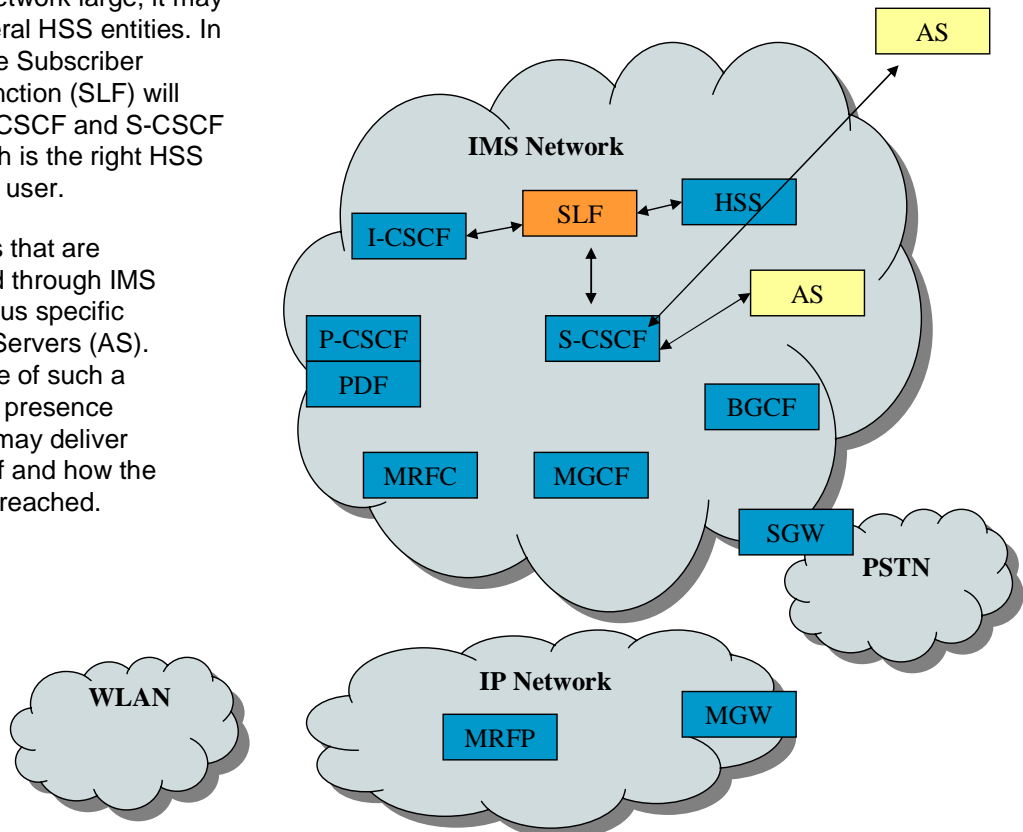
The HSS includes relevant subscriber information, service profiles, addressing information, security information, etc.



Functional Entities in the IMS environment

If the IMS Network large, it may contain several HSS entities. In this case, the Subscriber Location Function (SLF) will inform the I-CSCF and S-CSCF entities which is the right HSS for the given user.

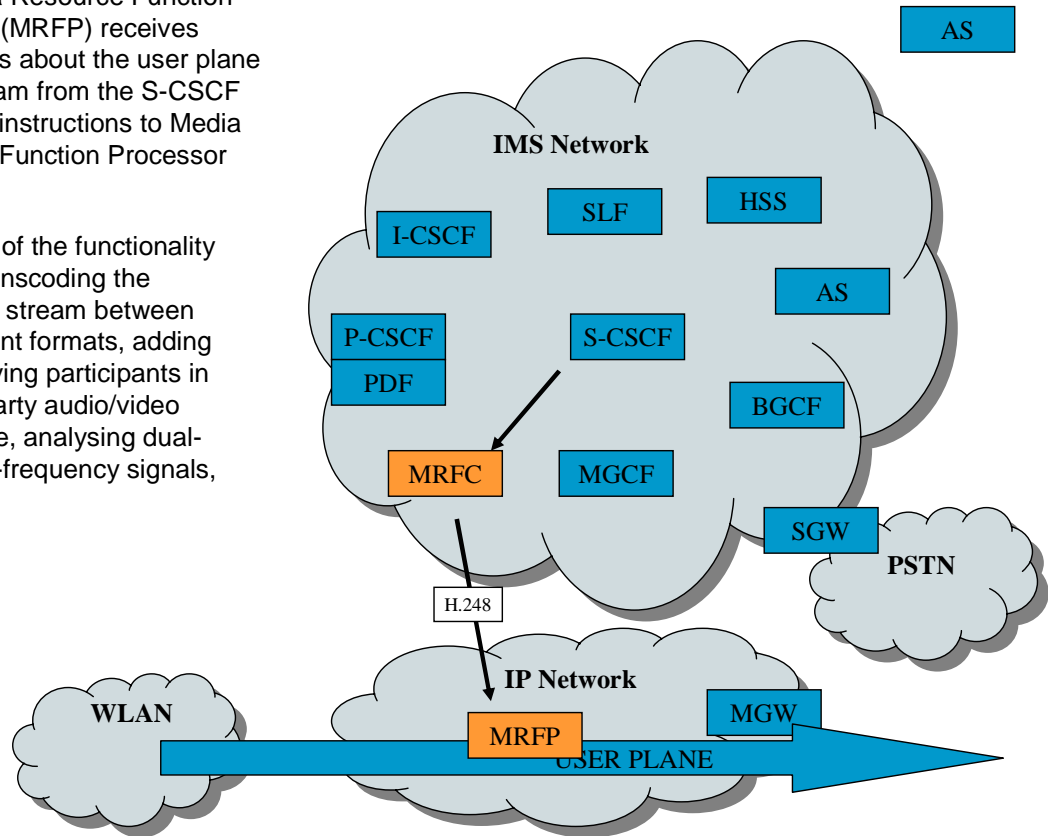
The services that are implemented through IMS require various specific Application Servers (AS). One example of such a server is the presence server, that may deliver information if and how the user can be reached.



Functional Entities in the IMS environment

The Media Resource Function Controller (MRFC) receives instructions about the user plane media stream from the S-CSCF and gives instructions to Media Resource Function Processor (MRFP).

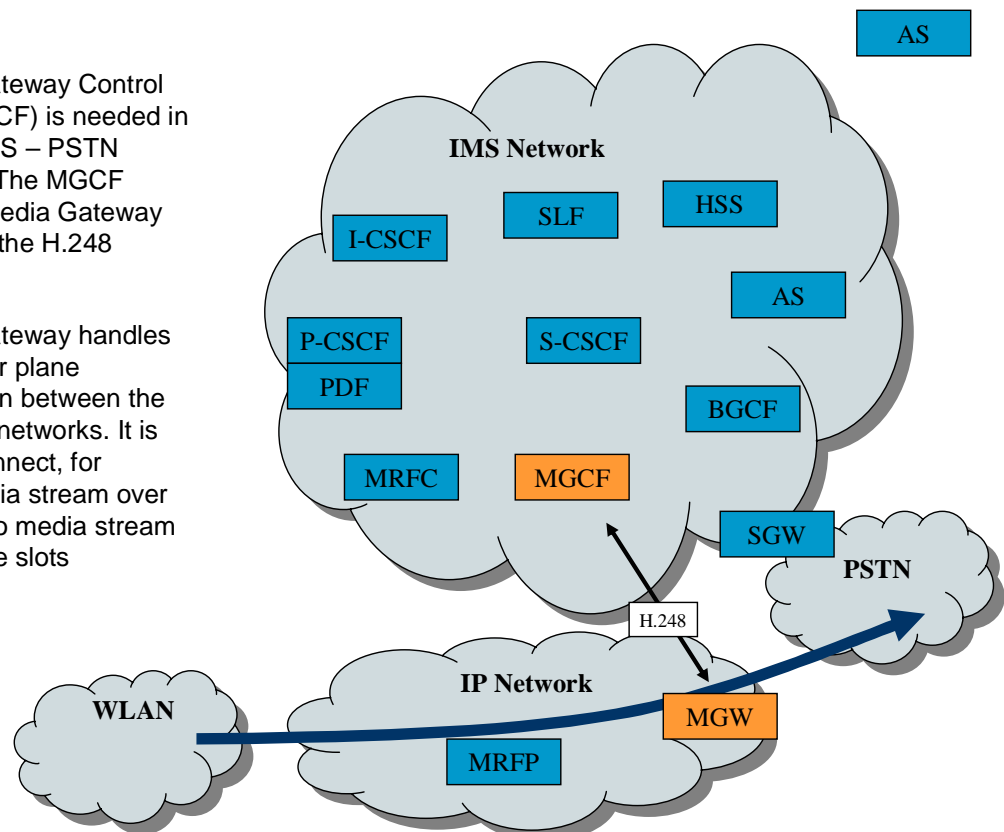
Examples of the functionality include transcoding the speech bit stream between two different formats, adding and removing participants in the multiparty audio/video conference, analysing dual-tone-multi-frequency signals, etc



Functional Entities in the IMS environment

The Media Gateway Control Function (MGCF) is needed in the case of IMS – PSTN Interworking. The MGCF controls the Media Gateway (MGW) using the H.248 protocol.

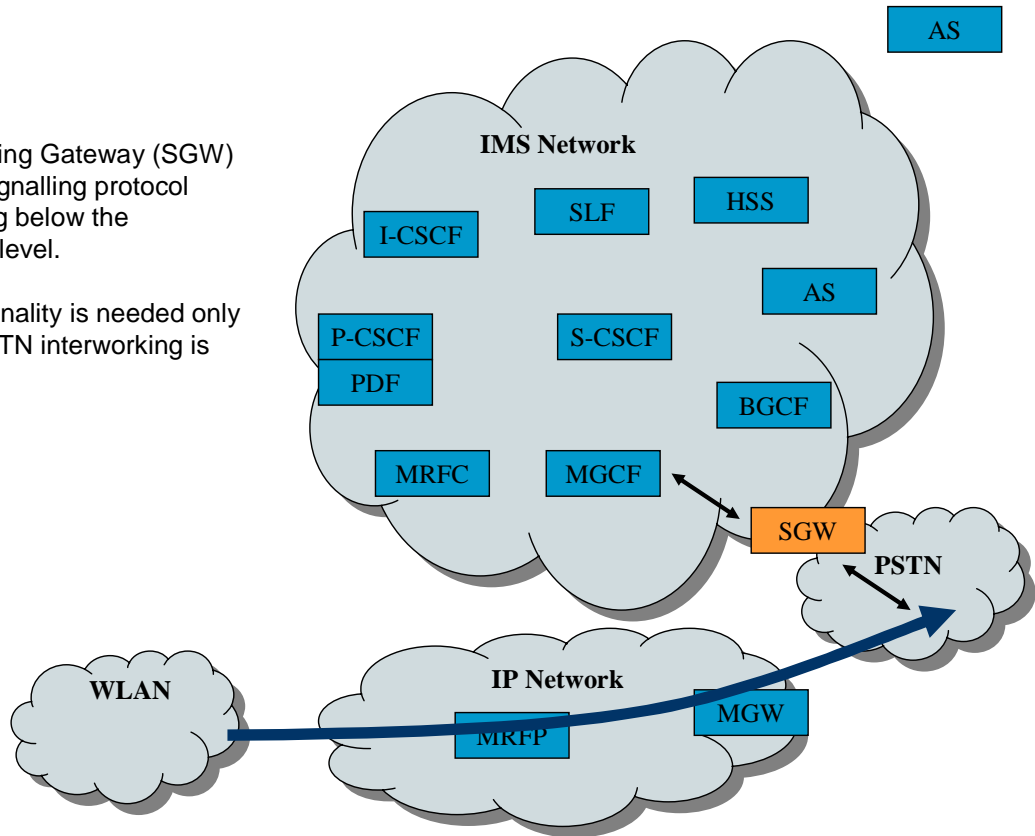
The Media Gateway handles the actual user plane interconnection between the IP and PSTN networks. It is capable to connect, for example, media stream over RTP over IP to media stream over TDM time slots



Functional Entities in the IMS environment

The Signalling Gateway (SGW) performs signalling protocol interworking below the application level.

This functionality is needed only if IMS – PSTN interworking is required.



Acronyms

- 3GPP – 3G Partnership Project
- CDMA – Code Division Multiple Access
- CS – Circuit Switched
- DSL – Digital Subscriber Line
- GPRS – General Packet Radio Service
- GSM – Global System for Mobile communications
- IMS – IP Multimedia Subsystem
- IETF – Internet Engineering Task Force
- IP – Internet Protocol
- ISP – Internet Service Provider
- LAN – Local Area Network
- MAC – Medium Access Protocol
- MS – Mobile Station
- PoC – Push to talk Over Cellular
- PS – Packet Switched
- PSTN – Public Switched Telephen Network
- QoS – Quality of Service
- RAN – Radio Access Network
- SIM – Subscriber Identity Module
- SIP – Session Initiation Protocol
- UE – User Equipment
- UMTS – Universal Mobile Telecommunications System
- VoIP – Voice Over IP
- WLAN – Wireless Local Area Network



References

- 3GPP TS 23.002 Specifications (<http://www.3gpp.org>)
- IP for 3G, D. Wisely, P.Eardley, I. Burness, Wiley 2002
- SIP Demystified, G. Camarillo, McGraw-Hill 2002,
- <http://www.ietf.org/rfc/rfc3261.txt>



Homework

- Describe shortly what are the key features that make IMS concept powerful in Mobile Communications Systems
- Consider a situation where a multiparty audio conferencing session is already ongoing using VoIP. During the connection, one of the participants retires from the session. What elements in the user plane participate in this re-arrangement and which elements control them.