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UMTS and IMS

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One step behind: GPRS

- The general packet radio service (GPRS) is a data service allowing traffic in the form of packets (usually IPv4 or IPv6 packets) to be sent and received across a traditional mobile network
  - **It has been termed always connected, since after the initial connection delay subsequent connections are almost instantaneous**
- GPRS introduces a packet-based core network but still uses much of the GSM functionality, including the home location register (HLR), equipment identity register (EIR) and authentication center (AuC)
  - **GPRS introduces is the capability to transport different traffic types with more efficiency in network resource usage, and allow the introduction of a wide range of services**
  - **the general higher-layer functionality does not need to change and can thus be reused**
- In many cases it is seen as an evolutionary step towards 3G, and hence is often referred to as 2.5G

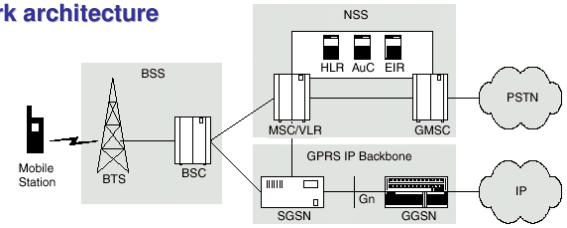
UMTS

- Third generation (3G) mobile network
  - **the network supports all traffic types (voice,video and data) with an eventual explosion in the services available on the mobile device**
  - **the driving technology is the Internet protocol**
- The first deployment of the universal mobile telecommunications system (UMTS) is the release 99 (R99)
  - **Respect to the GPRS, the major change is in the radio access network (RAN) with the introduction of code division multiple access (CDMA) technology for the air interface, referred to as wideband CDMA (WCDMA), and**
  - **asynchronous transfer mode (ATM) as a transport in the transmission part**
    - Note: The radio network controller (RNC) now can transfer data with the 3G SGSN using IP (in place of ATM)
  - **These changes have been introduced principally to support the transport of voice, video and data services on the same network**
  - **The core network remains relatively unchanged, with primarily software upgrades**

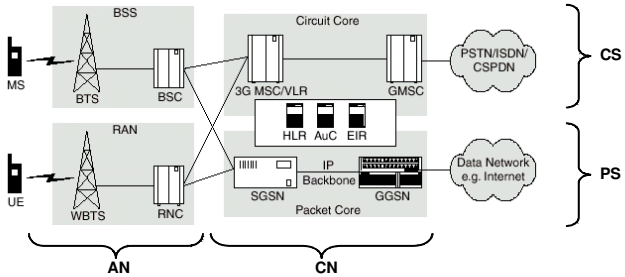
UMTS (cont.)

- The next evolution steps are the release 4 (R4) and release 5 (R5)
  - **the GSM core is replaced with an IP network infrastructure based around voice over IP (VoIP) technology**
  - **The MSC evolves into two separate components: an MGW and an MSC server (MSS). This essentially breaks apart the roles of connection and connection control. An MSS can handle multiple MGWs, making the network more scalable**
  - **IP clouds are merged together into one IP backbone. This extends IP right across the whole network**
  - **This is referred to as the all-IP network**
  - **Real-time services are supported through the introduction of a new network domain, the IP multimedia subsystem (IMS)**
- Currently the 3GPP are working on release 6, which purports to cover all aspects not addressed in frozen releases
  - **it includes such issues as interworking of hotspot radio access technologies such as wireless LAN**

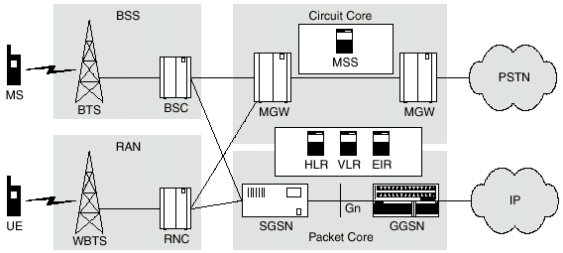
GPRS network architecture



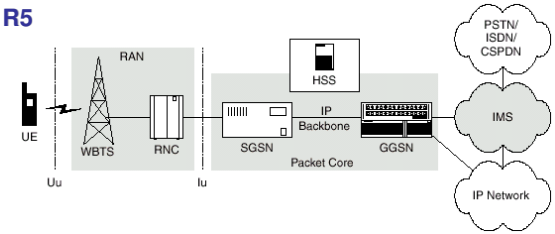
UMTS network release 99



UMTS network R4



UMTS network R5



Access Network and Core Network

- Functionally a PLMN (Public Land Mobile Network) may be regarded as independent telecommunications entity
  - **different PLMNs may be interconnected through the ISDN/PSTN and PDNs for forwarding of calls or network information**
    - The MSCs are the functional interfaces between the fixed networks and a PLMN for call set-up in CS domain
    - The GGSN and the SGSN are the functional interfaces between the fixed networks and a PLMN for packet transmission in PS domain
- The PLMN infrastructure is logically divided into a Core Network (CN) and an Access Network (AN) infrastructures
  - **The CN is logically divided into a CS domain, a PS domain and an IM subsystem**
  - **The AN is called BSS (Base Station Subsystem) for GSM and RNS (Radio Network Subsystem) for UMTS**

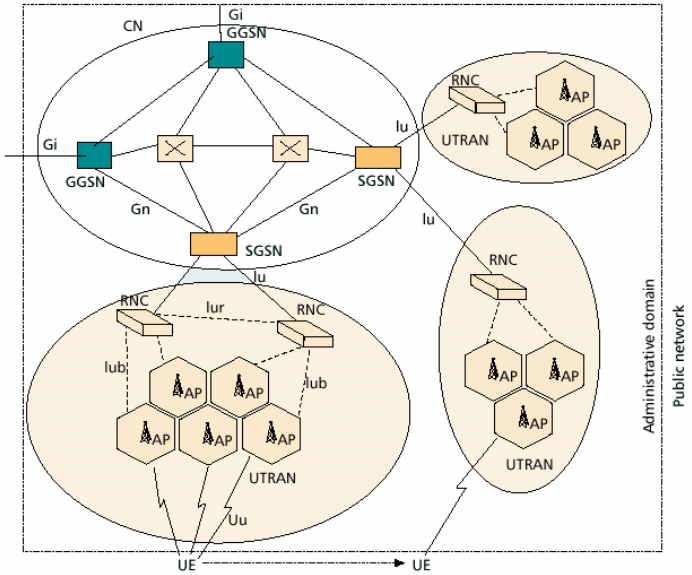
CS and PS domains

- The CN is constituted of a Circuit Switched (CS) domain and a Packet Switched (PS) domain
  - **These two domains are overlapping, i.e. they contain some common entities**
  - **A PLMN can implement only one domain or both domains**
- The CS domain refers to the set of all the CN entities offering "CS type of connection"
  - **Both user traffic and signaling**
  - **The entities specific to the CS domain are: MSC, GMSC**
- The PS domain refers to the set of all the CN entities offering "PS type of connection"
  - **Both user traffic and signaling**
  - **The entities specific to the PS domain are the GPRS specific entities, i.e. SGSN and GGSN**
- Entities common to the PS and CS domains are: HSS, (VLR), EIR, SMS-GMSC, and the SMS Interworking MSC

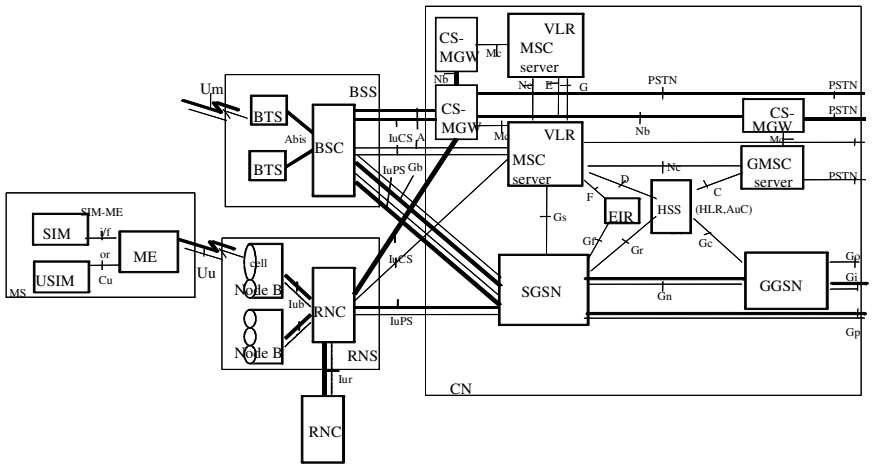
IM subsystem

- The IM subsystem comprises all CN elements for provision of IP multimedia services (audio, video, text, chat, etc.) over the PS domain
  - **The entities related to IMS are CSCF, MGCF, MRF, etc.**

UMTS network components



UMTS network architecture



The Mobile Station (MS)

- The mobile station consists of the physical equipment used by a PLMN subscriber
- It comprises the Mobile Equipment (ME) and the Subscriber Identity Module (SIM), called UMTS Subscriber Identity Module (USIM)

Access Network

- Two different types of access network are used by the CN:
  - **the Base Station System (BSS)**
  - **the Radio Network System (RNS)**
- Both BSS and RNS
  - **includes base station equipments (transceivers, controllers, etc..)**
  - **may support one or more cells and may consist of one or more base stations**
  - **are viewed by the MSC or SGSN as being the entity responsible for communicating with MSs in a certain area**
- The MSC and SGSN can connect to one of these Access Network type or to both of them
- The BSS may consist of
  - **one Base Station Controller (BSC) and**
  - **one or more Base Transceiver Station (BTS)**
- The RNS consists of
  - **one Radio Network Controller (RNC) and**
  - **one or more Node B**

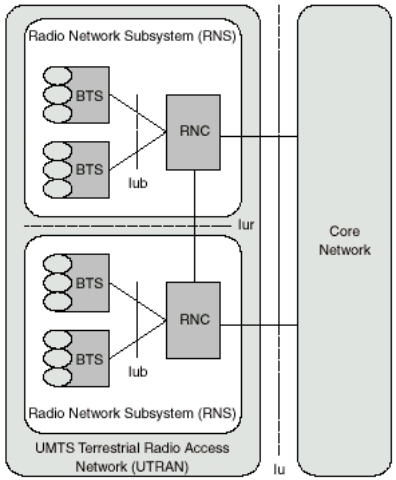
Base Station System (BSS)

- Base Transceiver Station (BTS)
  - **network component which serves one cell (as for GSM/GPRS)**
  - **the BTS houses the radio transceivers (TRXs) that define a cell and handle the radio link with the mobile station**
  - **each TRX can handle up to eight full-rate GSM users simultaneously**
  - **the BTS is also responsible for encrypting the radio link to the mobile device based on security information it receives from the core network**
- Base Station Controller (BSC)
  - **a network component in the PLMN with the functions for control of one or more BTS (as for GSM/GPRS)**
  - **the BSC manages the radio resources for one or more BTSs. It handles the radio channelsetup, frequency hopping and handover procedures when a user moves from one cell to another**

Radio Network System (RNS)

- Node B
  - **network component which serves one or more cells**
  - **it acts as base station and is more common to see this referred to as a WBTS, BTS, or AP (in IETF terminology)**
  - **it is the termination point between the air interface and the transmission network of the RAN**
- Radio Network Controller (RNC)
  - **network component in the PLMN with the functions for control of one or more Node B**
  - **the heart of the new access network; it is responsible for control of all the BTSs that are connected to it, and maintains the link to the packet and circuit core network**
  - **it is composed of a high-speed packet switch to support a reasonable throughput of traffic**
  - **it also needs to be capable of supporting interconnections to other RNCs**

UTRAN architecture



Entities common to the PS and CS domains

- The Home Subscriber Server (HSS)
  - **It is the master database for a given user. It contains the subscription-related information to support the network entities actually handling calls/sessions**
  - **It is responsible for holding the following user related information:**
    - User Identification, Numbering and addressing information.
    - User Security information: Network access control information for authentication and authorization
    - User Location information at inter-system level: the HSS supports the user registration, and stores inter-system location information, etc.
    - User profile information
  - **The HSS also generates User Security information for mutual authentication, communication integrity check and ciphering**
  - **A Home Network may contain one or several HSSs**
  - **The Home Location Register (HLR) and the Authentication Centre (AuC) (component entities of the GPRS/UMTS architecture until release 4) can be considered a subset of the HSS**

- The Visitor Location Register (VLR)
  - **controls a mobile station (MS) roaming in an MSC area**
  - **the VLR and the HLR exchange information to allow the proper handling of calls involving the MS**
  - **a VLR may be in charge of one or several MSC areas**
  - **The VLR contains information needed to handle the calls set-up or received by the MSs registered in its data base, including:**
    - the International Mobile Subscriber Identity (IMSI)
    - the Mobile Station International ISDN number (MSISDN)
    - the Mobile Station Roaming Number (MSRN)
    - the Temporary Mobile Station Identity (TMSI), if applicable
    - the Local Mobile Station Identity (LMSI), if used
    - the location area where the mobile station has been registered
    - the identity of the SGSN where the MS has been registered
    - the last known location and the initial location of the MS
- The Equipment Identity Register (EIR)
  - **the logical entity which is responsible for storing in the network the International Mobile Equipment Identities (IMEIs), used in the GSM system**

Entities of the CS domain

- The Mobile-services Switching Centre (MSC)
  - **constitutes the interface between the radio system and the fixed networks**
  - **The MSC performs all necessary functions in order to handle the circuit switched services to and from the mobile stations**
  - **It is an exchange, which performs all the switching and signalling functions for MSs located in its area**
  - **When needed, the MSC can be implemented in two different entities:**
    - the MSC Server, handling only signalling, and
    - the CS-MGW, handling user's data
- The Gateway MSC (GMSC)
  - **MSC where calls are routed when the network cannot interrogate the HLR**
  - **it interrogates the appropriate HLR and routes the call to the MSC where the MS is located**
- The Interworking Function (IWF)
  - **functional entity associated with the MSC that allows the interworking between a PLMN and the fixed networks (ISDN, PSTN and PDNs)**
  - **The IWF is required to convert the protocols used in the PLMN to those used in the appropriate fixed network**

Entities of the PS domain

- The PS portion of the core network in UMTS consists of two types of Generalized Packet Radio Service (GPRS) support nodes (GSNs)
  - **the Serving GPRS Support Node (SGSN) and**
  - **the Gateway GPRS Support Node (GGSN)**
- They constitute the interface between the radio system and the fixed networks for packet switched services
- The Border Gateway (BG) is a gateway between a PLMN supporting GPRS/UMTS and an external inter-PLMN backbone network used to interconnect with other PLMNs also supporting GPRS/UMTS
  - **The role of the BG is to provide the appropriate level of security to protect the PLMN and its subscribers**

Serving GPRS Support Node (SGSN)

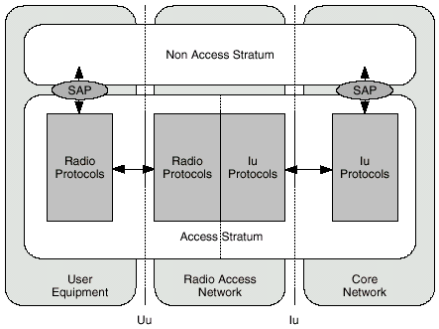
- The SGSN serves the mobile devices within its BSS/RAN, and provides authentication and mobility management
  - **It is the connection point between the BSS/RAN and the CN**
  - **At a high level the SGSN provides a similar role for the packet switched network as the MSC/VLR provides to the circuit switched network**
- the SGSN provides a mobility management context to MSs and it keeps track of the MSs to a routing area (RA) or specific cell
- The SGSN connects to GGSNs and to other SGSNs via an IP network
  - **for each MS a connection is established between the SGSN and corresponding GGSN so that the MS may transfer data to and from an external network**
- the SGSN stores two types of subscriber data:
  - **subscription information, i.e. the IMSI, one or more temporary identities, zero or more PDP addresses**
  - **location information, i.e. the cell or the routing area where the MS is registered, the VLR number of the associated VLR (if the Gs interface is implemented), the GGSN address of each GGSN for which an active PDP context exists**

Gateway GPRS Support Node (GGSN)

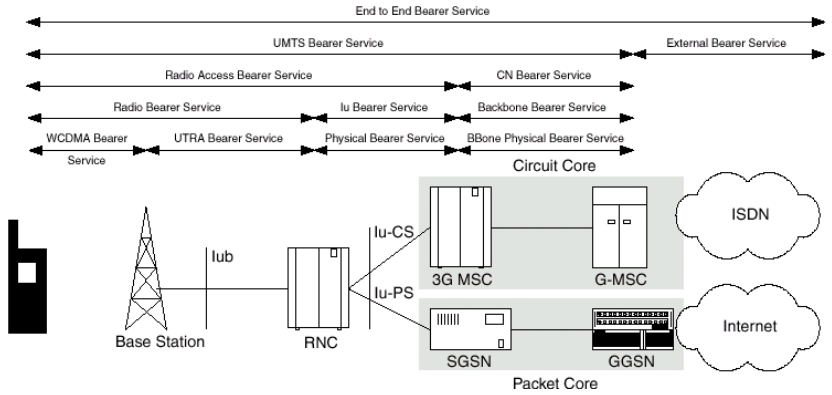
- The GGSN provides the interface between the mobile and the external packet switched network
- Packets are routed between the SGSN and GGSN using the GPRS tunnelling protocol (GTP)
- Like the SGSN, the GGSN also stores information about MSs that have established a session with the SGSN
- The GGSN does not need to know the location of the MS, only the address of the SGSN which is serving the MS
- Two types of subscriber data needed to handle originating and terminating packet data transfer
  - **subscription information, i.e. the IMSI, and zero or more PDP addresses**
  - **location information, i.e. the SGSN address for the SGSN where the MS is registered**

UMTS bearer model

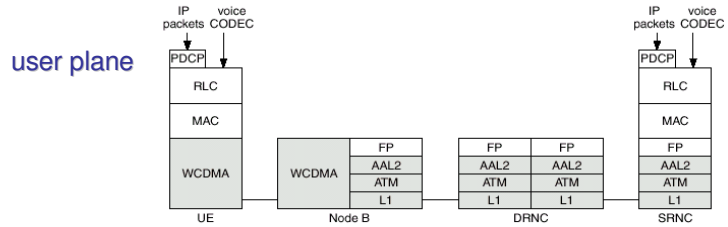
- The procedures of a mobile device connecting to a UMTS network can be split into two areas:
  - **the access stratum (AS)**
    - AS involves all the layers and subsystems that offer general services to the NAS
    - AS consists of all of the elements in the RAN, including the underlying ATM transport network
  - **the non-access stratum (NAS)**
    - NAS functions are those between the mobile device and the core network
      - for example mobility management

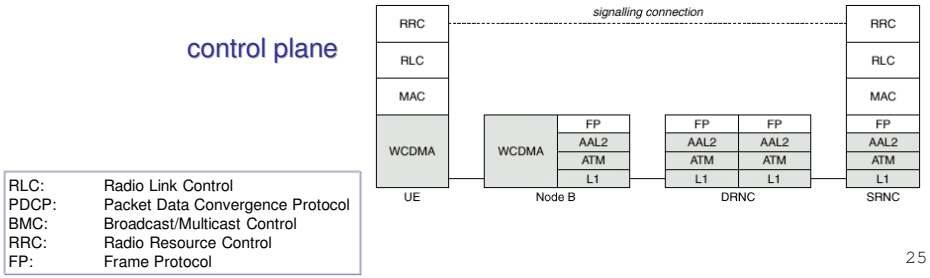


- All of the 'I 'interfaces (AS in the RAN and between RAN and CN) currently use ATM as a transport layer
  - **In the context of ATM, the BTS is seen as a host accessing an ATM network, within which the RNC is an ATM switch**
  - **UMTS release 5 provisions for the use of IP as a RAN transport protocol**



Radio interface protocol architecture





RLC:	Radio Link Control
PDCP:	Packet Data Convergence Protocol
BMC:	Broadcast/Multicast Control
RRC:	Radio Resource Control
FP:	Frame Protocol

Radio interface protocol architecture

- The PDCP layer is used to transport packet data such as IP, between the UE and the serving RNC
- RRC is the signaling protocol operating between the user and the RNC, and is responsible for controlling the lower RLC, MAC and physical layers
- At the MAC layer, the signaling control and user data streams are combined together to present a transport channel to the physical layer
- Across this transport network the FP layer is used to carry additional information, such as quality achieved on the air interface and user identification on common channels

Radio link control (RLC)

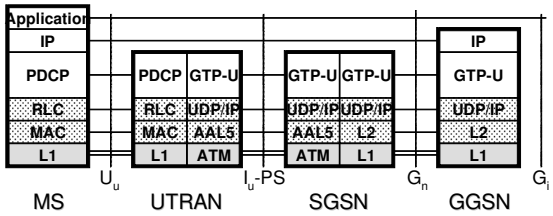
- The RLC layer provides three types of data transfer to the higher layers
  - **Transparent data transfer**
    - This exchanges packets with the higher layers without adding any protocol information
    - The encryption of user data for transparent mode is performed at the MAC layer
  - **Unacknowledged data transfer**
    - This passes packets onward without ensuring delivery; packets are passed without acknowledgement
    - Implemented functions are: Segmentation and reassembly, User data transfer, Discard of errored SDU, Concatenation, Padding, Ciphering, Sequence number checking
  - **Acknowledged data transfer**
    - This passes packets onward and guarantees delivery of the packets. It ensures that duplicate packets are discarded and that packets in error are retransmitted using an automatic repeat request (ARQ) mechanism
    - Respect to the function implemented by the unacknowledged data transfer, it adds: In sequence PDU delivery, Duplicate detection, Error and flow control

Packet data convergence protocol (PDCP)

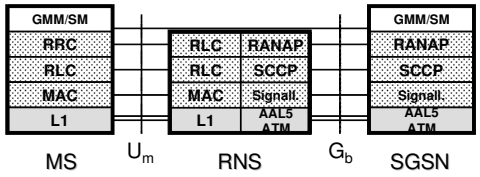
- The main task of PDCP is to carry network-layer protocol data units (such as IPv4 and IPv6, or PPP) transparently between the MS and UTRAN onto the underlying network
  - **Introduction of new higher-layer protocols shall be possible without any changes to the radio interface protocols**
- It is only used on the packet switched network and only for user data
- The main role of PDCP is to support header compression of upper-layer headers
  - **for example TCP/IP and RTP/UDP/IP compression**
- Currently, 3GPP defines only one header compression technique, which is 'IP Header Compression 'as defined in RFC 2507

CN protocol architecture

user plane



control plane



SM:	Session Management
GMM:	GPRS Mobility Management

CN protocol architecture

- Layers 1 and 2 are the physical and datalink protocols
  - **This is not specified and can be an Ethernet 100baseTX connection, an ATM connection, frame relay, MPLS, or other transport mechanism**
  - **In many cases the SGSN and the GGSNs will be in the same room or building, thus Ethernet,with its limited distance but high speed and simple network configuration, is commonly used**
  - **In other cases the GGSNs may be remote, and there may be a leased line or ATM network connecting the GGSN to the SGSN over a vast distance**
- Above this layer is the network layer which runs the IP. Above this is the connectionless UDP protocol,which is the transport mechanism for the GPRS tunneling protocol (currently GTP version 1 in Release 99)
  - **for GTP 1, as used in GPRS/UMTS, the destination device will be designated port number 2152/udp for GTP-U and 2123/udp for GTP-C**

GPRS Tunneling Protocol (GTP)

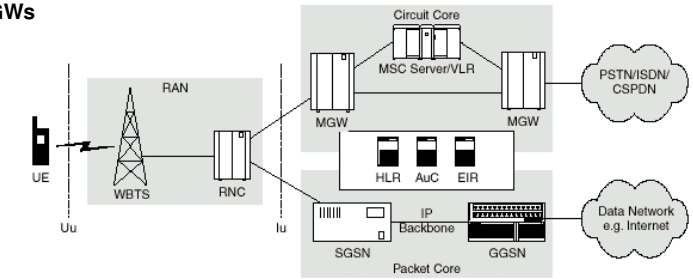
- This protocol tunnels user data between SGSNs and GGSNs, and between SGSNs, in the backbone network
  - **All PDP PDUs shall be encapsulated by GTP**
- The GTP protocol actually consists of two parts,the GTP-C and the GTP-U
- The GTP-C carries control data for creating, modifying and deleting GTP tunnels, while the GTP-U transports user data and some control information
- The header for both of these is of variable length, the minimum length being 8 bytes

UMTS-PS operation

- In order to communicate with the data network, the mobile host needs to register with the CN by performing a GPRS attach operation
  - **This results in the creation of two GTP sessions, specific to that host: between the RNC and the SGSN, and between the SGSN and the GGSN**
  - **The user-level packets are encapsulated into GTP frames and are forwarded between the RNC and the GGSN over a transport network**
- Upon GPRS attachment, a mapping is created at the RNC between the host identity and the GTP session between the RNC and the SGSN
- In addition, a record is created at the GGSN, which contains the mapping between the host's network layer (IP) address and the GTP session with the corresponding SGSN
- The SGSN handles the inter-RNC mobility of the host, while the GGSN handles the inter-SGSN mobility
  - **When the serving RNC of the MS changes, as long as the new RNC is within the scope of the same SGSN, it results in the redirection of the GTP session between the SGSN and the RNC. The session between the SGSN and GGSN remains unaffected**
  - **On the other hand, if mobility results in a different point of GPRS attachment (i.e., a different SGSN), both host-specific GTP sessions are reestablished**
- In addition the GSNs perform various accounting and security functions

R4 softswitch architecture

- In R4 the separation of the switching and call control functions within the core network is commonly referred to as a softswitch architecture
  - **For R4 the GSM MSC functionality is split into two components,the MSC server and the MGW**
- The call control component, i.e.the MSC server, is the softswitch
- This separation of functions makes it easier to scale the network as the traffic demand increases
  - **If the network planners require more switching capacity they can add MGWs**



VoIP call control

- Within a conventional telephony network, SS7 protocols are used to handle call control by establishing a circuit for the data to follow
- Within an IP domain two different general approaches have been proposed for handling call control within IP:
  - **Use the SS7 application protocols (and any other circuit switched call control protocols such as Q.931) unmodified,but transport them over the IP network transparently. For this approach a new transport protocol called stream control transmission protocol (SCTP)**
  - **Replace the call control protocol completely with a new protocol such as H.323 or Session Initiation Protocol (SIP)**
- Since some networks may be using SS7,some sigtran and some H.323,SIP or BICC, there is a need to be able to interwork between these protocols
  - **Messages must be translated at the interfaces between the networks**
- For the R4 network the interworking function is performed by the MSC servers

Motivations for the IMS

- In GSM/GPRS and even up to Release 4 of UMTS, only basic IP connectivity is standardized
  - **so it is difficult for the operator to offer services that will work across network boundaries**
- Up to now the wireless network operator usually acts as a normal ISP and does not provide IP multimedia services
  - **subscribers use third-party applications and access to third-party providers of IP multimedia services**

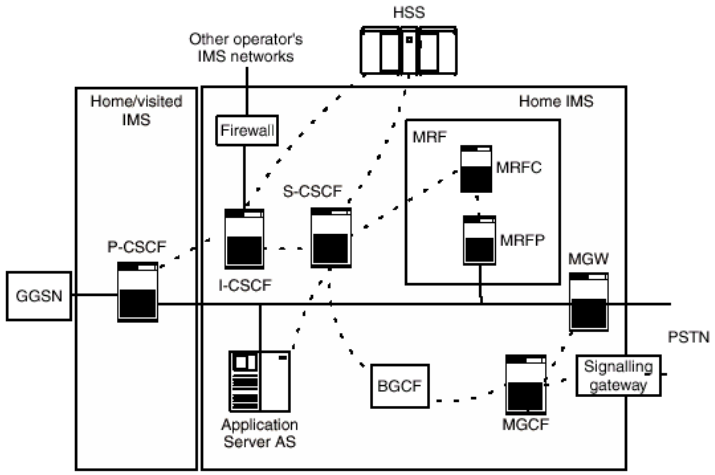
UMTS R5 and IMS

- UMTS Release 5 is designed to overcome the drawbacks of providing only basic IP connectivity while keeping the advantages
- In addition to basic IP connectivity, R5 introduces a new network domain called the IP multimedia subsystem (IMS)
  - **This is an IP network domain designed to provide appropriate support for real-time multimedia services**
- UMTS Release 5 builds on the partial implementation of Internet protocol (IP) packet switching within the core network to move to an all-IP architecture
  - **CS domain can be dispensed with since the services associated with it can be carried over the IMS networks**
  - **many operators may still be using the R4 CS domain as well as the R5 IMS architecture allowing for gradual migration to an all-IP architecture**

IP Multimedia Subsystem (IMS)

- The IMS comprises the network elements for control of multimedia sessions
  - **The network provider thus provides both the transport and network control elements for IP multimedia services**
- The network architecture also allows for third-party offering of additional IP multimedia services
- IP multimedia services utilize the GPRS network for transport
- The IMS is made up of a number of component parts connected together using an IP backbone
- This is implemented as a separate network from the IP backbone connecting the serving GPRS support node (SGSN) and the gateway GPRS support node (GGSN) for such purposes as security
- Each mobile user must first obtain a GPRS connection (i.e.a packet data protocol (PDP) context) to the IMS prior to using its services, which means authentication/registration is done twice, first for GPRS and then for IMS

IMS functional diagram



IMS concepts

- The IMS includes one or more CSCFs, MGCFs, IMS media gateways, MRFs, BGCFs, subscription locator functions, and application servers
- The UE always connects to the IMS via the proxy call session control function (P-CSCF), which may reside at the user 's home network or in a roaming scenario within a visited network
- External CS networks are connected via the MGW and media gateway control function (MGCF) (softswitch)
- The application server provides IMS value-added services
  - **this could be, for example, a content server (video on demand) or an interactive voice/video mailbox server**
- The interrogating call session control function (I-CSCF) connects this network to other IMS networks
  - **It acts as a point of entry for call signalling**
- The multimedia resource function (MRF) provides the support for conferencing applications
- Each of the components is a mandatory requirement with the exception of the application server and the MRF

Call session control function (CSCF)

- Data transfer between users of the IMS is organized into sessions. The CSCF is responsible for session control and is the control point for the following functions:
  - **user authentication**
  - **call routing**
  - **establishing QoS over the IP network**
  - **controlling the generation of call detail records (CDRs) for accounting purposes**
- All call/session control signalling in the IMS is performed using the session initiation protocol (SIP)
- Three types of CSCF are defined: P-CSCF, S-CSCF and I-CSCF
- Each network will typically provide multiple CSCFs of each type
  - **This allows for load sharing and supports increased reliability through the use of backup servers**

Proxy CSCF (P-CSCF)

- This acts as the first point of contact for call signalling coming from the UE
- The P-CSCF forwards the call signalling to the serving CSCF (S-CSCF), which is the home network 's point of control for the call
- For a roaming subscriber, the P-CSCF will be located in the visited network, or more specifically the P-CSCF for a given user will be located in the same network as the GGSN from which they are receiving service
- The P-CSCF is also responsible for controlling the generation of CDRs for mobile originated calls

Serving CSCF (S-CSCF)

- This carries out the call/session and accounting control for a given subscriber
- The S-CSCF is always located within the subscriber 's home network
- This means that all mobile originated call signaling is routed via the user 's home network
  - **For example, a IT subscriber roaming in Brazil who then phones Australia would have their call routed via the IT**
  - **The reason for this is that it allows a network operator to reconcile its call charging records with its overseas roaming partners for each subscriber**
  - **This non-optimal routing covers only signaling traffic; call traffic is still forwarded using standard IP routing between the Australian and Malaysian GGSNs**

Interrogating CSCF (I-CSCF)

- The I-CSCF is located at the boundary of the IMS and acts as a point of entry for SIP signaling coming from outside the operator 's network
- This signaling could be:
  - **a SIP call setup request destined to a subscriber of the operator 's network**
  - **a SIP call setup request destined to a roaming subscriber within the operator 's network**
  - **a registration request**
- For incoming registration requests the I-CSCF is responsible for assigning an S-CSCF to the subscriber
  - **The choice of S-CSCF can be made**
    - dependent on the identity of the subscriber (SIP address or international mobile subscriber identify (IMSI)),
    - handled on a load sharing basis,
    - or using a main server/backup server arrangement

Application server (AS)

- This provides value-added services to a subscriber
- This could be anything from receiving streaming video service (video on demand) to providing voice and video mail services

Breakout gateway control function (BGCF)

- This is used to select the appropriate gateway to forward calls destined for the CS domain (i.e.the CS breakout point)
- An S-CSCF will forward all call requests with CS destinations, which will then forward them to the appropriate MGCF

Multimedia resource function (MRF)

- The MRF is made up of two components, the MRF control (MRFC) and MRF processor (MRFP), and is responsible for providing functions such as:
  - **mixing media for video/voice conferencing (conferencing bridge)**
  - **providing multimedia announcements**
  - **processing media streams,e.g.audio transcoding**
- The interface between the two components is controlled using the H.248/MEGACO protocol
- The MRFC receives call control signalling via the SIP protocol (e.g.to establish a Videoconference between a number of parties)

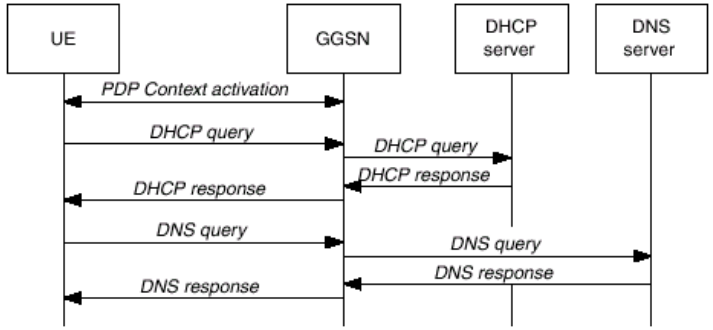
Media gateway control function and media gateway (MGCF and MGW)

- The MGCF functionality and MGW provide a connection between the IMS and external CS networks such as ISDN or GSM.The MGCF controls the MGW and interfaces to the S-CSCF using the SIP protocol
- The MGCF must translate messages between SIP and ISUP to provide interworking between the two protocols

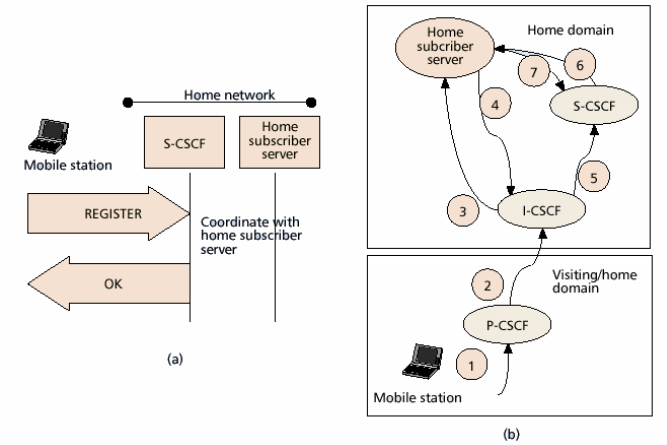
Home subscriber Server (HSS)

- The HSS contains a master database of all the subscribers on the network and contains the following information:
  - **identification information (user 's telephone number,SIP addresses,IMSI)**
  - **security information (secret authentication keys)**
  - **location information (current serving GGSN,SRNC,IP address)**
  - **user profile information (subscribed services)**
- It is also responsible for generating security information such as authentication challenges and integrity and ciphering keys
- The HSS incorporates the HLR and AuC functionality and provides service for three domains, as follows:
  - **authentication, service profile and location information for IMS (service for CSCF)**
  - **HLR/AuC service for packet switched (PS) domain (service for SGSN and GGSN)**
  - **HLR/AuC service for CS domain (service for R4 MSC server)**
- The communication between the HSS and CSCF (I-CSCF and S-CSCF) is based on Diameter protocol

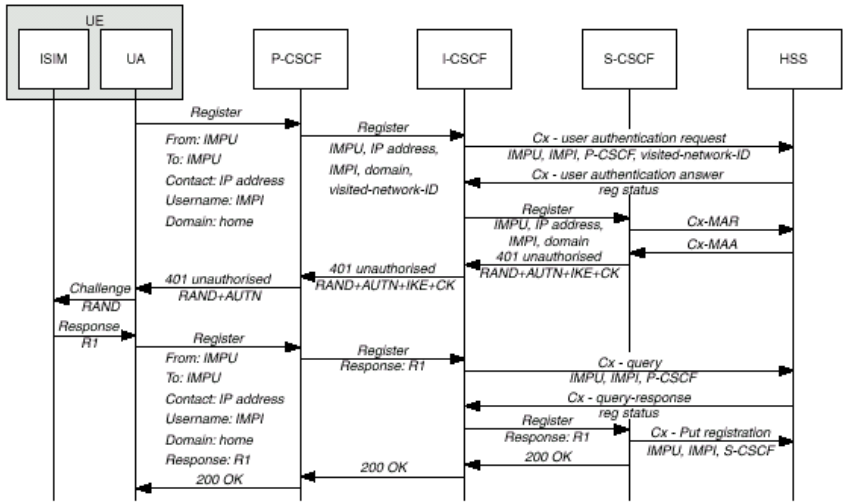
P-CSCF assignment using DHCP



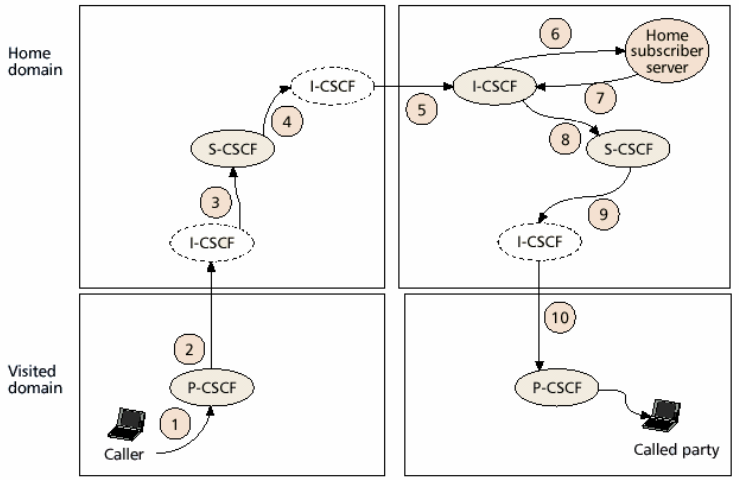
IMS registration



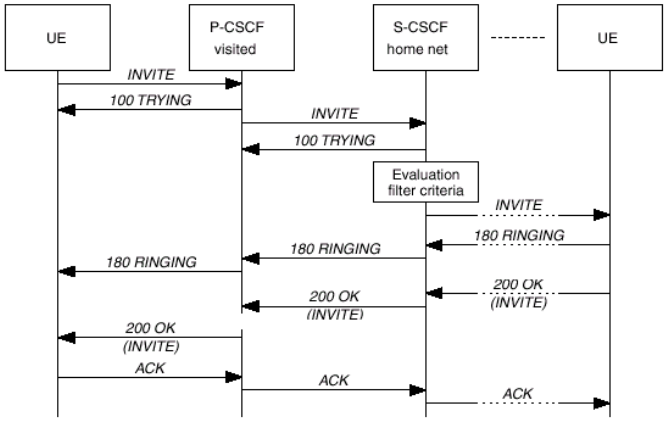
IMS registration



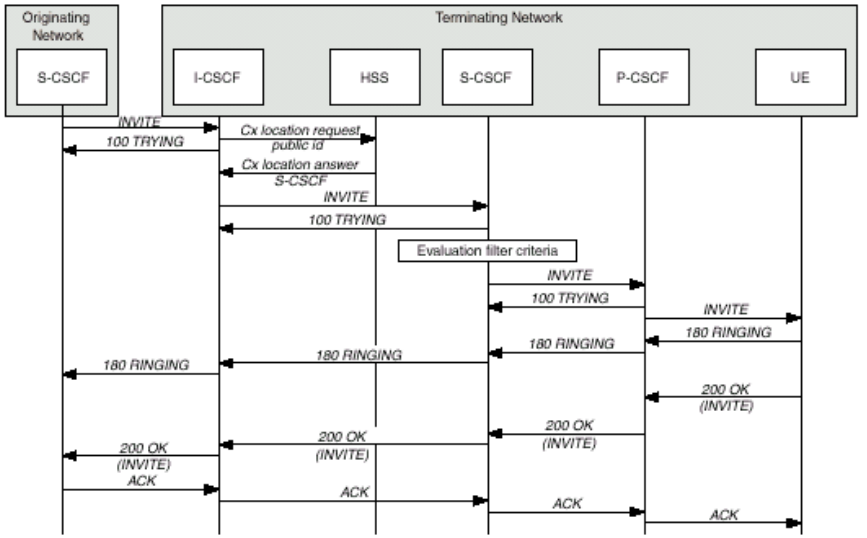
IMS call



IMS mobile originated call (without QoS setup)



IMS mobile terminated call (without QoS setup)



Glossary

ATM	Asynchronous Transfer Mode
AuC	Authentication Centre
BMC	Broadcast/Multicast Control
BSC	Base Station Controller
BSS	Base Station Subsystem
BTS	Base Transceiver Station
CS	Circuit Switched
CSCF	Call Session Control Function
FP	Frame Protocol
GMM	GPRS Mobility Management
GTP	GPRS Tunneling Protocol
I-CSCF	Interrogating-CSCF
IMSI	International Mobile Subscriber Identifier
IMIP	Multimedia
IMS	IP Multimedia Core Network Subsystem
ISIM	IMS SIM
MGCF	Media Gateway Control Function
MGF	Media Gateway Function
MGW	Media Gateway
MS	Mobile Station
OSA	Open Services Architecture
P-CSCF	Proxy-CSCF
PDCP	Packet Data Convergence Protocol
PDP	Packet Data Protocol e.g., IP
PLMN	Public Land Mobile Network
PS	Packet Switched
RAN	Radio Access Network
RLC	Radio Link Control
RNS	Radio Network Subsystem
RRC	Radio Resource Control
S-CSCF	Serving-CSCF
SIM	GSM Subscriber Identity Module
SM	Session Management
USIM	Universal Subscriber Identity Module
UTRAN	Universal Terrestrial Radio Access Network