Chapter 2

3G Network & Services

3G NETWORK AND SERVCES

It is a Layered Architecture comprises of three layers:

Application Layer

The "Application Layer" is responsible for providing services to users via applications regardless of the device and method in which the user accesses the network. The Application Layer itself is not a real network as such important operator parts of the application Layer may, however, be realized in what are called Service Networks.

Control Layer

The "Control Layer" contains nodes that control and direct traffic (both Circuit and Packet Switched). The Control Layer is realized in a Core Network. The WCDMA Core Network will contain, for example, MSCs, HLR/HSS, GMSC/TSC, SGW and possibly IMSI(IP Multimedia Sub system

The Connectivity Layer

The "connectivity Layer" consists of the transport nodes (M-MGW, SGSN and GGSN) and connects to the various access networks.
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Mobile Soft switch Solution

Mobile soft switch enable a layered architecture design for the mobile circuit core , where the network functions responsible for service management & control and for transport of service data are physically & logically separated .
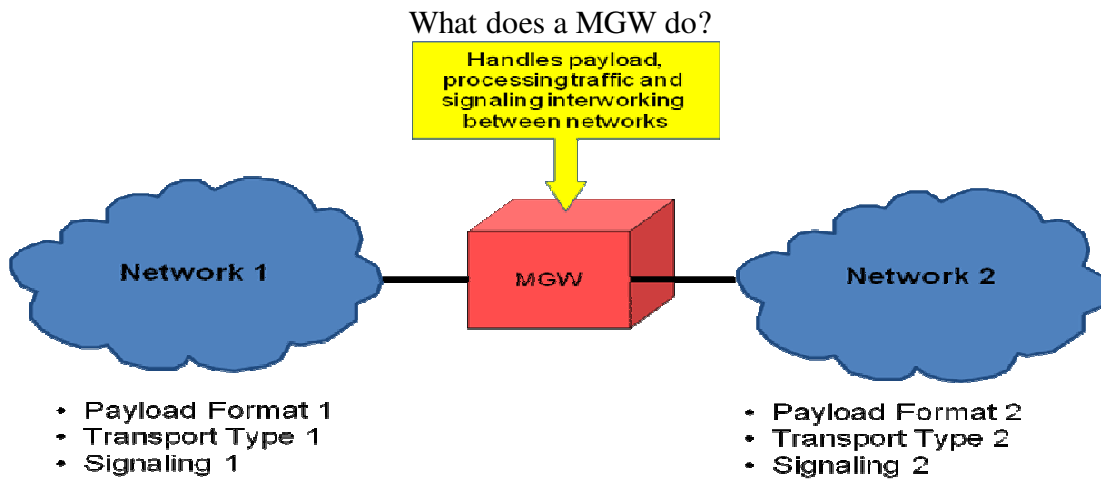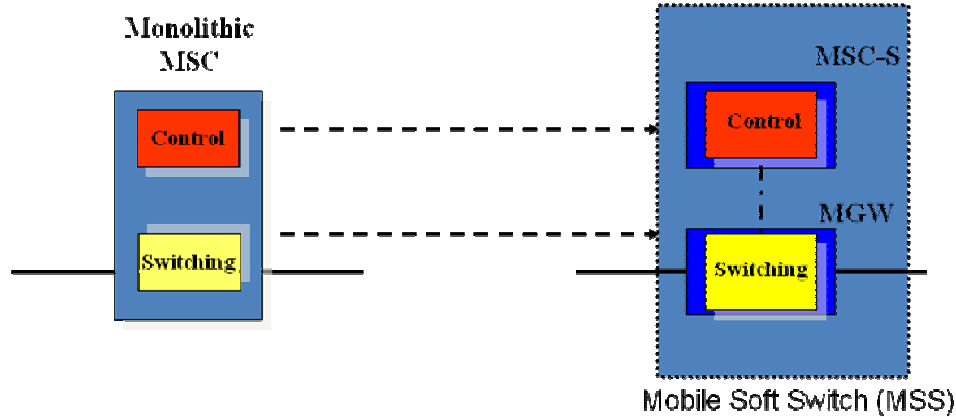
The UMTS network basically comprises of following three elements:

    a) Core Network
    b) Access Network
    c) Terminal or User Equipment.

The inter relationship of the network elements is shown in figure . Basic structure of UMTS is similar to that used in GSM/GPRS network. There are many similarities in the two architectures. However, the main difference comes in the protocols residing in UMTS. This is on account of the fact that here the air interface is based on WCDMA. Moreover, in UMTS, there is a combination of Voice traffic and data traffic. This results in the network topologies namely, CS domain (Circuit Switched) and PS domain (Packet Switched). In CS domain, circuit switched connections are used for communication between user and destination for voice traffic. Whereas, in PS

domain, packet switched connections are used for communication between user and destination for data traffic.

Apart from these network elements, there are other issues which needs to be discussed as overall implementation and roll out of 3G networks

We shall now discuss different components of UMTS in following paragraphs.
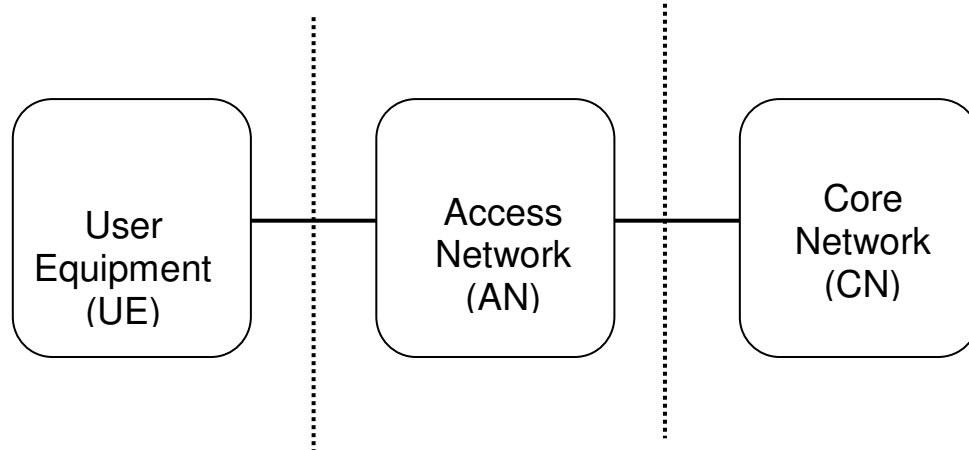

Figure Basic Structure of UMTS Network

CORE NETWORK

The basic function of core network can be broadly classified as follows:

    a) Switching and routing
    b) Call Control
    c) Mobility Management (MM)
    d) Managing the Subscriber Information

A typical core network structure is shown in figure . As said above, it has basically two domains CS and PS depending upon the functions it has to perform. Accordingly, the two domains are connected to either PSTN network or Packet network. On the other side, the core network is connected to Access work.

In order to perform switching functions, there is an MSC-S (Mobile Switching Centre) and Media Gateway(MGW) at the heart of the core network. Like GSM network, these are associated entities such as VLR (Visitor Location Register), HLR (Home Location Register), AuC (Authentication Centre), EIR (Equipment Identity Register) etc. VLR contains the subscriber profile, which it obtains from HLR.
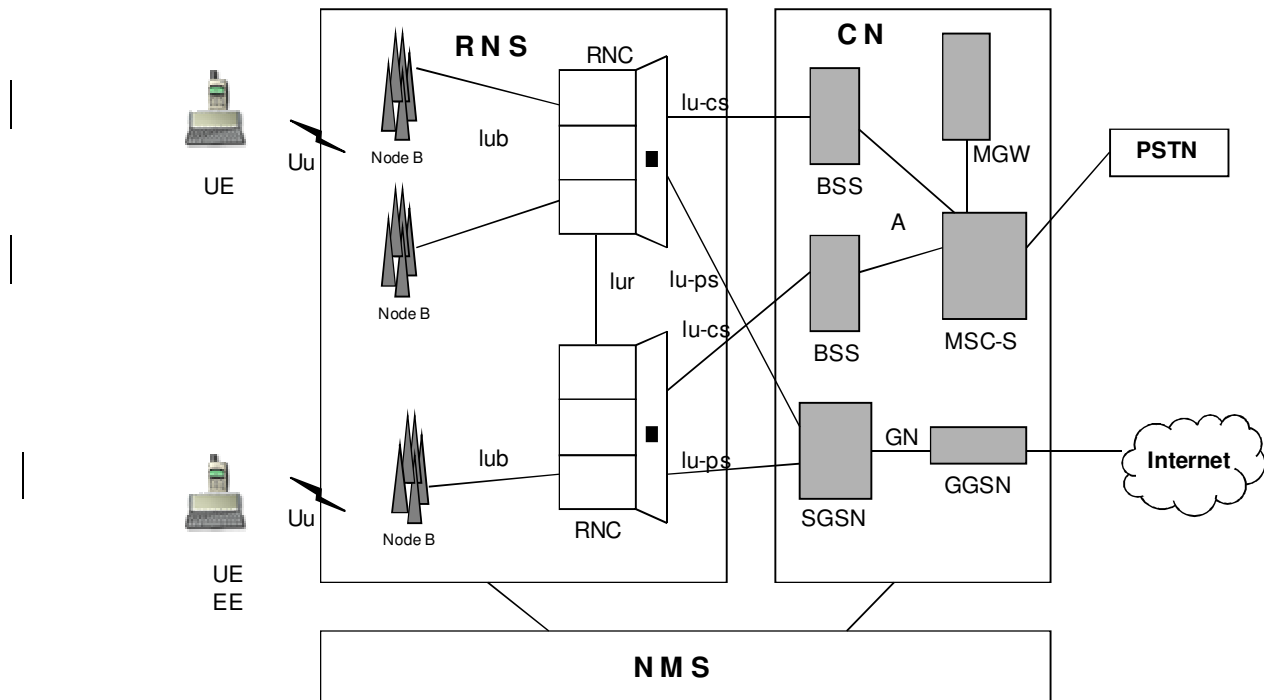
Figure 3 Core Structure connectivity in 3G

In PS Domain, Serving GPRS Support Node (SGSN) performs the functions similar to functions of MSC, we can loosely term SGSN as MSC for PS domain. It performs the function of routing as well holds the data base of the customers. In addition to SGSN, there is another entity known as Gateway GPRS Support Node (GGSN). The main function of the unit is to provide connectivity to the external PS networks.

There are some entities which are common to CS and PS domains. These are HLR, AuC, EIR, SMS Gateway MSC (SMS-GMSC) and SMS interworking MSC (SMS-IWMSC). In addition to them, there are certain entities which are service specific. Gateway Mobile Location Center (GMLC), CAMEL (Customized Application for Mobile Enhanced Logic) etc. are some of the important entities amongst them.

The functions of various nodes:-

Serving GPRS Support Node (SGSN)
- Session and mobility management (paging, attach, detach, Packet Data Protocol (PDP) context handling, intra- and inter-SGSN routing area update).
- Payload Handling
- Security includes features such as user and network authentication and data confidentiality through ciphering.
- CDR based charging includes functions for collecting   charging information from various sources within the SGSN
- CAMEL based charging provides a real-time charging mechanism
- Configuration management functions that support definition and handling of logical relations with other network elements

- SMS over GPRS
- Support for SS7 signaling.

MSC Server

- Circuit based connection management i.e. traffic control, roaming, call routing and handover.
- Media Gateway Control
- Mobility Management
- Authentication
- Charging data collection/output
- Supporting a comprehensive set of Supplementary Services that complement and modify the Tele-services and Bearer Services.
- IN and CAMEL Services
- Security

Home Location Register (HLR)

- Home Location Register (HLR) serves as the primary database of subscriber information used to provide control and intelligence within the GSM/GPRS and WCDMA networks.

- The HLR manages mobile subscribes profiles as well as subscriber location and activity, and also handles supplementary services.

Authentication Centre (AUC)

The Authentication Centre (AUC) contains functions for secure storage of individual subscriber identifiers and keys. AUC also includes algorithms necessary for generating authentication and ciphering data based on the subscriber keys. The authentication and ciphering data, provided by the AUC upon request, are used by different network elements to protect the network, users and operators against unauthorized use of the system.

Equipment Identity Register (EIR)

- The EIR database validates mobile equipment hardware identity, The MSC can request the EIR to check if an MS has been stolen or is faulty (black listed), not type-approved (gray listed), normal registered (white listed), or unknown.

Flexible Number Register (FNR)

The FNR node offers:
- Mobile Number Portability (MNP): This feature permits an end-user to keep his MSISDN identity when changing service provider or moving subscription between two service domains within the same country.

Flexible Allocation of MSISDN for the GSM and WCDMA networks. This feature provides mobile operators with free allocation of subscription identity without considering the relation between

BSNL 3G Services

Introduction

UMTS stands for "universal mobile telecommunications system" and is the portable radio system of the 3rd Generation. UMTS is a component of the vision "IMT-2000" of the International Telecommunication union (ITU) concerning a global standard of mobile communication systems of the third generation (3G). UMTS is to replace the presently used GSM system.

UMTS is by defined European Union as:

"... a third-generation mobile and wireless communications system capable of supporting in particular innovative multimedia services, beyond the capability of second generation systems such as GSM ...".

This definition is not very specific when it comes to what kind of new services to expect. ITU is slightly more specific as they define UMTS by higher capacity and enhanced network functionalities, which allow advanced services and applications, including multimedia. UMTS can provide a wide variety of services. The service concepts and definitions of UMTS are for the most part copied from the GSM world. But whereas in GSM the service parameters are often fixed, in UMTS they can be dynamically renegotiated whenever required.

UMTS Service Categories

The services provided by UMTS can be divided into four main classes:
1. Teleservices;
2. Bearer services;
3. Supplementary services;
4. Service capabilities (i.e., support for value-added services).

The key features for end-users provided by UMTS are:

- Provision of Internet and other multimedia applications.
- A range of content services.

- Worldwide roaming capability.

What makes UMTS so different from GSM and other 2G systems is the UE's ability to negotiate the QoS parameters for a radio bearer (RB).

In UMTS the Quality of service (QoS) requirements can be divided into four classes:
1. Conversational real-time services;
2. Interactive services;
3. Streaming services;
4. Background services.

Conversational class
In the conversational class the traffic is bidirectional and more or less symmetric.
Examples of applications belonging to this class include voice, videophones, and interactive games.
The conversational real-time service class is technically the most challenging class. Because the services in this class are conversational, only a very short delay is acceptable (typically a few hundred milliseconds), and the delay variation must be negligible and hold relatively constant.

Interactive class
In the interactive class services the user requests data from a remote server, and the response contains the requested data. Examples of these services are Web browsing, e-shopping, and database inquiries.
The difference between conversational and interactive classes is that the data traffic in the conversational class is symmetric or nearly symmetric, whereas in the interactive class, the data traffic is highly asymmetric.

Streaming class
This class of services, the streaming services, typically includes video and audio applications directed to a human user. The differences between the conversational and streaming classes can be demonstrated by considering the difference between talking on the phone (conversational) and listening to music on a CD (streaming). What makes streaming class different from the interactive class is that the data transfer in the streaming class is almost totally one-way and continuous: highly asymmetric. The receiving end does not have to receive the whole file before it can start presenting it to the user.

Background class
In the background class all those services that do not have precise delay requirements at all are included. The applications generally expect to receive the
data within a defined time, or the time limit is quite high. However, it may use timers to make sure that the data transfer has not stalled altogether. Typical applications using background services are fax and SMS.

UMTS will provide basic services as with GSM, i.e. voice, SMS, roaming and billing. In addition, multimedia services developed by operators as well as service providers will create additional value and it is probable and expected that different forms of service providers will have a more highlighted role in the future, implying new business models and new forms of revenue sharing.

The content services that will be provided by UMTS will evolve from the "there and then" voice and SMS services provided by GSM. These services provided by UMTS can basically be described as "mobile Internet", where content is optimised for the limited graphical abilities of the mobile handsets, as well as utilising functionality as location awareness. A range of services have been suggested, as for example:

- *Images and video:* streaming pictures and video, entertainment, games, lottery, gambling, pornography and video-conferencing.
- *Location based services:* Information of nearby restaurants, shops and special offers.
- *Context based services*: Notification of interesting sports event if you are in front of the TV, advertising if you are close to the advertiser
- Simultaneous transfer of speech, data, text, pictures, audio and video.
- High-speed, mobile access to the Internet.
- Customized infotainment.

Everybody involved in 3G businesses understand that it is not the technology people are buying

and consuming, but the services and content. There has already been one notable failure in 2G,

when WAP was marketed as a technology, but nobody told the customers what they could do

with WAP. GPRS has also had a slow adoption process because there have not been enough

GPRS-specific services on offer. This shows that customers are not eager to adopt new

technologies, but they are looking for new services.

Some examples of 3G Applications

Voice
Voice is and remains the most important type of application in mobile telecommunications. However, it will increasingly be combined with other forms of communication to form multimedia communication.
In 3GPP networks voice will be transferred in IP packets once the network becomes an all-IP network. This scheme is known as Voice over IP (VoIP). Actually VoIP is not an improvement as such for voice transfer. It is a mechanism that forces voice services into a packet-switched network not optimized to handle them; this had to be accomplished so that packet switched IP could be used everywhere.

Transmission of caller's and receiver's live images along with the voice call is new and interesting feature of 3G network. This is known as video calling and there is very high craze for this new service.

Messaging

Messaging services is an important application segment. The success of SMS messaging shows that there is a marketplace for services like these. The basic text-based SMS will also be available in 3G, but the faster data rates of the new system make it possible to send much more than plain text in these messages. There is a new concept developed based on the notion of an enhanced SMS concept. This is called the multimedia messaging service (MMS).

This concept translates into a non-real-time messaging service that can deliver several multimedia components, such as text, (still) images, voice, and video. An MMS message can contain more than one component; these components are then combined in the user interface to produce a multimedia presentation. A simple MMS application could be an electronic picture postcard. Other MMS examples include electronic newspapers, news, traffic information, maps and driving instructions, music on demand, advertisements, and on-line shopping.

Internet Access

Internet access is an almost mandatory application for 3G mobile terminals. Over the last decade the Internet has grown to be a very important communication medium, and it continues to grow rapidly. Access to a communication medium as important as the Internet must be included in a 3G application portfolio. Fortunately, this access will be relatively easy to implement in a 3G terminal.

The 3GPP is specifying an all-IP network, which means that Internet protocols could be used all

the way down to the terminal level. A mobile terminal would be an Internet node, just like any

PC, with its own IP address number.

Location-Based Applications

The UTRAN system contains several methods to determine the location of UE's. This makes it possible to provide a totally new class of applications to mobile phone users: applications that use the knowledge of the mobile user's location.

The location data itself can be useful information for the user and can be used in various ways for example the mobile terminal can inform a lost user about his or her location, how to get to a desired location from the current position, Location-specific billing is an application that could be used by a network operator.

Advertising

Generally the idea to send an advertisement to all subscribers in the network is not appreciated. Most subscribers are probably not at all interested in a certain advertisement and will regard it as junk mail. This will only irritate the customers. Moreover, sending large amounts of advertisements will use a lot of capacity; thus, it is expensive. The operator should therefore build an accurate user profile database and send the advertisement to only those customers who are

most likely to be interested in it. For example, if a customer has bought several books using his mobile device, it is probable that he is interested in receiving information on book sales or new books on the same subject.

Difference between 2G & 3G services

To overcome the limitations of 2G and 2.5G(low data rate) the 3G had been introduced. In this 3G Wide Brand CDMA Network is used with which the clarity increases and gives the perfection as like that of a real conversation. The data are sent through the technology called Packet Switching.Voice calls are interpreted through Circuit Switching.

S.No.	2G Services	3G Services
1.	Low Data Speed Rate	Very High Speed Rate
2.	CircuitSwitching technology.	Packet Switching technology
3.	Time Base Charging	Volume Base charging
4.	SMS / SMSCB	MMS / MBMS(Multimedia Broadcast and Multicast Services)
5	Very Slow Internet , Only Audio (Voice) Multiparty Communication, On Line Applications not possible in 2G.	Fast Communication, Internet, Mobile T.V, LBS, Video Conferencing, Video Calls, Multi Media Messaging Service (MMS), 3D gaming, Multi-Gaming and On Line Applications like Bill Payments etc.

Enhanced Content services.

The content services include the following:-

- Full movie /music download / Tone downloads / Wallpapers and pictures

- Users can download full track music and videos on their mobile any time, any where Mobile TV allows the user to view TV channels on the mobile.

- Live news & sport updates / Interactive games / video streaming

3G is introduced in India for the very first time. Operators globally have used innovative strategies to lure 3G customers through varied content & pricing 3G services will be primarily used by high end customers who will expect high levels of customer support.

Video Mail :-addition to voice mail available on 2G platform, with 3G we can deploy video mail service also

Video Conferencing:- With 3G Technology we can have video conferencing facility through our mobile phones

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