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Implication of IPv6 addressing on mobile network

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Abstract: **Our understanding of the telecom network interface (address) scheme leads to introduce a different interfacing mechanism using Internet protocol. The present telecom technology uses SS7 (Signaling System 7) protocol, which defines the telecom network architecture, configuration and message transfer protocol for public telephone networks. Improved versions of SS7 such as SIGTRAN, VoIP, etc. helped implement two mobile interfaces. One for voice communication, voice communication happens in traditional Telephone network and other for GPRS services (data transfer), Internet connection happens in modern soft phone devices. This paper helps in understanding how interfaces are identified in the PSTN (Public switched telephone system) and in the GPRS connection using dynamic IPv4 address, which solves lot of problems associated with routing, identifying and the performance issues related to the mobile network. In this paper, we have given brief description of implication of IPv6 addressing mechanism instead of IPv4 addressing mechanism, presently used in GPRS service of mobile network and also discussed the expected results of the above said implication. Thus, this paper helps in understanding, assigning an IPv6 address to each and every components of the mobile network and also to the mobile devices will achieve high speed, high capacity, high bandwidth; fast connection with high transmission rate and also multiple interfaces can be easily replaced with single interface with one IPv6 address.**

Keywords: **mobile network architecture, SS7, IPv4/IPv6 addressing schemes.**

1. INTRODUCTION:

Addressing is the basic method of identifying anything in the world. Effective addressing methods solve lot of problem in the technological world. In this paper we have given the brief description of mobile Infrastructure for understanding the importance of addressing and solving associated problem in the present telecom domain. A mobile operator's network is called Public Land Mobile Network. It is subdivided into three parts: Base Station Subsystem (BSS); Network Switching Subsystem (NSS); Network Management Subsystem (NMS)

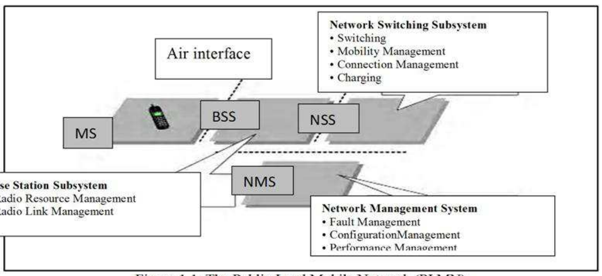

Figure 1.1: The Public Land Mobile Network (PLMN)

The Network Switching Subsystem is responsible for switching, mobility management, and traffic element, i.e. that here network elements such as exchanges and databases can be found. The exchanges are responsible for switching, while the databases are used to keep track of the current location of the subscriber and his mobile phone. Imagine, a subscriber can be anywhere worldwide, and someone is calling him. There are millions of cells, where the subscriber and his mobile phone can be located.

The Base Station Subsystem is responsible to for a link between the mobile phone and the exchange, which is presently serving it. The radio interface requires hereby a lot of attention. User data must be protected. Therefore ciphering of user data is done in the base station and the mobile phone. The transmission must be reliable. If a mobile subscriber wants to make a call, physical resources must be allocated to him. The tasks of the BSS can be summarized under the key terms Radio Resource Management (RRM) and Radio Link Management (RLM).

The Network Management System supports the operator in remote network supervision. Fault, configuration, and performance management are central tasks performed within the NMS. Very important open interfaces are the Um interface and the A-interface. Open interfaces guarantee interworking of network elements from different vendors. An operator may select the NSS from manufacturer 1, the BSS from manufacturer 2, while the subscriber uses a mobile phone from manufacturer 3.

The GSM network is called Public Land Mobile Network (PLMN). It is organized as shown in fig 1.2: architecture of PLMN network which is very much similar to CDMA technology also. The following are the important components of mobile and the respective tasks are presented below

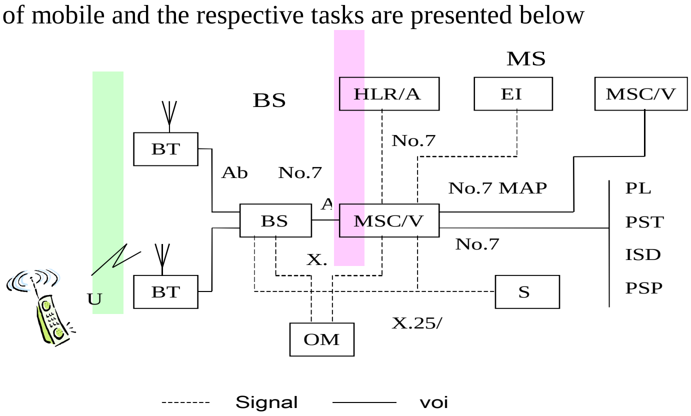

Figure1.2: Important components of PLMN network

BTS (Base transceiver station) is the network element responsible for maintaining the air interface and minimizing the transmission problems this is very sensitive to the disturbances. The other functions such as Air interface signaling, Ciphering, Speech processing,etc. The base station can contain several TRXs (Transceivers), each supporting one pair of frequencies for transmitting and receiving information. The BTS also has one or more antennas, which are capable of transmitting and receiving information to/from one or more TRXs. The antennas are either omni directional or sectored. It also has control functions for Operation and Maintenance (O&M), synchronization and external alarms, etc. MSC (Mobile Switching Center) is responsible for controlling calls in the mobile network. It identifies the origin and destination of a call (mobile station or fixed telephone), as well as the type of a call. Other responsibilities of MSC are Call control, Initiation of paging, Charging data collection, etc. VLR (Visitor Location Register) is a database that contains information about subscribers currently being in the service area of the MSC/VLR, such as: Identification numbers of the subscribers, Security information for authentication of the SIM card and for ciphering and also services related location registrations and updates. When a mobile station comes to a new MSC/VLR serving area, it must register itself in the VLR, in other words perform a location update. A mobile subscriber must always be registered in a VLR in order to use the services of the network and also the mobile stations located in their own networks are always registered in a VLR. The VLR database is temporary, in the sense that the data is held as long as the subscriber is within its service area. It also contains the address to every subscriber's Home Location Register.HLR (Home Location Register) HLR maintains a permanent register of the subscribers. For instance the subscriber identity numbers and the subscribed services can be found here. In addition to the fixed data, the HLR also keeps track of the current location of its customers. As you will see later, the GMSC asks for routing information from the HLR if a call is to be set up to a mobile station (mobile terminated call).

AUC (Authentication Center) The Authentication Centre provides security information to the network, so that we can verify the SIM cards (authentication between the mobile station and the VLR, and cipher the information transmitted in the air interface (between the MS and the Base Transceiver Station)). The Authentication Centre supports the VLR's work by issuing so-called authentication triplets upon request. Equipment Identity Register (EIR) the Equipment Identity Register is used for security reasons. But while the AC provides information for verifying the SIM cards, the EIR is responsible for IMEI checking (checking the validity of the mobile equipment). When this optional network element is in use, the mobile station is requested to provide the International Mobile Equipment Identity (IMEI) number. The EIR contains three lists: Mobile equipment in the white list is allowed to operate normally, If we suspect that mobile equipment is faulty, we can monitor the use of it. It is then placed in the grey list, If the mobile equipment is reported stolen, or it is otherwise not allowed to operate in the network, it is placed in the black list. IMEI checking is an optional procedure, so it is up to the operator to define if and when IMEI checking is performed. (Some operators do not even implement the EIR at all.) SC (Short Message Center) The Short Message Service Centre (SMSC) is an element in a GSM network responsible for the delivery of short messages (SMS). All messages are sent to the SMSC. The SMSC stores the messages, extracts the destination from it and tries to deliver the message. If the message cannot be delivered, the SMSC will try again to deliver the message in a so-called retry-schedule. If the mobile phone is turned on or comes within reach of the network, the SMSC will also retry to deliver the message. If a mobile telephone received a message, it will send an acknowledgement back. Usually the message will be discarded after two days if the destination cannot be reached.

OMC (Operation and Maintenance Center) Operation Maintenance Center (OMC) is used to monitor and maintain the performance of all the components of the system such as Mobile Station (MS), Base Station (BS), Base Station Controller (BSC) and Mobile Switching Center (MSC) within a GSM system. MS (Mobile Station) is is a combination of terminal equipment and subscriber’s dataSIM (Subscriber Identity Module). SS7 was designed exclusively as a signaling network; Signaling is just a techie word for the exchange of messages between telecommunications network elements (Signaling Points). SS7 was an important enabler for the Mobile Application Parts (MAP) that enabled roaming with cellular systems, notably GSM MAP and ANSI-41 (which supports CDMA, TDMA and analog networks). These protocols coordinated activities between Mobile Switching Centers (MSCs), Home Location Registers (HLRs), Short Message Centers (SMSCs) and other types of signaling points. SS7 is a true packet-switching protocol, allowing the exchange of messages between any two points on the network without any need to set up an association or have a direct connection. It is also extremely robust. By continually monitoring route status, it can usually find the best route, and when failures occur with messages in transit, many re-routing options are available Some of the major restrictions with SS7 are Link speed and capacity, Message size, Addressing and International routing.

Link Speed and Capacity

The standard link speed with SS7 is 64 kbps, designed to fit nicely within the basic North American digital T1 trunks (which contain 24 circuits, each with a 56-64 kbps capacity) or the basic international digital E1 trunks (32 circuits running at 64 kbp). The capacity can be increased by implementing up to sixteen SS7 links at a single signaling point.Capacity can be further expanded by implementing 1.5 Mbps links (i.e. an entire T1). Well, in theory they can. In practice it is not so easy, as we will see.

Message Size

Application messages on an SS7 network are limited to between 200 and 250 bytes depending on the size of the message headers. This is one of the reasons why wireless short messages have been limited to fewer than 200 bytes in length, even though radio protocols can often handle more. Recent versions of SS7 can support larger messages.

Addressing

SS7 is defined to a significant extent by the ITU and adapted by each nation. Consequently there are significant differences between national SS7 variants, notably with regard to addressing. The fundamental address in SS7 is the point code, a unique number assigned to a signaling point (including STPs). Well, unique within a national network. Point codes are assigned separately by each network, and vary significantly in size, from 14 bits to 24 bits. The second address type in SS7 is known as the 'global title'. This enables a telephony address, such as a phone number or calling card number to be used for SS7 routing. The global title may be translated into either an intermediate or final point code (i.e. the point code of the destination signaling point). In the case of international signaling the global title will first be translated into the point code of an international gateway which will perform protocol translation, and then translate the global title into a point code in the destination national network, or use global title routing to forward the message to an STP to perform this function. The major problem with global titles is the management burden they impose on STPs. Every STP has to have a set of routing tables for each type of global title, these must be customized for the position of an STP in the network and they have to be frequently updated. Errors in the global title tables could cause the loss of messages or even network failure.

International Routing

International routing using SS7 can best be accomplished with global titles. This does not mean that global titles are fully compatible between countries. The encoding of global titles is a national issue making international gateways specialized and complex devices. Furthermore, higher level differences also exist.

Implication of IP on mobile network

Internet Protocols took the world by storm in the 1990's. Initially, they were expected to be only an interim measure until international standard protocols were implemented, but their use is now so widespread it is hard to see how they could ever be replaced. Even though internet protocols and SS7 were developed for different purposes, they do have a lot in common. In both cases, the basic protocol is purely packet based. Connections or associations between end-points must be supported by higher level protocols and both use a numeric address to route messages. These are important similarities, but the differences are far more numerous. The internet uses a more layered approach than SS7. Above the physical layer (e.g. Ethernet) runs IP which is a pure packet-switching protocol, providing the information that routers need to get a message to a correct destination. IP does not guarantee that a message will reach its destination, so TCP (Transmission Control Protocol) is commonly used as a higher layer to ensure that every message gets delivered exactly once. Above this layer run higher level protocols such as http (Hyper Text Transfer Protocol) which supports the ubiquitous HTML.

IP Bandwidth, Capacity and Message Size

IP was designed to run over virtually any link speed, so providing raw capacity is not an issue. Message sizes are more than doubling that available with SS7, and fragmentation is built into the basic IP protocol. Consequently, messages those are many times larger than the current SS7 maximum can be transmitted.

IP Addressing

IP addressing has some similarities with SS7. The basic IP address is also numeric and a second logical level of addressing, using domain names is also provided. IP addresses are truly global, however, not limited to one national network like SS7 point codes. Domain names not only include letters as well as digits (and some special characters) giving them more mnemonic value, but they are also interpreted quite different. Domain names are not used for routing, but are simply translated into an IP address, or list of IP addresses, before routing occurs. This means that routers do not have to be configured to interpret them. This reduces the management load, and also means that the domain name infrastructure can be changed independently of the routing fabric, as long as the output is still an IP address. It also makes routers much simpler (and therefore cheaper) than STPs. But, all is not well with IP addressing. Due to inefficient assignments, the current IPv4 (Version 4) address space is quickly being exhausted. IPv6 will provide a massive increase in the number of networks and individual addresses, this is our next choice. In this paper we are giving an idea of using IPv6 instead of IPv4 which is used in most of the telephone networks implemented. The problem is that the additional addresses in IPv6 can only be utilized if they are addressable from IPv4, which means that there cannot be more addresses than IPv4 can already address! The best that can be hoped is for a slow migration to IPv6, turning on the additional addresses only after all IPv4 network elements in the world are shut off.

Technology behind the IP usage

To extend the life of IPv4, many innovative techniques have been developed. IP addresses are now assigned less rigidly, and many organizations implement NAT (Network Address Translation) to allow the assignment of many virtual IP addresses within an organization, while using only a small number of public IP addresses. Mobile devices may need their own IP address to support 'always on' services. Present technology 3Gusesto interfaces one works on SS7 to support voice communication and other GPRS interface to exchange/transfer data. Presently GPRS enabled handsets are used for vedio/audio, file sharing, related application are using internet connection and it is achieved by GPRS connection by DNS and DHCP servers with the help of service access point associated in the handset. With the above technology, it very clear that every device cannot provided with IPv4 address to connect internet. This faces other problems such as international roaming, connectivity, IPv4 address exhaustion,

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speed (because of overhead in dynamically allocationing IPv4 address to each connection request to connect internet) etc.

In this paper, we are proposing a method of using IPv6 interfaces to connect to internet and also to be used for voice calls. IP enabled devices can directly connect to internet avoiding the intervention of DNS, DHCP servers responsible for allocation dynamic IP to the interface for GPRS services. This will helps to increase the performance of mobile network. IPv6 address space is too large, so that we can provide each with a static IP to connect to internet.

Our observation on the implication of IPv6 into the mobile network can be given as below.

1. International Roaming is possible by retaining the same IPv6 address.
2. Speed/Capacity increases with the IPv6 enabled devices,which supports many applications at same time with high speed
3. It is possible to have high Bandwidth, fast connection and transmission rate with IPv6.
4. 12 digit mobile numbers for GSM/Voice and Dynamic IPv4 address to achieve GPRS service in the present mobile technology will be replaced with unique IPv6 address for voice and GPRS services.
5. With proper structure of IPv6 address distribution and assignment helps in high performance mobile network.

CONCLUSION

In this paper, we have discussed the importance of IPv6 in mobile technology and importance of adopting IP addressing model for telephone system instead of traditional method using SS7 protocol and its drawback. Because of inefficiency of SS7 and IPv4 address exhaustion, IPv6 will take lead in the advancement of Mobile Technology and communication technology as a whole. Taking into account all the aspects discussed so far, it is possible to assign an IPv6 address to each and every components of the mobile network and also to the mobile devices to achieve high-speed, high capacity, high band width, fast connection with high transmission rate and also multiple interfaces can be easily replaced with single IPv6 address. This paper surely helps in thinking of new innovations with the implementation of IPv6 protocol into the communication technology.

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