

Evolution from GSM to 3G

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Brief Description

In this poster, we will look at some of the important issues pertaining to the evolution of mobile communication networks from GSM (Global System for Mobile Communications) to GPRS (General Packet Radio Service) and to 3G (Third Generation). Some network operators may also choose to implement HSCSD (High Speed Circuit Switched Data) or EDGE (Enhanced Data Rate for GSM Evolution) in this evolutionary process. Other operators may choose to miss these steps.

This evolution will manifest in the form of new techniques for modulation, multi-access, multiplexing, radio resource management, mobility management, traffic management, parallel circuit and packet switched networks, compression, ciphering, authentication, handover, roaming, switching and transmission technologies, communication protocols, user terminals, services, etc.

From a mobile network operator viewpoint, the major issues in this evolution will be

- (a) Provision of radio resources for transmission and eventual separation of circuit switched and packet switched traffic in the GSM BSS (Base Station Subsystem) or 3G RAN (Radio Access Network).
- (b) Introduction of new network elements that are capable of handling packet switched traffic and the associated functionality, such as SGSN (Serving GPRS Support Node), GGSN (Gateway GPRS Support Node), DNS (Domain Name Server), BG (Border Gateway), etc.
- (c) Charging in GSM was simple and based on the duration of the connection. But in a packet switched network, an end-to-end connection is not provided. Thus new charging models for GPRS and 3G based on data throughput, QoS, etc., need to be developed. Support for pre-paid data and hot billing services have to be incorporated.
- (d) QoS service issues become important in packet switched networks. Current GPRS and 3G standards have defined a number of QoS services that can be requested by a user. Mechanisms to provide QoS requested by the subscriber have to be incorporated throughout the network.
- (e) Improved radio interface techniques that offer higher capacity.
- (f) Evolution from IPv4 to IPv6 for the packet core networks and its interface to the Internet.
- (g) In most networks there will be a co-existence of the GSM and 3G network. Existing GSM network will continue to serve rural and semi urban areas where there are low traffic demands. Thus handover mechanisms between 3G and GSM networks need to be incorporated.
- (h) Subscriber terminals and SIM (Subscriber Identity Module) have to evolve to be able to handle both circuit and packet switched services.
- (i) Network management for combined circuit and packet switched network elements needs to be incorporated.
- (j) Security issues pertaining to packet switched traffic and the Internet needs to be developed to minimize the effect of hacking.

EXTENDED ABSTRACT

(k) Provision of voice over IP services through a packet switched network in the distant future networks.

(l) Evolution from an IP based backbone to an ATM based backbone network.

(m) Minimization of operator cost in the evolution process. In this plethora of technologies, an operator needs to choose technologies that will guarantee a return on their investment and satisfy the subscriber expectations.

(n) Modification to the subscriber data stored in the HLR and network databases. The present GSM subscriber data is very simple but in future there will be a large amount of information that will need to be stored about each subscriber. This includes list of allowed connections, QoS, etc.

(o) Provision of SMS services through circuit switched and packet switched networks. At present, SMS services are provided through signalling channels in GSM. In the future, it is anticipated that SMS can be delivered through the packet switched network.

(p) At PDP context activation (requesting a data connection), a mobile subscriber specifies an APN (Access Point Name) which consists of an operator ID and external network ID. The APN has to be translated into a GGSN IP Address. This requires deployment of an alternate 3G/GPRS DNS (Domain Name Server) hierarchy that is capable of translating Mobile DNS inquiries.

(q) Roaming strategies are needed for GPRS and 3G data users through operator to operator inter PLMN packet switched networks or through the Internet. Roaming agreements need to be signed between operators.

(r) New techniques for monitoring and apprehending rogue data subscribers by Law Enforcement agencies (LEA) have to be incorporated through the use of LIG (Lawful Interception Gateway).

(s) Alternative network capacity planning techniques are used for TDMA and CDMA networks. Thus planning of 3G networks will be considerably different to GSM based networks.

(t) Good models exist for mobile circuit switched traffic behaviour but at present no models exist for mobile packet switched traffic. These models are essential for network planning and management.

(u) Several different models for connectivity to external networks such as Intranets and Internets have been proposed. Each of the models has to be evaluated by operators.

(v) With increasing complexity of mobile networks and the wide spread use of common channel signalling (SS7), there will be a considerable rise in the signalling traffic flowing in the signalling network. There is a possibility that even though transmission resources are available, communication is not possible due to congestion in signalling networks. There is need to re-dimension the signalling networks in the evolution process.

(w) Most circuit switched planning is based on the concept of busy hour, which is a continuous period of 60 min during which CS traffic is at its peak. In future networks, the peak traffic need not necessarily be at the time when circuit switched or packet switched traffic is at its peak.