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Mobility Management Issues In 3G & 4G Network

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ABSRACT
3G refers to technologies associated with wireless communications and is most often associated with cell phones. Popular use of the term 3G, such as "a 3G phone," refers to the types of cell phones equipped to access to a wireless data network using 3G standards. Cell phones and other Internet-enabled devices that use 3G wireless technology are perceived as achieving higher speeds when browsing the Web, downloading files or performing other wireless Internet-related tasks. Numerous different network technologies with their individual pros and cons are existing globally. 4G or Fourth Generation networks are designed to facilitate improved wireless capabilities, network speeds and visual technologies. The growing interest in 4G networks is driven by the set of new services, will be made available for the first time such as accessing the Internet anytime from anywhere, global roaming, and wider support for multimedia applications. This article discusses some of the mobility issues in 4G networks along with a little coverage of the evolution of different generations.

Keywords
3G,4G, Mobility Management, Triggering, Handover

1. INTRODUCTION
With the huge worldwide increase in the number of mobile users each day and with emerging demands like totally user-centric services, high speed streaming Internet multimedia services, seamless global roaming with ubiquitous coverage and unrestricted QOS support, 3G systems have started showing their limitations with bandwidth availability, spectrum allocation, air interference standards and lack of seamless transport mechanisms between different networks[2]. . Technically, 3G stands for 3rd generation and refers to the third generation of related standards established by the ITU, or International Telecommunication Union. The family includes technologies recognized by consumers such as GSM EDGE and Wi MAX. The 3rd Generation Partnership Project (3GGP) has taken an active role in establishing and promoting 3G standards in order to increase the benefit of 3G technologies to consumers. Regarding the architecture it changed as shift from 2G to 3G because of spectrum needed and promise provided to the telephone subscribers and also devices used in 2G generation were also not able to provide the efficient quality of service as 3G spectrum and it was necessary to replace these devices with new enhanced device. No doubt it was a challenge but ITU and UTMS make it possible.

The third generation (3G) mobile technology has much superior bandwidth than 2G and supports high quality data and voice services. Universal Mobile Telecommunication System (UMTS), standardized by the 3GPP, is the 3G mobile communication technology successor to GSM and GPRS. UMTS enhances the existing GSM technology by providing increased bandwidth, data capacity and a wide range of high end services and features using a unique radio interface standard known as UMTS Terrestrial Radio Access (UTRA). Apart from normal talking services users can now use interactive services like internet access, chat services, online banking, data transfer, music and movies download etc. But as services increase and mobile networks become more complex and open, so do the security risks and type of attacks from potential hackers. Valuable and precious information sent through wireless networks has to be protected from potential hackers. The complex network configuration, which allows superior connectivity rates and “o n the go” connectivity, may increase the probability of possible attacks. In addition, the introduction of IP layer in the network domain, for signaling and user data transmission, makes the network open and more vulnerable. UMTS security architecture as proposed by 3GPP retains and enhances the essential features of GSM security.

There are three different generations as far as mobile communication is concerned as discussed below:

1. First Generation (1 G)
2. Second Generation (2G)
3. Third Generation (3G)
4. Fourth Generation (4 G)

The 4G systems is a potential smooth merger of all the existing heterogeneous technologies with a natural progression to support seamless cost-effective high data rate, global roaming, efficient personalized services, typical user-centric integrated service model, high QOS and overall stable system performance[4].

The article is structured as follows: section 2 introduces the evolution and section 3 discusses the mobility issues in 4 G networks. The conclusion is presented in section 4.

2. THE EVOLUTION
0G Networks represents the 1st Generation of mobile telephony, where satellite phones were developed and deployed for boats mainly. 1G Network provided the facilities of making voice calls and sending text messages. (NMT, AMPS, TACS) are considered to be the first analog cellular systems, which started in early 1980s. The greatest disadvantage 1G had was that it only allowed to contact within the premises of that particular nation. 2G Network

(GSM) represents the 2nd Generation of mobile telecommunications and is still the most widespread technology in the world but with a slow rate of 9.6 Kbytes/sec. 2.5G Network, mid generation offered a higher data rate than 2G technology and enabled the delivery of basic data services like text messaging but not enough to download an image or browse a website with data rate upto 144 kbps. GPRS, EDGE and CDMA 2000 were 2.5 technologies. 2.75G Network enabled watch streaming video and download mp3 files faster upto 180kbps.

3G Network represents the 3rd Generation designed to overcome all the limitations of above technologies. GSM 3G networks are termed UMTS in US and wideband CDMA (WCDMA) worldwide. UMTS supports global roaming capabilities and speed is 3 times that of a GSM. 3.5G or 3G+ NETWORK offers 7.2 and 14.4 Mbps on cell phones. 4G Networks is the future. Some basic 4G research is being done, but no frequencies have been allocated. The Fourth Generation could be ready for implementation around 2012. 4G should support at least 100 Mbps peak rates in full-mobility wide area coverage and 1Gbps in low-mobility local area coverage". Some of the limitations of 3G [3] which originated 4G can be listed as:

1) All the problems are partly solved, doesnot have sufficient capabilities.
2) Difficulty in increasing bandwidth.
3) Limitation of spectrum and its allocation.
4) Difficult to roam across distinct service environment.

The 4G mobility management includes additional mobility related features, absent in previous generation networks, such as; Moving Networks, Seamless Roaming and Vertical Handover.

The main aim of the research Paper is to check the oppertunities and challenges in 3G & 4G Architecture.There is constant increase in global demand for data transfer, record growth in Internet links and access together. With the requirement to make these services in the fixed network sector as well in the mobile sector, all forecasts are predicting a steep rise in the volume of data transfers using mobile communication systems.

Although the demand for mobile computing, Internet and intranet access already exists, expansion in these sectors was greatly hindered by cumbersome equipment, very low data transfer rates and overly expensive costs for the mobile transfer of data. All of these barriers are set to be overcome in GSM Phase 2+ and by the 3G systems. Against this background, the expert studies (for example, UMTS Forum) are predicting a considerably greater increase in the volume of data for transfer than for speech transmissions.

Current Market Demands Regarding Mobile Communications

The demands currently made by the mobile communications market are varied and include the following:

1. Improved speech quality
2. User friendliness
3. Global accessibility
4. Special services for particular user groups (for example, Closed User Groups)
5. Flexible Service Creation
6. Everywhere the same services as in HPLMN
7. Fast transfer of large data volumes
8. Mobile Internet / Intranet Access.

The study also aims at obtaining the following objectives as corollary and subsidiary objectives:

- Explaining various phases of 3G
- 2G to 3G Network standardization
- Over view of 3G architecture.
- Challenges and opportunities in 3G & 4G

3. MOBILITY MANAGEMENT ISSUES

According to the mobility scenarios for future, referred in ongoing researches the following mobility management issues can be highlighted:

3.1 Connectivity

Triggering. Different kinds of events can trigger mobility management actions that may result in some conflicts. A general framework is required to resolve conflicting triggers generated simultaneously by different components, on the basis of predefined policies and rules.

Handover . In the emerging 4G networks which are both multi-domain and multi-technology, handover requests could be based on a number of different needs or policies such as cost reduction criteria, network resource optimization etc. Various handover solutions have been devised to provide seamless transfer of services across heterogeneous boundaries. One is *IP-Based.* Many researchers agree that Mobile IP will be the key for providing efficient interworking between different technologies. Others are IDMP-based or Agent based.

3.2 Location Management

Location management involves two operations; location registration and call delivery. Location registration involves the mobile terminal periodically updating the network about its new location (access point).This allows the network to keep a track of the mobile terminal. In the second operation the network is queried for the user location profile and the current position of the mobile host is retrieved.

3.3 Routing Group Formation

Moving networks are a prominent component of future networking scenarios. a typical example can be of moving users with several terminals forming temporary moving clusters and network hierarchies while traveling on a train. A common characteristic for this kind of scenarios is that some mobile entities that are close by move together, forming a *cluster*,, be joined together into a unified network. The formation of this unified network will be highly dynamic, and some kind of hierarchy will be needed in order to integrate them into encapsulating moving networks.

3.4 Seamless Mobility

Seamless mobility must be a set of solutions that will provide easy, uninterrupted access to information, entertainment, communication, monitoring and control – when, where and how we want, regardless of the device, service, network or location. Instead of experiencing a disconnect as movement occurs between different devices, environments and networks, seamless mobility will deliver experiences that span the home, vehicle, office and beyond.

3.5 Mobility Context Management

It is assumed that the future terminals, applications and networks will be able to provide a versatile set of information about themselves, their surroundings and the situation where they are used. The mobility management component needs

access to the Context Information Base, CIB, within the network that is responsible for maintaining user policy and context information, and that is updated by mobility triggers from the mobility events.

3.6 Paging

Current paging solutions are dependent on the link layer technology and network structure. The 4G Network requires the facility to be able to page across heterogeneous network technologies.

3.7 Network Composition

Composition, as a new architectural element, can enable new type of dynamic networks where new business models and roles evolve: anyone can become a network/service operator. In this view, everything is a network and a terminal is a network itself. Composition of networks will be possible, independently from the technologies of composing networks.

3.8 Migration

Backward compatibility and migration is one of the basic requirements in the evolution and deployment of heterogeneous networks. Although migration from current technologies and compatibility is different, similar approaches that address both these issues exist. Backward compatibility enables smooth migration. So, such a design should be aimed that interoperate with existing technologies using their original interfaces.

4. CONCLUSION

4G wireless networks not only enable more efficient, scalable, and reliable wireless services but also provides wider variety of services. The article discussed the evolution of network generations from 0G to 4G networks. It mainly discussed the significant mobility issues within 4G heterogeneous networks which are the hot issues in todays research. The future research will overcome these challenges and integrate newly developed services to 4G networks making them available to everyone, anytime and everywhere.

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