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Challenges in the Way of Migration to 4G

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ABSTRACT

High data rates, wider coverage, and improved mobility are all now largely owing to wireless broadband technology, which is now being developed and deployed worldwide. As a means to this end, the 4G network, an amalgamation of several wireless technologies, is planned to allow seamless mobility. 4G networks will also be totally packet-switched systems based on the Internet Protocol (IP). Researchers are working to develop intelligent mobility management solutions that use IP-based technologies to enable global roaming among different access technologies in the 4G-Network. The integration of diverse networks is facilitated by the use of Mobile IPv6. Fast handover is critical for mobile networks, however the original Mobile IPv6 doesn't have this capability. There are a large number of research teams striving to create a consistent protocol that will make it easier for customers to move about freely. In this study, we identify and examine the various concerns and challenges associated to mobility management in 4G-networks.

KEYWORDS: *4G, migraton, network, wireless*

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INTRODUCTION

Almost every day, a new mobile phone is released. Every day, the devices get smaller and lighter. These new gadgets feature larger displays, higher screen resolutions, HD video recording, better battery life, and so on. Features like live video streaming, televideo-conferencing, and Voice over Internet Protocol (VoIP) are no longer a distant reality today. 60 % of the worldwide people now has access to a cell phone. There has been a significant shift in the mobility of voice communication. Voice calls are the only function of the first generation of wireless telecommunications technology. [1] In addition to voice conversations, the wireless telecommunications technology's second iteration enables SMS services as well. Telephony, internet access, video calls and mobile television are all part of the third generation of wireless telecommunications technologies.

A number of new services, ranging from high-quality speech and high-definition video to high-data-rate wireless channels, are expected to be made available with the upcoming 4G mobile communication systems, which are expected to address the remaining issues with 3G (third generation) systems. A wide range of broadband wireless access communication systems, not just cellular phone networks, are referred to as 4G when discussing the term. MAGIC – Mobile multimedia, anytime anywhere, Global mobility support, integrated wireless solution, and tailored personal service [2] – is one of the phrases used to characterise 4G. 4G systems, or cellular broadband wireless access systems, have been garnering a lot of attention in the mobile communication space as a promise for the future. Mobile service, as well as fixed wireless networks, will be supported by the 4G networks.

As a 4G network is a heterogeneous network, mobility management is critical. According to the OSI model it can take place in many layers, including L3, L2, and cross-layer (L3 + L2) [17]. Mobilizing a mobile node between various access nodes while maintaining the same IP network connection is what is meant by layer-2 (L2) mobility. Switching IP addresses is part of layer-3 (L3) mobility, which is also known as IP mobility. [3] 4G networks need new techniques of mobility management to efficiently supply services to mobile users, where the location of every user is proactively established before the service is supplied. 4G - networks Furthermore, existing mobility management methods must be smoothly integrated into an adaptive communication protocol.

Advantages

A. This is a "All-IP" data network, and it is what 4G stands for. More data can be transmitted via a network with a purely data-based architecture because of the increased bandwidth available.

B. 4G network devices can take advantage of the increased capacity and speeds to deliver more robust and data-intensive applications.

C. Data rates of up to 100 Mbps for high mobility and up to 1Gbps for poor mobility have been proposed as the target value for 4g theoretical speed.

D. Data rates of up to 100 Mbps for high mobility and up to 1Gbps for poor mobility have been proposed as the target value for 4g theoretical speed.

E. With the new 4G network standards, switching from one area of service to another will be seamless, with no loss of data in transit. As a result, the user will experience lag-free data transmission.

F. There are many benefits to using 4G technology, including reduced latency. Latency is reduced to 1/100th of a second thanks to 4G technology. – Wikipedia (about 10ms). [4]

Disadvantages

It is necessary to address several restrictions in spite of the numerous advantages described above. Operating space is a serious drawback. Wireless networks in rural areas and in many buildings in metropolitan areas are currently underused. Future wireless systems will be plagued by the same drawbacks that now exist in today's networks. Furthermore, the use of new frequencies requires the introduction of additional components in cell towers. Other drawbacks include the fact that it drains more battery power, is difficult to execute, and requires complex technology. Due to the compatibility of current equipment with the 4G network, consumers must purchase a new gadget in order to take use of 4G. [5]

Objectives

- To investigate the migration from 2G to 4G
- Investigate challenges related to the transition to 4G
- To examine the vertical and horizontal handover of a mobile terminal.
- For the purpose of comparing various wireless communication methods

Research Methodology

It is the systematic and theoretical investigation of the methods used in a particular field of research. Theoretical analysis of a branch of knowledge's methodologies and principles is included. Parameters like paradigm, theoretical model and phases are typically included in this type of research. Based on secondary sources such as books, journals, academic articles, government publications and printed and online reference materials; this study is descriptive rather than prescriptive in character.

Result and Discussion

Table 1 Comparison of Wireless Communication Technologies

	1G	2G	2.5G	3G	4G
Transmission	Ana-log	Digital	Digital	Digital	Digital
Architecture		Circuit Switch	Packed Switch	Circuit And Packet Switch	Packet Switch
Speeds		9.6 to 14.4 Kbits/s	64 to 144 Kbits/s	384 Kbits/s to 2 Mbits/s	100 Mbits/to 1000 Mbits/s

Table 2. Key Challenges for 4G

4G Definition	Consensus on the 4G definition is needed for the purpose of the standardization.
Seamless Connectivity	Inter-network and intra-network connectivity is fundamental to the provision of temporally and spatially seamless services. Vertical and horizontal handovers are critical for 4G. In the former case the heterogeneity and variety of networks exacerbate the problem.
Latency	Many 4G services are delay sensitive. Guaranteeing short delays in networks with different access architecture and coverage is far from straight forward.
New Access	More study is required to replace the non
Architectures	Conventional access architectures to conventional ones.
Concealing Complexity	The complexity of 4G network needs to be hidden from the user.
Spectrum Issues	As the spectrum for 4G has not yet been allotted hence it is difficult to design a wireless system without knowing the channel.
Complex Resource Allocation	Management of time, frequency and spatial resources in a multi –network, multi user environment is far from trivial.
Interference	Multiple access interference control and mitigation in heterogeneous environments (coexisting air interfaces, varied terminals and
Power Consumption	Power consumption in future multi-function multi-standard 4G terminals will sharply increase. Usability is seriously compromised; hence heat management becomes an issue [3].
Personalization	In short required provisioning for advanced signaling & session control, AAA (authentication, authorization, accounting); open third party access (e.g. web services); communication (protocols); reconfigurable terminals; new strategies for pervasive/ ubiquitous computing; programmable open platforms.
Seamless Access	In short, requirements are seamless network integration based on IP, terminal mobility, personal mobility, service mobility, session mobility, dynamic resource allocation at all network /system levels, high adaptability /programmability of network components good security but simple
Quality of Service	This encompasses the customer perception of Qos, the offered Qos and the Qos actually delivered. Qos modeling and signaling would be crucial factors for a system that integrates
Intelligent Billing	(i) User requirement – QoS dependent charging, billing support to diverse access; support to real time billing information; support to interworking of prepaid systems; support to "per-call" services situations. (ii) Operator requirement –billing support to IP traffic; flexibility; of costs calculations (time, volume, QoS dependent, access dependent); distribution of revenue by value chain operators; customer relationship management; reliability of billing operations; instant fraud detection and cut-off.
Security	A good security system needs to be designed, which needs co-operation amongst; Government regulator, Network infrastructure provider, Wireless service provider, Wireless equipment provider, Wireless user.
Cost	Cost of terminal and service are required to be kept low for practical mass implementation.

There must be a built-in intelligence in 4G. Personalization, easy access, and quality of service, as well as intelligent billing, will be the main difficulties [6]. Migrating to 4G has certain challenges, that are summarised in Table 2.

Selecting the wireless technologies to employ for 4G services requires multimode user terminals. Base stations currently emit signalling messages for service subscription to mobile stations on a periodic basis in GSM systems. [7] However, the variations in wireless technology and access protocols make this process more difficult in 4G heterogeneous networks. Using software radio devices that are able to scan for networks is one of the proposed solutions

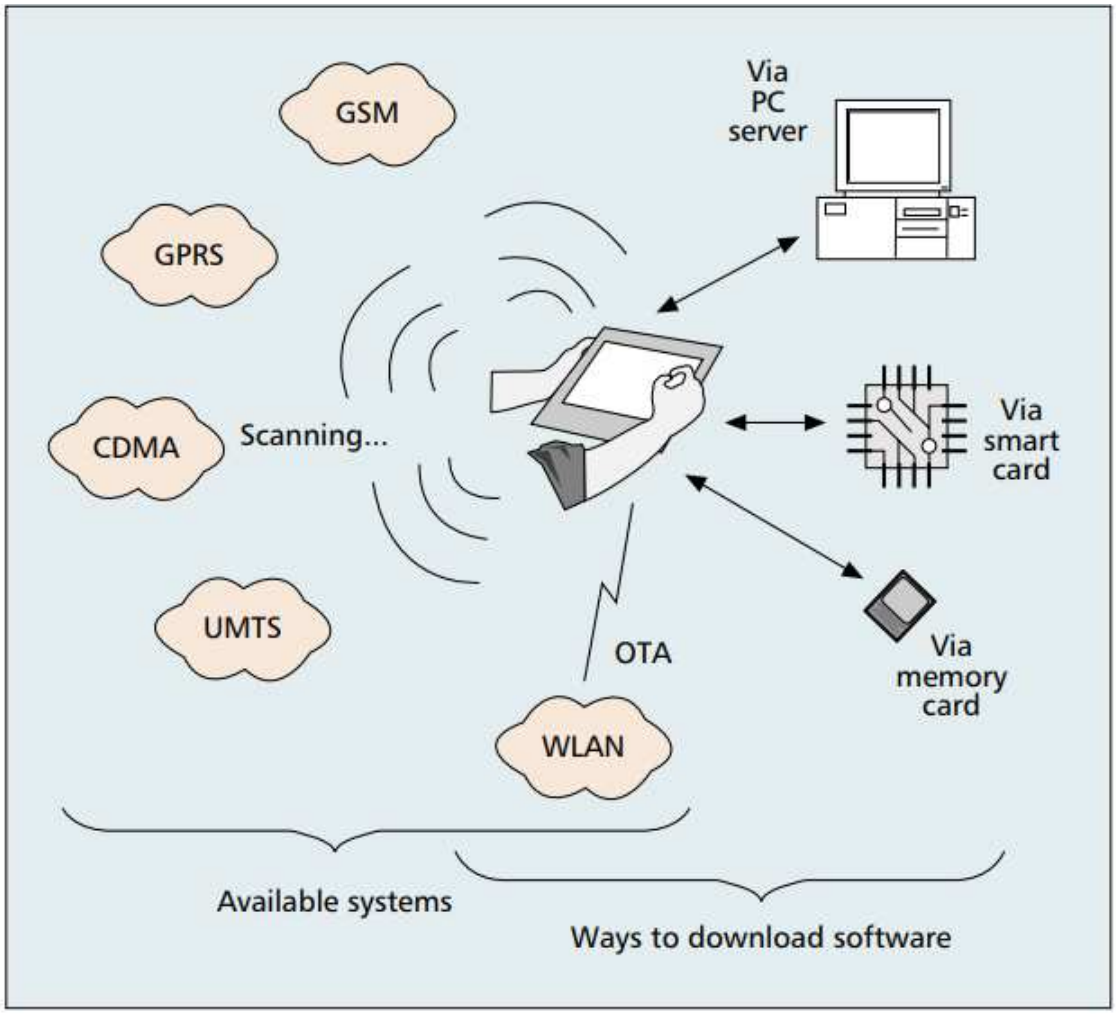

Figure 1: The WLAN is connected to a multimode terminal, which scans the available networks. It is possible to manually or automatically download the necessary applications.

Scanners are then reprogrammed to connect to the network they were scanning. In Fig 1 we see an example of how a WLAN-enabled multimode terminal scans for wireless networks. [8]. 4G infrastructure must have terminal mobility if it is to offer wireless services at anytime and anywhere. Mobility of terminals enables mobile clients to travel across wireless networks' geographic bounds. [9] As part of terminal mobility, location and handoff management must be addressed. It's important to keep track of all the roaming terminals' location and authentication information, as well as their Quality of Service (QoS) capabilities. Handoff management, on the other hand, ensures that communications continue even when the terminal is roaming. [10]

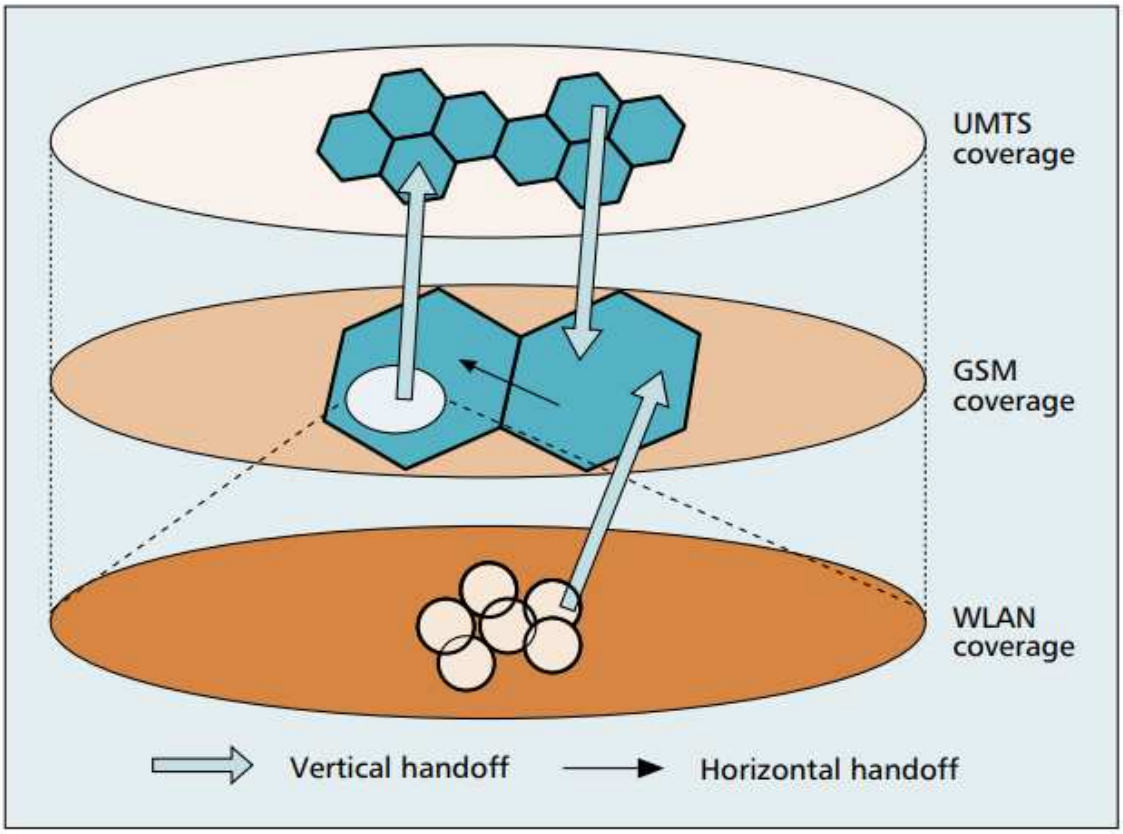

Fig. 2 illustrates the vertical and horizontal handover of a mobile terminal.

Figure 2 depicts a handoff that occurs both horizontal and vertical. Moving from one cell to another inside the same wireless network is known as horizontal handoff. But the terminal movement between two separate wireless networks is dealt with by vertical handoff (e.g., from WLAN to GSM). [11] 4G networks are projected to be able to offer real-time multimedia services that are time-critical. MIPv6 handoffs are unacceptable if they significantly impact system performance, particularly in terms of Quality of Service (QoS). In addition, determining the correct handoff time is difficult due to the difficulty in measuring handoffs between various wireless systems. [12]

Conclusion

Every two days, a new mobile gadget enters the marketplace. Every day, the gadgets get smaller and lighter. These new devices include larger screens, higher resolutions, HD video recording, and longer battery life. Features like live streaming video and televideo-conferencing and Voice over Internet Protocol (VoIP) are no longer a distant reality today. Mobility management has become a major issue in 4G - Network due to the rise in use of mobile devices. In order to allow users to travel between different types of networks, a mobility management protocol that includes vertical handoff support is a critical requirement. Multi-network Mobile Nodes are becoming increasingly common in the telecommunications business.

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