An overview of Technical aspect for Mobile Network Technology
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ABSTRACT- The next step for wireless technology is a natural progression to support high data rates over a wide area and provide the roaming among a variety of systems, today a generally held view. The mobile infrastructure market is the second largest wireless communications market and also the most challenging. Rapid technologies are changing i.e.2/2.5G and 3G and slow revenue development turning to declining revenues have created a difficult environment for companies that are competing in this market. 4G has an ability to provide these features and many more, which can alter the way. Some of these challenges are radio access methodologies, mobility management across different networks and the physical as compared to 3G wireless data networks that have emerged as the first high speed, ubiquitous data networks. 4G wireless networks are to replace 3G networks as the next generation of mobile data networks. This paper gives an insight for these issues, some of the proposed solutions to these problems and provide some of the advantages of this technology.

Keywords – 3G, 4G.

I. INTRODUCTION

Mobile communication has developed rapidly during the last few decades. The 1G technology was based on analogy technique and developed in the 1980s. This technology built the basic structure of mobile communications and solved many fundamental problems just like cellular architecture adopting, multiplexing frequency band, roaming across domain, non-interrupted communication in mobile circumstances and etc. It also gave the service of speech chat. 2G was based on digital signal processing techniques and called as a changes from analogy to digital technology, has also gained many success during 1990s with GSM as the representative. It also contributes SIM (Subscriber Identity Module) that supports many capabilities for a large number of users. 2.5G extended the 2G with data service and packet switching methods and it was just like 3G services for 2G technology. 2.5G carried the Internet into mobile personal communications under the same networks with 2G.3G is a new system with new services rather than only providing higher data rate and broader bandwidth. On the basis of intelligent DSP techniques, various multimedia data communications services are transmitted by converge 3G networks. The 3G mobile communication system consists of large coverage, high speed mobility, completed subscriber management (billing system) and nearly universal roaming.

The 3G mobile communication system has the transmission rate from 144Kbps to 2Mbps. The data transmission rate of 3G mobile system is superior to 2G mobile system while WLAN provides only hot spot coverage with high data rate (reaching 54Mbps for 802.11 a/g). Obviously the WLAN is not able for global roaming and mobility support. The integration of two diverse networks can make for each other’s weakness, and bring the benefits to subscribers. The subscribers are able to access 3G mobile network with the integration service while high speed traveling or WLAN when the users are moving slowly to a specific area. Therefore, the integration of WLAN and 3G systems can give the convenient way for user to access networks and also speed up the joining of new customers for 3G service providers.

The interest of many research bodies transfers towards future systems beyond 3G with the deployment of 3G (3rd generation mobile communication systems). Such new systems are planning to be introduced and on improving or replacing existing systems, are called B3G (beyond 3G) or 4G (4th generation mobile communication system). There is no formal definition for 4G but; however, there are certain objectives that are projected for 4G. These objectives consists of that 4G will be a fully IP-based integrated system.
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4G is capable of providing between 100 Mbit/s and 1 Gbit/s speeds both indoors and outdoors, with high security. [1] The term 4G is used broadly to include several types of broadband wireless access communication systems, not only cellular telephone systems. While neither standards bodies nor carriers have concretely defined or agreed upon what exactly 4G will be, fourth generation networks are likely to use a combination of WiMAX and Wi-Fi technologies [2]. With 4G, a range of new services are available that needs to be further examined for their interface with the design of 4G.

2. BEFORE 4G

The history and evolution of mobile service from the 1G (First generation) to fourth generation has discussed in this section as follows:

A. First generation- The process began with the designs in the 1970s that is known as 1G. Almost all of the systems from this generation were analog systems where voice was considered to be the main traffic. The first generation wireless standards used as TDMA and FDMA. Some of the standards are NMT, AMPS.

B. 2G (Second generation)- The 2G (second generation) systems was designed in the 1980s, still used for voice applications but were based on digital technology, including digital signal processing techniques. These 2G systems provided circuit switched data communication services at a low speed [3]. The second generation standards are GSM, D-AMPS, IS-95, PDC, CSD, GPRS, and HSCSD.

C. 2.5G- 2.5G is the generation between 2G and 3G wireless technologies. This term is used to describe 2G-systems that have implemented a packet switched domain as well as the circuit switched domain. 2.5G provides the some benefits of 3G and can use some of the existing 2G infrastructure in GSM and CDMA networks.

<table>
<thead>
<tr>
<th>Technology</th>
<th>1G</th>
<th>2G</th>
<th>2.5G</th>
<th>3G</th>
<th>4G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services</td>
<td>Analog voice</td>
<td>Digital voice</td>
<td>Higher capacity packet data</td>
<td>Higher capacity broadcast (Europe)</td>
<td>Completely IP-based speed up to hundred of Mbps</td>
</tr>
<tr>
<td>Standards</td>
<td>NMT, AMPS, D-AMPS, DCS, ETACS</td>
<td>GSM, DCS, D-AMPS</td>
<td>GPRS, EDGE</td>
<td>WCDMA, CDMA 1000</td>
<td>Single standard</td>
</tr>
<tr>
<td>Data Bandwidth</td>
<td>4.8 kbps</td>
<td>14.4 kbps</td>
<td>64 kbps</td>
<td>144 kbps</td>
<td>2 Mbit/s</td>
</tr>
<tr>
<td>Multiplexing</td>
<td>FDMA</td>
<td>TDMA, CDMA</td>
<td>TDMA, CDMA</td>
<td>CDMA</td>
<td>CDMA</td>
</tr>
<tr>
<td>Core Network</td>
<td>PSTN</td>
<td>PSTN</td>
<td>PSTN, packet network</td>
<td>Packet network</td>
<td>Internet</td>
</tr>
</tbody>
</table>

Fig. 1 Series of mobile generations and their features

B. 2G (Second generation): The 2G (second generation) systems was designed in the 1980s, still used for voice applications but were based on digital technology, including digital signal processing techniques. These 2G systems provided circuit switched data communication services at a low speed [3]. The second generation standards are GSM, D-AMPS, IS-95, PDC, CSD, GPRS, and HSCSD.

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D. 3G (Third generation)- The rates required for high speed data transfer and multimedia applications, 3G standards started evolving to meet the growing demands in network capacity. The systems in this standard are a linear enhancement of 2G systems. They are based on two parallel backbone infrastructures, one consisting of circuit switched nodes, and other packet oriented nodes. The third generation (3G) has been launched in several sections of the world.

3. LIMITATIONS OF 3G

A new mobile generation comes up with new capabilities and functionalities, has been observed after every 10 years. As the roll out took around 10 years for 2G, a similar period will apply to 3G which has started deploying since 2001 and by the year 2010 it will be the time to deploy 4G [4] networks and with this assumption the work on 40 has been started since year 2000. 3G systems have some limitations which are as follows:

- 3G can support multimedia internet type services at high data rates up to 384kb/s for moving up to 2Mb/s in limited coverage area. [4]
- In 3G, extension to higher data rate is difficult with CDMA due to excessive interference between the services and users.
- To ensure connection together with high bandwidth and mobility, the network architecture must be heterogeneous.
- It is difficult to provide full range of multi-rate services with different QoS and performance requirements due to the constraints on the core network by the air interface standard so that 3G is not a fully integrated system.
- The bandwidth available in the 3G mobile systems will be saturated.
- spectrum and its allocation is limited.
- roaming across distinct service environment in different frequency bands is difficult.

4. NEED FOR 4G

3G was launched on the assumption that it would become popular among the users but this didn't happen. Network operators were tried to force to reduce their expectations. The main reasons for the leap towards 4G as compared to the 3G are as follows:

- As compare to 3G, 4G will provide rich multimedia contents. The downloading speed of 4G system will exceed 100 Mbps, which is about 260 times greater than 3G wireless networks.
- Because of single global standard, the roaming between the different networks will be possible. Many services can be accessed by the users from the same mobile terminal.
- The 3G mobile network is based on the wide-area concept. In 4G system, utilizing both wireless LAN and cellular design the users will be connected to a high-speed network anywhere, anytime.
- In near future, there will be a great demand for high data rates and bandwidth. The 4G technology, would offer high-bandwidth services with the transmission speeds of more than 20 Mbps within the reach of LAN "hotspots", which are installed everywhere in offices, homes, malls and airport lounges.
- The 4G mobile networks systems are cheaper than 3G because they can be built on the existing networks and there will be no need for the operators to completely change their equipments nor will they be required extra spectrum.
- The problem of handling increasing numbers of users and diversity of services can be solved by the 4G system.

5. FEATURES OF FOURTH GENERATION TECHNOLOGY (4G)

Some of the features of 4G which make it an “above all” technology:

A. High performance:
Users will not have an ability to take advantages of rich multimedia content across wireless networks with 3G. In contrast to this technology, 4G provide the high quality video of quality comparable to HD (high definition) TV. Wireless downloads at speeds reaching 100 Mbps, i.e. 50 times of 3G, are possible with 4G.

B. Interoperability and easy roaming:
Multiple standards of 3G make it difficult to roam and interoperate across various networks, whereas 4G provides a global mobility. Each is practically designed to support a different set of specific services and devices. 4G will
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embrace various types of terminals because various heterogeneous wireless access networks typically differ in terms of coverage, data rate, latency, and loss rate, which may have to provide common services independently of their capabilities, concept is called as ‘service personalization’.

C. Fully converged services:
If a user wants to be able to access the network from lots of different platforms: cell phones, laptops, he is free to do so in 4G which delivers connectivity intelligent and flexible enough to support streaming video, VoIP telephony, still or moving images, e-mail, Web browsing, e-commerce, and location-based services through a wide variety of devices. That means Freedom for consumers.

D. Low cost:
4G systems is cheaper than 3G, since they can be built existing networks and not require to carry for the operators to purchase costly extra spectrum. In addition to being a lot more cost efficient, 4G is spectrally efficient.

E. Devices: more user friendly interface:
4G devices are considered to be more visual and intuitive rather than today’s text based systems. They have an ability to interact with the environment around it and act accordingly.

F. Enhanced GPS Services:
a 4G version of GPS technology may be able to let people be virtually present in a variety of places.

G. Scalability:
It is most challenging aspect of the mobile networks. It is able to handle the increasing number of users and services.

H. Crisis-Management applications:
Natural disasters can affect the entire communications infrastructure, restoring communications quickly is necessary. With wideband wireless mobile communications internet and video services can be set up in hours instead of days or even weeks necessary for restoration of wired line communications.

6. APPLICATIONS OF 4G

1) Virtual presence:
4G system gives mobile users a "virtual presence"—for example, always-on connections that keep people involved in business activities rather than place.

2) Tele-medicine:
4G supports remote health monitoring of patients. For example the paramedic assisting the victim of traffic accident in a remote location may access medical records and must need videoconference assistance from a surgeon for an emergency intervention.

3) Tele-geoprocessing applications:
The combination of geographical information systems (GIS), global positioning systems (GPS), and high-capacity wireless mobile systems will be enable the new type of application.

4) Crisis-Management applications:
Natural disasters may affect the entire communications infrastructure, restoring communications quickly will be needed. With wideband wireless mobile communications Internet and video services, could be set up in hours instead of days or even weeks required for restoration of wireline communications.

5) Education:
Educational opportunities available on the internet will be unavailable to client in remote areas because of the economic unfeasibility of providing internet access for individuals interested in life-long education. 4G wireless communications gives a cost-effective solution in these situations.

7. CONCLUSION

This paper discussed the feature and core technology of mobile system and introduced the research status in quo. With the progress of research, the 1G, 2G, 3G and 4G will be close with us. The 4G mobile system has high data rate, high spectrum utilization ratio, low transmitting power, supporting flexible service, so it will be the certain path to the future radio and mobile communication system.
REFERENCES


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