

Assignment 9

Title:

Case study of cellular network

Problem Statement:

Case study : Evolution of all the way upto 7G Cellular networks

Theory:

Wireless Communication -

Wireless communication is the transfer of information over a distance without the use of physical conductors or wires. The distance may be short (a few meters :TV remote control) or long (thousands or millions of kilometers : for radio) communication. There are several generations namely from 0G to 4G,5G is under development

Key benefits of developing cellular system are: -

1. Require minimal bandwidth and enhance customer satisfaction.
2. Wireless networks are cheaper to install and set up as compared to world networks.
3. Duplexing allows users to send and receive information at the same time through a single radio link,

1. Zero Generation

Zero Generation is also known as mobile radio telephone system. As the generation was invented prior to cellular system it was mentioned as pre cellular system. This system was analog in nature i.e. analog signal were used as carriers. Generally Mobile Radio Telephone System provides half duplex communications i.e. only one person will speak and other should hear. Mobile Radio Telephone System (0G) consists of various technologies such as Advanced Mobile Telephone System (AMTS), Mobile telephone system (MTS), MTD (Mobile Telephony system D), OLT (Offentlig Land mobile Telephony or Public Land Mobile Telephony), Push to talk (PTT) and improved Mobile Telephone Service (IMTS).The device would connect to local telephone network only if it is in the range of 20Kms. Each city had a central antenna tower with 25 channels. Roaming facility was not supported in this generation.

2. First Generation

The first generation is the wireless telephone technology. It was the analog telecommunication standard which was introduced in the 1980s and continued till the invention of 2G technology. The antecedent of 1G technology was mobile radio telephones or 0G. This technology was used in the first wireless mobile phone handsets. When the mobile phone began to rise in popularity with general public, it replaced 0G network. 1G technology was first used in Japan and spread quickly to the whole world. 1G technology used the analog radio signal. Through this

network the voice call gets modulated to a higher frequency of about 150MHz. This was done with the help of Frequency Division Multiple Access (FDMA). The 1G mobile phones used a single universal network standard which is known as Advance Mobile Phone System (AMPS). The cell phone networks were intended for the industrial, military & research application. They used a series of dissimilar network with very small broadcast areas; the idea of the universal network that started with 1G persists in today's worldwide digital network.

3. Second Generation

2G technology means second generation wireless telephone technology. It was based on the technology known as the global system for the mobile communication which is also called as GSM. This technology allowed various networks of services likely text messages, picture messages and MMS (Multi Media messages). The second generation was launched in Finland in the year 1991. All phone conversations were digitally encrypted. GSM has enabled the users to utilize the short message services (SMS) at anywhere and anytime. SMS is a cheap and easy way to send a message to anyone rather than voice call or conference. 2G technologies were either time division multiple access (TDMA) or code division multiple access (CDMA). TDMA allows for the division of signal into time slots. CDMA allocates each user the special code to communicate over a multiplex physical channel. 2G technology offers improved privacy that was not possible with earlier technologies. 2G technology introduces the digital data services such as SMS and E-Mail that has allowed the world to come closer. The family of this technology includes 2.5G and 2.75G.

3.1 FEATURES OF 2.5 G TECHNOLOGIES

- 2G cellular technology with GPRS.
- Data rates-56Kbps to 115Kbps.
- E-mail.
- Web browsing.
- Camera phones.

3.2 FEATURES OF 2.75 G TECHNOLOGIES

- Data rates for GSM Evolution (EDGE).
- Invented and developed by Cingular (AT&T).
- Maximum speed 384 Kbps.
- Works only on GSM networks.

4. Third Generation

Third generation wireless technology is the advanced wireless technology. This technology is widely used in mobile phones and data cards. 3G describes updating cellular telecommunications network around the world to use 3G technologies. Japan was the first country to commercially launch 3G in 2001. The transition to 3G was completed during 2005-2006 in Japan. In 2005, there were 23 networks worldwide which operating 3G technology. Some are only for test use and some operators are providing services to consumers. International Telecommunication Union (ITU) has defined the demand for 3G in the International Mobile Telecommunication

(IMT)-2000 to facilitate growth, increase bandwidth, support diverse applications. The family of this technology includes 3.5G and 3.75G.

4.1 FEATURES OF 3.5 G TECHNOLOGIES

- Known for HSDPA (High Speed Downlink Packet Access).
- It provides a smooth evolutionary path for 3G networks allowing for higher data transfer speeds.
- Data transmission up to 8-10Mbps (20Mbps for some systems).

4.2 FEATURES OF 3.75 G TECHNOLOGIES

- The 3.75G refers to the High Speed Uplink Packet Access (HSUPA) technology.
- The HSUPA mobile telecommunications technology is directly related to HSDPA and these two are complementary to one another.
- HSUPA will enhance advanced person-to-person data applications with higher and symmetric data rates, like Mobile E-Mail Real-time person-to-person gaming Speed 1.4Mbps-5.8Mbps

5. Fourth Generation

4G wireless systems are a packet switched wireless system with wide area coverage and high throughput. It is designed to be cost effective and to provide high spectral efficiency. The 4G wireless use the technique of Orthogonal Frequency Division Multiplexing (OFDM), Ultra Wide Radio Band (UWB) and millimeter wireless. Data rates of 20Mbps are employed. Mobile speed will be up to 200km/hr. 4G technology refers as “MAGIC”: M= Mobile multimedia A= Anytime anywhere G= Global mobility support I= Integrated wireless solution C= Customized personal service In 4G mobile systems, each terminal is assigned a home agent, which has permanent home IP address. When terminal moves to another location it obtains a new temporary address which is known as care-of address. The home agent known the care-of address of the user and it forwards the setup message to the user terminal. The home agent also forwards the care-of address of the user to the host so that future messages can be sent directly to the user. A 4G system is expected to provide a comprehensive and secure all-IP based mobile broadband solution to laptop computer wireless modems, smart phones and other mobile devices. Facilities such as ultra-broadband internet access, IP telephony, gaming services and streamed multimedia may be provided to users. PRE-4G technologies such as mobile WiMAX and Long Term Evolution (LTE) have been on the market since 2006 & 2009 respectively, and are often branded as 4G.

6. Fifth Generation

The 5G (Fifth Generation Mobile and Wireless Networks) can be a complete wireless communication without limitation, which bring us perfect real World –Wireless World Wide Web (www.5G) denotes the next major phase of mobile telecommunications standards beyond the 4G. 5G is the latest generation of cellular mobile communication. It succeeds the 4G (LTE-A, Wi-Max), 3G (UMTS, LTE) and 2G (GSM) systems. 5G performance targets high data rate, reduced latency, energy saving, cost reduction, higher system capacity, and massive device connectivity. The 5G mobile cellular communications system provides a far higher level of performance than the previous generations of mobile communications systems. 5G technology has a bright future

because it can handle best technologies and offer priceless handset to their customers. May be in coming days 5G technology takes over the world market. In a few years, we may be able to download a full length HD movie in six seconds, while 4G require seven minutes and 3G require more than an hour to download the same. Also video chats will be so immersive that it will feel like we can reach out and touch the other person through the screen. 5G is a packet switched wireless system with wide area coverage and high throughput. 5G wireless uses OFDM and millimeter wireless that enables data rate of 20Mbps and frequency band of 2-8GHz.

7. Sixth Generation

6G mobile network/Internet uses an air fiber technology with masts and transceivers on tall buildings and even lamp posts to create a local network capable of delivering phenomenal speeds instead of disappointing averages. The air fiber combination will be the best method to broadcast much secured information from transmitters to destinations. 6G's converged network provides local with a truly all-in-one solution: uploads, downloads, super-fast broadband Internet, multiple line telephones, CCTV monitoring, video conferencing every telecommunications requirement your business needs is catered for with 6G. The 6th generation (6G) wireless mobile communication networks shall integrate satellites to get global coverage. The global coverage systems have been developed by four countries. The global position system (GPS) is developed by USA, the COMPASS system is developed by China, the Galileo system is developed by EU, and the GLONASS system is developed by Russia. Thus, these independent systems are difficulty for space roaming. The task of 7th generation (7G) wireless mobile communication networks is going to unite.

8. Seventh Generation

7G mobile network is like the 6G for global coverage. It will be the most advance generation in mobile communication but there will be some researches on demanding issues like the use of mobile phone during moving condition from one country to another country, because satellite is also moving in constant speed and in specific orbit, the standards and protocols for cellular to satellite system and for satellite to satellite communication system. The dream of 7G can only be true when all standards and protocols are defined. May be this is possible in next generation after 7G and can be named as 7.5G or 8G. When 7G will complete all its weak points then there will be no issue of data capacity coverage and hand-off left behind. At that time there will be only one demand from user which is the cost of mobile phone call and its services. This issue will again start evolutionary change in standard and technology, and will also open new horizons for computing research. This new revolution in technology for cost of mobile phone call and services will be called as 7.5G or 8G.

Conclusion:

Thus, in this assignment we have learnt the evolution of cellular networks from zero generation to seventh generation (0G-7G).