Various Cellular Generations –A survey

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Abstract:

The rapid development of wireless communication and their effectiveness, depend on the building blocks of their architectures. In this paper we presented an overview of cellular communication and their evolving architectures up to the current scenario and also discuss architectures based on their generations**.** We describe the survey of various generations on cellular systems and propose a comprehensive definition. In this paper, we are briefly summarizing the existing techniques of the mobile generations in the wireless communications and it is presented in order to highlight and compare the issues and challenges that are involved in 0G,1G, 2G, 3G, 4G, 5G and also in order to understand how solutions and improvements were successfully performed and implementation to these issues starting from the earlier generations along to the following generations and finally till the current available generation.

0G-0.5G cellular system

Wireless telephone started with what you might call 0G if you can remember back that far. The great ancestor is the mobile telephone service that became available just after World War II. In those pre-cell days, you had a mobile operator to set up the calls and there were only a handful of channelsavailable.0G refers to pre-cell phone mobile telephony technology, such as radio telephones that some had in cars before the advent of cell phones. Mobile radio telephone systems preceded modern cellular mobile telephony technology. Since they were the predecessors of the first generation of cellular telephones, these systems are called 0G (zero generation) systems. Technologies used in 0G systems included PTT(Push to Talk), MTS (Mobile Telephone System),IMTS (Improved Mobile Telephone Service),AMTS (Advanced Mobile Telephone System), OLT(Norwegian for Offentlig Landmobil Telefoni,Public Land Mobile Telephony) and MTD (Swedish abbreviation for Mobilelefonisystem D, or Mobile telephony system D).These early mobile telephone systems can be distinguished from earlier closed radio telephone Systems in that they were available as a commercial service that was part of the public Switched telephone network, with their own telephone numbers, rather than part of a closed network such as a police radio or taxi dispatch system .These mobile telephones were usually mounted in cars or trucks, though briefcase models were also made. Typically, the transceiver (transmitter receiver) was mounted in the vehicle trunk and attached to the "head" (dial, display, and handset) mounted near the driver seat. They were sold through WCCs (Wireline Common Carriers, AKA telephone companies), RCCs (Radio Common Carriers), and two-way radio dealers. The primary users were loggers, construction foremen, realtors, and celebrities. They used them for basic voice communication.

1G cellular system

The concept of cellular telephony was invented in AT&T's Bell Labs in the early 1970's. The first commercial cellular network was the Nordic mobile telephone (NMT) network deployed in the Scandinavian countries in 1981. The advanced mobile phone service (AMPS) cellular system was deployed in the United States in 1983 and was followed by other analog deployments across the world. These first analog-technology mobile systems are referred to as first generation or 1G.

The analog systems use a frequency division multiple access (FDMA) radio system where each user channel has a dedicated carrier band. For example, the AMPS system uses a 30 KHz wide carrier band for each mobile user channel. An improvement upon the AMPS system is. Narrow AMPS (NAMPS) where each carrier band is only 10 KHz wide so that three times as many mobile subscribers can be supported An add-on to the AMPS system is cellular digital packet data (CDPD) developed in the early 1990s and first deployed in 1994. CDPD enabled the transfer of packet data over analog channels by leveraging idle channels for short data transmissions. Data speeds reached up to 19.2 Kbps.

2G cellular systems

As the number of cellular subscribers grew and there was a need for increased network capacity, digital systems were invented. These included, among others, the European initiated global system for mobile communication (GSM) and the United States initiated code division multiple access (CDMA). The 2G version of CDMA is referred to as cdma One. These digital systems form the second generation or 2G. GSM was developed by the European Telecommunications Standard Institute (ETSI) in the late 1980's, and the IS-95 CDMA standard, known as cdmaOne, was introduced by the TR45.5 subcommittee of the Telecommunications Industry Association (TIA) in 1993.

The GSM system is a TDMA radio system with carrier bands that are 200 KHz wide. Each band is comprised of eight bearer slots. A single cell will typically support multiple carrier bands. In GSM, the radio frequencies used for the carrier bands can be reused between cells as long as the radio transmitters that use the same frequencies are not in adjacent cells. The reuse pattern is referred to as a "frequency plan" and is engineered so as to minimize radio interference.

Another TDMA system, introduced by Motorola in 1994, is the integrated digital enhanced network (iDEN), a digital wireless standard designed to work in special frequencies originally designated for analog Specialized Mobile Radio (SMR) networks used for dispatch operations. iDEN provided a unique capability as its cell phones include an integrated push-to-talk (PTT) capability, similar to walkie-talkie, which works across a wide area network, on the same cell sites used for cellular telephony.

CdmaOne uses a different radio technology referred to as "spread spectrum" where the radio spectrum is divided into carriers which are approximately 1.23 MHz wide. In cdmaOne, each voice channel is assigned a unique code within the carrier and the voice signal is spread to a transmitted rate of about 1.23 Megabits per second. Since all user calls in a given cell share the same channel band, the only way to distinguish between the calls is through the unique code assigned to each voice channel. The unique code is used to spread the original signal and then to decode the signal at the receiver end. The cdmaOne network utilizes universal frequency reuse where the same frequency can be reused in every cell since what distinguishes the voice channels are the unique codes.

2.5G cellular systems

The 2G systems support basic data services

with limited capacity since a single voice channel is used for the data transmission. Only one wireless bearer slot of a GSM carrier band is allocated to the data transfer so that the transfer rate is limited to 9.6 kbps. Furthermore, the mobile subscriber is charged, as for voice calls, on a connection-time basis. An improvement to this scheme was made available in the form of high-speed circuit switched data (HSCSD) where multiple bearer slots are made available to the same call. The downside of this scheme is that the additional bearer slots are no longer available to other voice calls for the duration of the data call.

To provide better support for data services, ETSI developed the general packet radio service (GPRS), a packet transmission system that overlays GSM and inter-works with external packet data networks such as the Internet. GPRS is a 2.5 generation, or 2.5G, wireless communication system.

In a GPRS system, each mobile terminal is assigned an IP address. The assignment can be static, as determined by the cellular operator, or else dynamic, on a per connection basis. A GPRS-enabled mobile terminal can use between one and eight wireless bearer slots of a GSM carrier band. The bearer slots are dynamically allocated to a user when there are packets to be sent; the higher the number of assigned slots, the faster the data transfer with speeds of up to 115 kbps.

An operator's mobile network is also referred to as a public land mobile network (PLMN). Figure 7 shows a GSM PLMN with an overlaid GPRS network; the element and interface names are as specified by the ETSI standards. The GSM network elements used for handling cellular telephony calls are the BSS, MSC/VLR, and HLR.

The BSS is the base station subsystem that includes the BTS and BSC. The BTS is the base transceiver station that includes the antennas and handles the radio transmission to the mobile terminals. The BSC is the base station controller which manages several BTSs. The BSC transmits voice calls to the MSC and contains the packet control unit (PCU) for handling data traffic to the GPRS network.

The MSC is the mobile switching center; it switches voice calls between the mobile terminals and the public switch telephone
ed GPRS network. The GGSN allocates

network (PSTN). It handles the setup of calls and allocation of circuits between mobile terminals and the PSTN, or between mobile terminals. The VLR is the visitor location register, often co-located with the MSC. This database stores temporary information about the mobile terminals in its area.

The HLR is the home location register. This database contains the mobile subscribers profile information that includes the list of subscribed services. The HLR authenticates mobile terminals that want to access the mobile network and also records the mobile terminal locations in the network.

The GPRS network includes two new nodes, the serving GPRS support node (SGSN) and the gateway GPRS support node (GGSN). The traffic from the mobile terminal is split at the BSC with voice sent to the MSC and data packets sent to the SGSN. The SGSN is responsible for tracking the GPRS mobile terminals in its area and for routing data packets to the mobile terminals. It keeps a record of the BSC to which each mobile in its area is assigned. The GGSN serves as a router that interfaces between the Internet, or other packet data network, and the IP-bas.

3G cellular systems

The evolution towards third generation cellular systems (3G) was driven by the need of higher capacity, faster data rates, and better quality-of-service (QoS). Also prominent was the desire to define a new system that resolved many incompatibilities between the different standards, mainly GSM and cdma One, so as to facilitate, for example, mobile roaming between the different systems. This work was spearheaded by the International Telecommunications Union (ITU) and referred to as International Mobile Telecommunications 2000 (IMT-2000). The IMT-2000 effort could not reach agreement on one common standard and now consists of a family of standards to handle the evolution of GSM and cdmaOne.

Some of the standards are based on wideband CDMA (W-CDMA), also referred to as universal mobile telecommunications systems (UMTS); these are worked on by the original GSM proponents and handled by the Third Generation Partnership Project (3GPP) established in 1998.In addition, 3GPP handles the development of GSM and enhanced data rates for GSM evolution (EDGE) standards. 3GPP reported in April 2006 that some 55 million subscribers worldwide were supported by 105 W-CDMA commercial networks.

The evolution of the cdmaOne standard, referred to as cdma2000, is managed by another standards body, 3GPP2, established in 1999.Development Group (CDG), an international consortium of companies .

. **4G cellular systems**

4G refers to the fourth generation of cellular wireless standards. It is a successor to 3G and 2Gfamilies of standards. The nomenclature of the generations generally refers to a change in the fundamental nature of the service, non-backwards compatible transmission technology and new frequency bands. The first was the move from 1981analogue (1G) to digital (2G) transmission in 1992.This was followed, in 2002, by 3G multi-media support, spread spectrum transmission and at least200 kbit/s, soon expected to be followed by 4G,which refers to all-IP packet-switched networks, mobile ultra-broadband (gigabit speed) access and multi-carrier transmission. Pre-4G technologies such as mobile WiMAX and first-release 3G Long-Term Evolution (LTE) have been available on the market since 2006 and 2009 respectively .It is basically the extension in the 3G technology with more bandwidth and services offers in the 3G.The expectation for the 4G technology is basically the high quality audio/video streaming over end to end Internet Protocol. If the Internet Protocol (IP) multimedia sub-system movement achieves what it going to do, nothing of this possibly will matter. WiMAX or mobile structural design will become progressively more translucent, and therefore the acceptance of several architectures by a particular network operator ever more common.

Some of the companies trying 4G communication at100 Mbps for mobile users and up to 1 Gbps overfixed stations. They planned on publicly launching their first commercial wireless network around2010. As far as other competitor's mobile communication companies working on 4Gtechnology even more quickly. Sprint Nextel was planned to launch WiMAX over 4 G broadband mobile networks in United States. Some of the other developed countries like United Kingdom stated a plan to sale via auction of 4G wireless frequencies couple of years back. The word "MAGIC" also refers to 4G wireless technology which stands for Mobile multimedia, Any-where, Global mobility Solutions over, integrated wireless and Customized services.

5G cellular system

5G (5th generation mobile networks or 5thgeneration wireless systems) is a name used in some research papers and projects to denote the next major phase of mobile telecommunications standards beyond the

upcoming 4G standards, which are expected to be finalized between approximately 2011 and 2013. Currently 5G is not a term officially used for any particular specification or in any official document yet made public by telecommunication companies or standardization bodies such as 3GPP, WiMAX Forum or ITU-R. New 3GPP standard releases beyond 4G and LTE Advanced are in progress, but not considered as new mobile generations.5G technology has changed the means to use cell phones within very high bandwidth. User never experienced ever before such a high value technology. Nowadays mobile users have much awareness of the cell phone (mobile) technology. The 5G technologies include all type of advanced features which makes 5G technology most powerful land in huge demand in near future. The gigantic array of innovative technology being built into new cell phones is stunning. 5Gtechnology which is on hand held phone offering more power and features than at least 1000 lunar modules. A user can also hook their 5G technology cell phone with their Laptop to get broadband internet access. 5G technology including camera,MP3 recording, video player, large phone memory, dialing speed, audio player and much more you never imagine. For children rocking fun Bluetooth technology and Piconets has become in market.5G technology going to be a new mobile revolution in mobile market. Through 5G technology now you can use worldwide cellular phones and this technology also strike the china mobile market and a user being proficient to get access to Germany phone as a local phone. With the coming out of cellphone alike to PDA now your whole office in your finger tips or in your phone. 5G technology has extraordinary data capabilities and has ability to tie together unrestricted call volumes and infinite data broadcast within latest mobile operating system. 5Gtechnology 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. 5GTechnologies have an extraordinary capability to support Software and Consultancy. The Router and switch technology used in 5G network providing high connectivity. The 5G technology distributes internet access to nodes within the building and can be deployed with union of wired or wireless network connections. The current trend of 5Gtechnology has a glowing future.

Conclusion:

In our day today life, processing the information can be done in various ways. In every generation we've felt various limitations while processing various kinds of data like analog, digital and so on. But fortunately the coming generation technologies overcome all the previous generation limitations. Especially this paper is adopted from after the brief research to conclude how to overcome the drawbacks which is to be maintained for future and as well as to improve the characteristics performance and the features of future generation of mobile technologies.

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