COMPARATIVE STUDIES OF 1G TO 5G WIRELESS TECHNOLOGIES BASED ON PRINCIPLES OF PHYSICS

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ABSTRACT:

It is well known to all of us that there are some important links between technology and physics, such as radio and T.V. related to the principle of propagation of electromagnetic waves, computers related to digital logic, electric generators related to Faraday's laws of electromagnetic induction etc. Mobile and Telephones have become very essential part of our everyday life. The present paper covers on the evolution and development of various generations of wireless technologies. There are five generations (1G-5G) present till today and 6G may be planned for the next decade. We know that the new mobile generation appears only after every tenth year since 1981. 1G device uses the analog technology which includes the communication on certain frequency band. 2G technology enables the mobile phone network to provide such as text, picture and multimedia messages. 3G has several technologies such as WCDMA, EV-DO and HSPA. 4G provides different facilities in Tele-Medicine, Management and Education Programme. The important goal of 4G is to allow to access the internet. Latest generation of wireless technology i.e., 5G technology is providing large broadcasting of data in giga bite which will support about 65000 connections. The uploading and downloading speed of 5G technology is more satisfactory. This technology helps to promote Internet service, cloud computing and nanotechnology. Also 5G technologies includes camera, MP3 recording, video player, large phone memory, audio player and much more which we never imagine earlier. In coming future 5G technology takes over the world market. Thus we can say that the 5G technology is available at proper rates having high peak future and much reliability than its preceding technologies.

Keywords: Digital logic, Analog technology, Frequency, Generation, nanotechnology

[1] INTRODUCTION

As per our observations the mobile and wireless systems have been improving rapidly every day. G (generation) indicates the evolution in the cell phone technology with respect to the time. There are five generations present till today and 6G may be planned for the next decade. 0 G devices were built in the year 1946 by Motorola & Bell system and these devices used the mobile telephone service to connect to the calls. The new mobile generation appears at every tenth year since the first 1G system was introduced in 1981, followed by the 2G system 1992, 3G in 2001 while the 4G system in 2010. This 4G refers to all internet protocol packet switched networks giving mobile ultra broad band access. The fifth generation communication system is envisioned as the real wireless network, capable of supporting wireless world-wide-web (www) applications in 2010 to 2015 time frame.
The wireless network refers to any type of network that is not connected by cables of any type. Wireless networking helps save the cost of installation of cable mediums, save time from installation and also creates mobility for devices connected to a network [1].

[2] FIRST GENERATION (1G)

The first commercially automated cellular network (1G) was launched in Japan by NTT (Nippon Telegraph & Telephone) in 1979, while in 1983 the first 1G network launched in the U.S.A. 1G device used the analog technology for the communication which includes the communication on certain frequency band. This device was equipped with direct dialing hence operator help was no more required to talk to others. Some companies like Nokia, Motorola built such type of devices in the 1970 but it was used in about 1981.

[3] SECOND GENERATION (2G)

2G cellular telecom networks were commercially launched on the GSM standard in Finland by Radialinja in 1991 [2].

[3.1] ADVANTAGES
(a) Phone conversations were digitally encrypted.
(b) These systems were more efficient on the spectrum allowing for far greater mobile phone penetration levels.
(c) 2G introduced data services for mobile, starting with SMS.
(d) 2G technologies enabled the mobile phone network to provide such as text messages, picture messages and multimedia messages. 2G has been superseded by newer introduced technologies such as 2.5G, 2.75G, 3G etc. but 2G networks are still used in some parts of the world. 2G services are frequently referred as personal communications service of PCS in the USA.

[3.2] DISADVANTAGES OF 2G
a) Weaker digital signal
b) Angular decay curve
c) Reduced range of sound.

[4] THIRD GENERATION

3G wireless technology represents the convergence of various 2G wireless telecommunications systems into a single global system that includes both terrestrial and satellite components. So 3G wireless technologies is its ability to unify existing cellular standard i.e., CDMA, GSM and TDMA under one umbrella. There are a bunch of technologies that fall under 3G such as WCDMA, EV-DO and HSPA among others. 3G technologies use a hybrid of circuit switching is old technology. The down side of this technology is that it ties of the resource of as long as the connection is kept up [3]. 3G wireless networks consist of a Radio Access Network (RAN) and a core network. The core network consist of a packed switched domain, which includes 3G, SGSN and GGSN, which provides the same service that they provide in a GPRS system.
[4.1] ADVANTAGES

Latest 3G releases which often denoted 3.5G and 3.75G, also provide mobile broadband access to smart phones and mobile modems in laptop computers. Several radio interfaces are offered sharing the same infrastructure as follows [4]

(a) The original and most wide spread radio interface is called W-CDMA.
(b) The TD-SCDMA radio interface was developed in 2009 and is only offered in China.
(c) The latest UMTS release, HSPA can provide peak data rates up to 56 Mbit/s in the down link and 22 Mbit/s in the up link.

[5] FOURTH GENERATION

First release 3G long term evolution has been available on the market since 2009. The high expectation for the 4G technology is the effective quality in audio /video streaming over internet protocol. The word MAGIC related to 4G means Mobile multimedia, Anywhere, Global mobility solutions over, Integrated wireless and Customized services.

[5.1] ADVANTAGES

(a) Virtual presence & Navigation:- 4G provides user services at all times, even if the user is off-site. It also provides that when users can access a database of the streets, buildings etc of large cities. This requires high speed data transmission.
(b) Tele-Medicine: - A user needs not to go to the hospital instead a user can get video conference assistance for a doctor at anytime and anywhere.
(c) Crisis Management: - Due to the several causes sometimes communication system breaks down. For a usual position organization takes some weeks. But in 4G it is expected to restore such crisis issues in a few hours.
(d) Capabilities: - The ambitious goal of 4G is to allow to access the internet satisfactorily. The provided connection to internet will allow users to access all types of services such as text, databases, multimedia etc. 4G will also provide higher bandwidth, data rate and will ensure the service is well provided to the users.

[5.2] DISADVANTAGES OF 3G & 4G

- The cost of cellular infrastructure, upgrading base stations & data prices are very high.
- Requirement of different handsets and some devices.
- Roaming & voice work together has not been implemented.
- Power consumption is high.
- Not available in every part of the world.

[6] FIFTH GENERATION

As per the first view evolutionary the 5G System will be capable of supporting the www allowing a highly flexible network such as a dynamic adhoc wireless network (DAWN). But in case of second view, i.e., revolutionary, 5G system would be an intelligent technology capable of
interconnecting the whole world without limits [5, 6]. In 5G, each network will be responsible for handling user mobility [7], while the terminal will make the final choice among different wireless network providers for a given service. A model diagram of multiple integrated wireless network access solution has been shown in figure 1, which is commonly used in the 5G mobile communication.

Figure: 1. multiple integrated wireless network access solution.

[6.1] ADVANTAGES

(a) User Personalization: - Any person can have right to filter these data and services as per his choice by configuring the operational mode of their devices, so that he can preselect the service conditions.

(b) Network Heterogeneity: - This means the different types of access networks like WiMAX, Wi-Fi (wireless Fidelity) etc, which differ in their coverage area, data rate and data loss rate.

(c) Lower Power consumption: - 3G and 4G both devices required batteries. 5G aims at breaking this directly proportional rule. Shorter communication links is one of the few solutions proposed to cater to this requirement.

[7] COMPARISION WITH EYES OF PHYSICS

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<tr>
<th>Physical Properties</th>
<th>1G</th>
<th>2G</th>
<th>3G</th>
<th>4G</th>
<th>5G</th>
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<td>Digital Cellular</td>
<td>CDMA,IP</td>
<td>LAN/WAN</td>
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[8] CONCLUSION

This paper explains different generations of wireless technologies with their performance, advantages & disadvantages. We have observed that due to the application of packet switching, speed of internet becomes higher. The application of orthogonal frequency division increases the bandwidth increases. At last 5G technologies has several advanced features since it became most powerful and popular among users.

REFERENCES