Different Generation of Wireless Communication

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Abstract- **The paper classify the different generations of the wireless communication. Analyze all the generation of wireless communication with respect to the each other. During the past two decade there is a brought uprising in the field of communication. The mobile communication industry growth has beaten the growth of all other fields. Even our own country is not left behind. The number of mobile subscribers in the country rise to over 915 in Mar 2012. 3G system has been introduced in line with other countries. Talks have started about 4G / 5G. The application of 4G /5G will most probably be the definitive goal in the field of communication.**

I. INTRODUCTION

The ability to communicate with people on the move has evolved remarkably since Marconi first demonstrated radio's ability to provide continuous contacts with ships sailing in English channel in 1897. Since then new wireless communication methods and services have been adopted by people throughout the world. Particularly during the last two decades the wireless communication industry growth has been remarkable. The digital switching techniques, new large scale integration and other miniaturization technologies have been major contributory factors in this regard. 3G has also been launched in India in line with other countries of the world. There were over 911 m mobile users in India in Mar 2012 (1). This is expected to reach 1b in 2015. As regards mobile users are concerned, India's figures are still low as compared to other advanced countries as can be seen from the table (2)

S.No	Country	Population in m	Mobile users in m	Mobile %
1	China	1341	1010	75.32
2	India	1210	911.68	75.42
3	USA	310	327	104
4	Russia	142	224	154
5	UK	61	75	122
6	Germany	81	107	130
7	Japan	127	121	95
8	Pakistan	178	114	66.5
9	Brazil	192	245	127

II. DIFFERENT WIRELESS GENERATIONS

2.1 1G

1G-refer to the first generation wireless telephone technology, mobile communication. That were introduced in the 1980s and this generation continued until being replaced by 2G digital telecommunications. In First generation of wireless telecommunication technology the network contains many cells (Land area was divided into small sectors, each sector is known as cell, a cell is covered by a radio network with one transceiver) and so same frequency can be reused many times which results in great spectrum usage and thus increased the system capacity i.e. large number of users could be accommodated easily. The First generation of wireless telecommunication technology used analog transmission techniques which were basically used for transmitting voice signals. First generation also consists of various standards that were Advance Mobile Phone Service (AMPS), Nordic Mobile Telephone (NMT), and Total Access Communication System (TACS).

Features of 1G technology
Narrow band analogue wireless network is used, with this we can have the voice calls and can send text messages.
Services are provided with circuit switching.

Example: NTT, AMPS, NMT

Problems of first generation
In data transferring there is no security i.e. anybody could listen to the conversion easily by simple techniques. Analog signal can easily be affected by interference and call quality decreases. User defined number could be stolen easily.

2.2   2G
2G-refer to the second generation wireless telephone technology, mobile communication. After 2G was launched, the previous mobile telephone systems were retrospectively dubbed 1G. the main difference between the 1G & 2G is that in 1G radio signal are analog and in 2G radio signal are digital. 2G technologies can be divided into Time Division Multiple Access (TDMA)-based and Code Division Multiple Access (CDMA)-based standards depending on the type of multiplexing used.

Features of 2G technology
In 2G Narrow Bands Wireless Digital Network is used. In case of 2G the roaming facility a semi-global facility is available It brings more clarity to the conversation and both these circuit-switching model Make use of CODEC (compression and multiplex algorithm) to compress and multiplex digital voice data.
It emit less radio power hence it is safer for consumer.
The error checking has improved sound quality. Digital coding also reduces the noise in the line, thus improving the precision of the voice. The digital encryption provides privacy and safety to the data and voice calls, which is surrounded by the many other welfare of 2g technologies.SMS is also low priced and a easy to communicate with others.

Disadvantages of 2G technology
Angular decay curve
The disadvantage of 2g technologies is Analog has a smooth decay curve, digital a jagged steppe one. Under adverse condition, digital will sometime drop outs & may fail totally if the requirement inferior.

2.3   3G
3G-refers to the third generation wireless telephone technology, mobile communication. It allows sending and receiving large amount of data using a cell phone. It permits extremely quick speeds. As estimates vary, most predictor agree that the 3G provide speed in range of 144KBps to 2.4MBps. This technology also provide the value added facilities like video calling, mobile internet access, IPTV etc on the mobile phones. 3G provide the necessary bandwidth that's why facilities possible in mobile phone. 3G technology designed for hyper media communication.

What is Required for Using 3G?:
The first thing require for 3G is a device (e.g. a mobile phone) . This is where the name 3G phone comes from - a phone that has 3G functionality; nothing to do with the number of cameras or the memory it has. An example is the iPhone 3G.
3G phones commonly have two cameras since the technology allows the user to have video calls, for which a user-facing camera is required for capturing him/her.
Unlike with Wi-Fi which you can get for free in hotspots, you need to be subscribed to a service provider to get 3G network connectivity. We often call this kind of service a data plan or network plan.

Contributor Technologies of 3G
The 3G technology is included basically three technologies.
 The technologies are:
 CDMA2000   -   Code Division Multiple Access.
TD-SCDMA   -   Time-division Synchronous Code-division Multiple Access.
·W-CDMA (UMTS)   -   Wideband Code Division Multiple   Access.
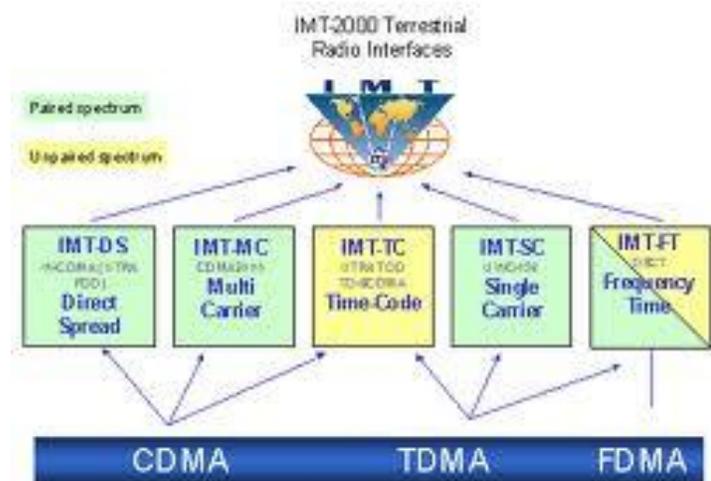
[5] Features of 3G

Enhanced multimedia (voice ,data ,video and remote control), Usability on all popular models (cellular phones , e-mails , pagers , fax , video conferencing and web browsing), Broad bandwidth and high speeds (upwards of 2 MBPS), Bandwidth 5 – 20 Mbps, Access WCDMA / CDMA 2000, Frequency Band 16 – 25 G Hz, Component Design -- Optimized antenna multiband adapters, Has both circuit / packet switching, Routing flexibility (repeater , satellite and LAN), International roaming capability, Excellent quality of voice., Email with full-fledged attachments such as PowerPoint files, Instant messaging with video / audio clips, Fast downloads of large files e.g. power point, Access mutual applications.

Applications of 3G consist mobile TV, video on demand, video conferencing, telemedicine, location base service, GPS (global positioning system)

Disadvantages of 3G

Technology and management are more expensive than 2G so cost is high.
Base stations need to be closer to each other (again more cost).

2.4   4G Network

4G-refers the fourth generation of wireless telephone technology. It was developed in 2010. Speed of the 4G is fast up to 100Mbps. It has low cost

Accessing information anywhere, anytime with seamless connection to a wide range of information, obtaining services, receiving a large volume of information, data, pictures, video and so on are the key of 4G infrastructure.

Transmission
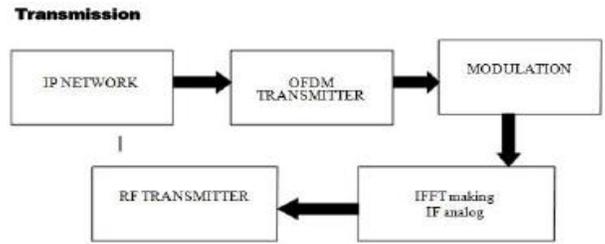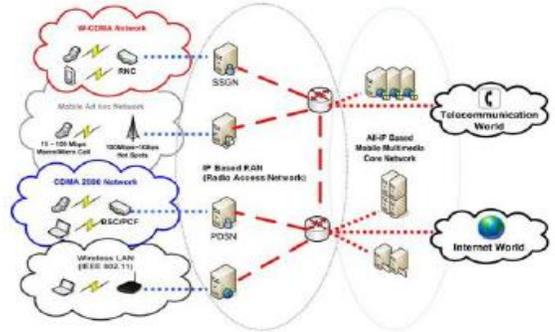
Architecture in prospect

End-to-end Service Architectures for 4G Mobile Systems:-(7)

The main reason of transition of 3G systems and beyond is that the telecommunication suppliers were not able to provide an effective economics of scale. This is due to the fact that they can't match up with the future high performance applications like multi-media, full- motion video, etc. innovative speed up. So we need a single broadband network with high data rates which integrates wireless LANs, Bluetooth, cellular networks, etc. So a direct solution of these facts is that a new end to end service architecture is launched during the exploitation of 3G technology and become an outstanding working model for 4G telecommunication network. And the 4G system will not be organized as a huge structure that can exploited by a single business article but a vibrant association of cooperating and competing- service providers.

Middleware Architecture:-
The middleware architecture consists of three different layers; i.e. user support layer, service support layer and network support layer. The user support layer has an independent agent aspect which the middleware in 3G technology lacks. This layer helps in reduction of the avoidable user interaction with the system.

The middle layer is the service support layer which contains the most functions of traditional middleware. And the bottom layer is the network support layer which helps in providing a support to the connectivity for all IP networks.

Network Architecture:-

It is clear that more fundamental enhancements are necessary for the very ambitious throughput and coverage requirements of future networks. Towards that end, in addition to advanced transmission techniques and antenna technologies, some major modifications in the wireless network architecture itself, which will enable effective distribution and collection of signals to and from wireless users, are sought. The integration of "multi hop" capability into the conventional wireless networks is perhaps the most promising architectural upgrade. In a Multi hop network, a signal from a source may reach its destination in multiple hops (whenever necessary) through the use of "relays". Since we are here concerned with infra structure-based networks, either the source or destination is a common point in the network base station (or, access point, in the context of WLANs).

The potential advantage of relaying is that it allows substituting a poor-quality (due to high path loss) single-hop wireless link with a composite, two or more hop, better-quality link whenever possible. Relaying is not only efficient in eliminating black spots throughout the coverage region, but more importantly ,it may extend the high data rate coverage range of a single BS ; therefore cost effective high data rate coverage may be possible through the augmentation of the relaying capability in conventional cellular networks.

Advantages:-

• Property owners can install their own access points.
- Spreads infrastructure cost.
•Reduced network access operational cost:
- Access points configure into access network.
- Some access points may be moving (bus, train)
• Multihop also could reduce costs in heterogeneous 3G networks.


e.g. of Heterogeneous network

Overlay network:-

In this architecture, a user accesses an overlay network consisting of several universal access points (UAP). These UAPs in turn select a wireless network based on availability, QoS specifications, and user defined choices. A UAP performs protocol and frequency translation, content adaptation, and QoS negotiation-renegotiation on behalf of user's .The over lay network, rather than the user or device, performs handoffs as the user moves from one UAP to another. A

UAP stores user, network, and device information, capabilities, and preferences

.Because UAPs can keep track of the various resources a caller uses; this architecture supports single billing and subscription.

(a)A multimode device lets the user, device, or network initiate handoff between networks without the need for network modification or interworking devices.
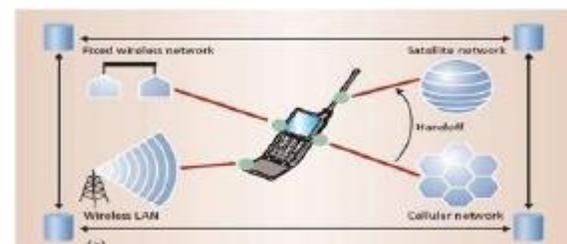
(b)An overlay network consisting of several universal access points (UAPs) that store user, network, and device information—performs a handoff as the user moves from one UAP to another.
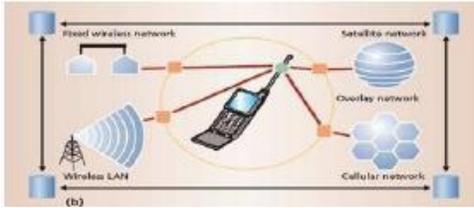
(c)A device capable of automatically switching between networks is possible if wireless networks can support a common protocol to access a satellite-based network and another protocol for terrestrial networks.
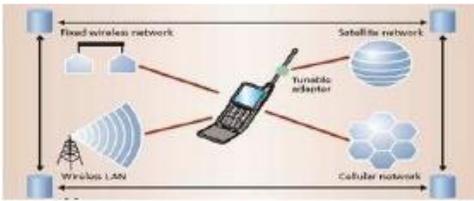
Attempts are already underway to provide the ultimate in wireless communication. Developments have been made by Japanese Company DoCoMo , Samsung and Apple Inc. 4G is expected to be operational by 2012 and is described as MAGIC (6) which means

      M   Mobile Multimedia
      A   Anytime Any-Where
      G   Global Mobility
      I   Integrated Wireless Solution
      C   Customized personal Service

Objectives of 4G

A 4G technology is being developed to raise the quality of service and these rate requirements are set by developing the existing 3G applications like mobile broadband access, mms, video chat and conferencing and even HDTV. 4G technology also allows roaming with wireless local area network and can even interact with digital broadcasting systems.

So the objectives include:-

- In 4G, a nominal data rate when a client physically moves at high speed id about 100Mbits/s and when the client and the station both are in relatively fixed positions is 1Gbit/s.
- It has a data rate of 100Mbits/s between any destination in the world.
- There is always a horizontal handoff across the mixed networks.
- There is a flawless connectivity across several networks.

- There is a high quality service for high speed data, HDTV video content, etc in 4G technology.
- It is a packet switched network for all IP networks.

Benefits of 4G:

- It is a high speed, high capacity and low cost per bit network.
- It has better spectral efficiency
- It is an IP based mobile system.
- It has better arrangement and call access managing techniques
- It supports for interactive multimedia, voice, video, internet and other broadband services.
- It has higher bandwidth
- It works at 2.6GHz frequency which means better coverage even though it uses the same tower where the receiver send transmitter for 3G is.

4Gtechnology is significant because the users carry much of the network with them only. As the users congregate and create pockets of high demand, they themselves create additional routes for each other. So the users will automatically hop from the congested routes to the non congested routes. So increase network utility. So the cost will automatically reduced.

2.5   5G Systems

5G systems are the 5th generation systems which have not been yet developed. But is expected to be launched by year 2020. So the developments are not only ongoing on 4Gsystems but their key concepts have also been launched.

Key concepts of 5G systems

According to a unified global standard, in 5G technology the peak download/upload speed will be more than 1Gbps. With this technology a real wireless world will be there with no more limitations like access and zone issues. A mobile IP address is assigned to the mobile users according to the different locations and connected network. Multiple parallel data transfer path will be there. Different radio technologies share spectrum efficiently by adaptively finding unused spectrum and then adopting the transmission scheme to the requirements of the technologies that are sharing the spectrum by this time. It is ensured that the user will simultaneously connected to multiple technologies and

then flawlessly move between them. Till 4G, the wireless assessment follows the path of Moore's law. In the new generation the bit rate of data will increase by (2G- 9.6Kbps to 4G- 1Gbps). So it is observed that the 5Gsystems will defy the Moore's law and it will be a segment of assimilation of network technologies rather than the evaluation of new wireless standard. Because as it has already been discussed that beyond 4G, there will no need of accessing new technologies as 4G will convert each mobile connection into a broadband connection. So the telecom operators will invest in developing new applications instead of developing new wireless standards and these applications includes health care, banking, chemical, etc to provide a flawless mobile experience to users.

Future in 5G

In future the 5G would be just "ubiquitous computing", that is having the ability to access any application, anywhere and anytime. But to create an environment like this one needs to incorporate many applications that is rising from various engineering practices. In future human life will be bounded by intelligent sensors which will bring an essential change in human life's approach of doing things any work which includes:

- An intelligent car that will send an SMS to the mobile phone if someone tries to open the door of the car while we are away of the car.
- A home security camera that can show your room on your laptop/mobile phone just by accessing secured website.
- A single bill for all telecom services like mobile phone bill, electricity bill, water supply bill, house tax, etc.

Researches going on to be implemented in 5G

- Researchers are now working on a new concept with which the users can access several wireless technologies concurrently and can also switch between them.
- They are researching for using internet protocol version6- IPv6 instead of Internet Protocol version 4 - IPv4.
- It would have user centric network concept.(13)

III.   CONCLUSION

As we can observe these days the incredible growth potential of data traffic generation by generation. In this paper we review the various generations of mobile wireless technologies. Till 4G technology the wireless has grown so fast from simple messaging to video calling. Under 4G technologies the accessible voice centric telecom hierarchies move to the simple IP architecture. And now research on 5G is going on. And is about to come at 2020. And this technology will be even more compliment by using advanced semiconductor. 5G will encourage the concept of super core where it will be observed that all network operators will operate on a single infrastructure.

even more flatter architecture by using advanced semiconductor technologies as 22mN CMOS. 5G will promote concept of super core, where all the network operators will be connected one single core and have one single infrastructure, regardless of their access technologies.

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