IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 9, Issue 4, Ver. I (Jul - Aug. 2014), PP 55-59
www.iosrjournals.org

Wireless Networks & Imt 2000 Challenges and Solutions

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Abstract: *communication means, "To establish communication without the use of cables or wires, where data distribution occurs through an unguided medium such as atmosphere by using radio wave technologies." Wireless technology has pervaded our lives – mobile phones, cordless phones & infra red remote control devices are just a few examples of the wireless devices we use. All the digital personal communication systems used in past were mainly based on voice communication and were getting overloaded in metropolitan areas. Therefore, a need of another communication system having greater capacity for ordinary voice calls and that allows higher data rates for digital communication was felt. The idea was to have a Universal Personal Telecommunications (UPT) terminal that would work any where, using a fixed variety of RF standards for fixed, mobile and perhaps even satellite operation. Thus, third generation digital personal communication system (IMT 2000) was evolved by increasing its data rate but leaving the basic system unchanged. IMT-2000 (International Mobile Telecommunication 2000) refers to a standard for mobile communication throughout the world whereby certain protocols are followed by all cellular service providers. IMT – 2000 works at 2000 MHz and was also setup around the year 2000. IMT-2000 has been constituted to make mobile access universal and to increase the services it provides. It is through the universal interconnection of various networks that allows these goals to be achieved. IMT - 2000 supports cross interfacing between different mobile standards. IMT-MC, IMT-DC, IMT-TC are the backbones through which different CDMA modes such as CDMA 2000, W-CDMA, ULTRA TDD, TD-SCDMA are supported. IMT also has support for TDMA and FDMA networks through its IMT-SC and IMT-FC backbone structures*

Keywords: *Universal Personal Telecommunications (UPT), Personal Communication Systems (PCS), International Telecommunication Union (ITU), Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA), etc*

I. Introduction

In India, Communications is the basic necessity in the present world of advancements & technologies. We could not have as many things going on around this world as we do now. Police, for example would have a much tougher job. They could not tell each other what is going on where and no dispatcher could inform them about any call. Communications make them easier to build large infrastructures. Communication is today's need for the information the job to be transferred. This world would have been quite chaotic without communications. There are two types of communications.

The term wireless has come to mean non-broadcast communication, usually between individuals who very often use portable or mobile equipments. The term is rather is vague, of course, and there are certainly borderline applications that are called wireless without falling exactly into the above definition. Wireless communication is the fastest growing of the very dynamic field of electronic communication. It is an area with many jobs that go unfilled due to a shortage of knowledgeable people.

II. Literature Review

1. History

Wireless communication began only a little later than the wired variety. In 1837 – Morse's telegraph and in 1876 Bell's telephone were soon followed by Hertz's first experiment in 1857 with radio. These successes lead to widespread use of radio for ship-to-ship and ship – to – shore communication using Morse code.

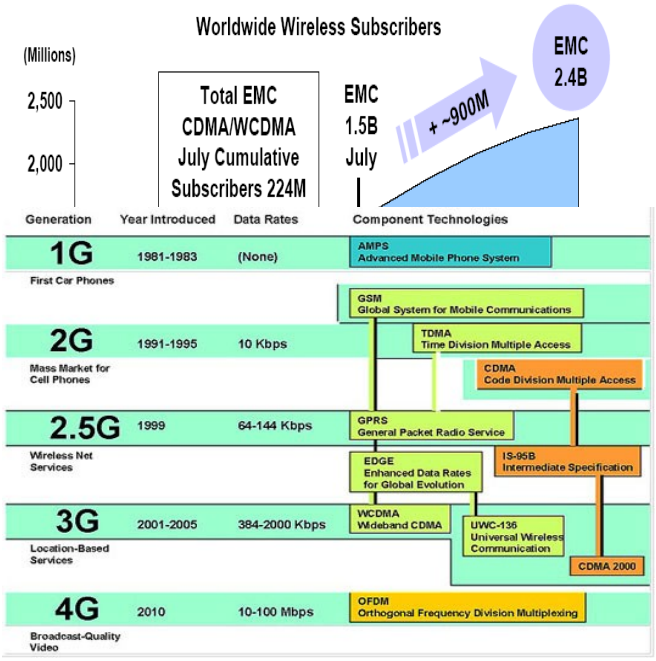
Early wireless systems used crude, though often quite powerful, spark gap transmitters, and were suitable only for radiotelegraphy. In 1906 the invention of the triode vacuum tube by De Forest allowed for the modulation of the continuous wave signal and made voice transmission practical.
In 1920 Commercial Radio Broadcasting began in both United States and Canada.

The first mobile radio systems, for police departments, were one way, with only a receiver in the police car. The first such system to be considered practical was installed in Detroit in 1928. In late 1930's Amplitude Modulation (AM) was used when Frequency Modulation began to displace it.

Later incentives were provided for the development of mobile and portable radio systems, including two way systems known as "walkie talkie". In 1962 pagers were introduced. The first cellular radio service was installed in Japan in 1979.

1.1 Literature Review:

There is no doubt that we are still near the beginning of the wireless revolution. The cellular concept started the revolution by allowing frequency reuse at relatively short distances. As higher frequencies become economical for everyday use, there is almost no limit to the amount of data that can be sent by wireless means. 900M Over 128M Subscribers, 105Operators, 46 Countries, 543 Handsets, 53 Vendors 3G



III. Third Generation

Cellular radio and PCS have been very successful but they are not the ultimate in wireless personal communication. Manufacturers, service providers and standard bodies were already working on improvements when the first systems went into operation. At this time, third- generation (3G) wireless systems are about to be deployed.

Challenges For The Third Generation

There are several areas in which improvements in the present system are needed. Brief description of some of them is as follows:-

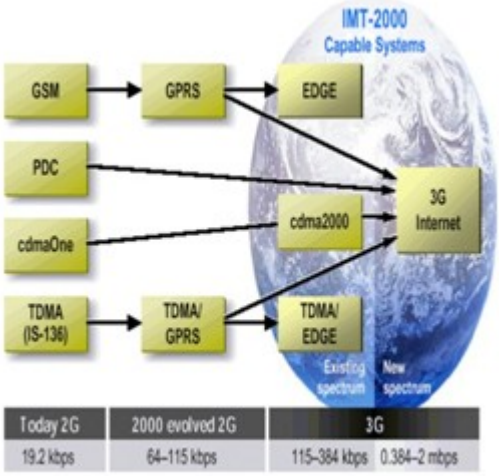
Improved Data Communication – All the digital personal communication systems (PCS) used in past were designed mainly for voice communication. The emphasis was on keeping bandwidth requirements low, along with minimizing power requirements for the mobile unit. These systems also work well for e –mail and other short messages, but the available bit rate for data communication is quite low, even compared with ordinary telephone modems.

Greater capacity – One of the reasons for the creation of second- generation (PCS) wireless systems was that the first-generation cell phone systems were becoming overloaded in major metropolitan areas. At the current

growth rates, it will not be long before the same thing happens to the second-generation networks (it is already happening in Japan). Therefore, a third generation wireless network should have greater capacity for ordinary voice calls, as well as allowing higher data rates for digital communication.

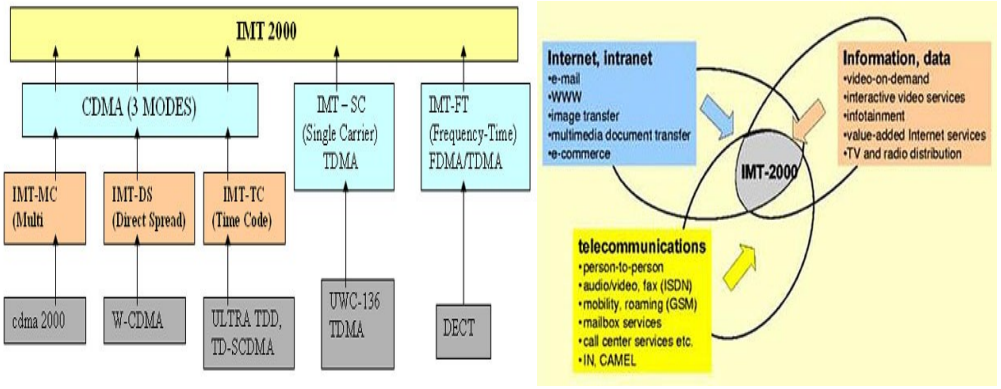
Adaptability to Mobile, Pedestrian and Fixed Operation – The idea is to have a Universal Personal Telecommunications (UPT) terminal that would work any where, using a variety of RF standards for fixed, mobile and perhaps even satellite operation. The whole system would be transparent to the user, who would not need to know how the connection was made any more than a present-day wire line telephone user needs to know the details of call switching and routing.

Greater Standardization- Any of the second-generation systems could be extended by increasing its data rate but leaving the basic system unchanged. Obviously, adopting a single third-generation specification using any of the existing standards would give an advantage to those manufacturers and service providers who already have experience with that system. Consequently, there has been a good deal of arguments about the merits of various proposals for a 3G system. Not all the arguments have had a strictly technical basis.



IV. Imt 2000

By autumn of 1999, general agreement was reached on the outline of third-generation system, designated by the International Telecommunication Union (ITU) as IMT-2000 (IMT stands for International Mobile Telecommunications, and 2000 refers both to the approximate implementation date and to the fact that the proposed system will operate at about 2000 MHz), which meets most of the above requirements. Maximum data rates will be 144 kb/s for mobile users in high speed vehicles, 384 kb/s for pedestrians and perhaps for slow moving vehicles and up to 2 Mb/s for stationary users. There are two major reasons for the difference in data rates. The first is that pedestrians, because of their low speed, encounter handoffs less frequently than users in moving vehicles. Stationary users, of course, are not subject to handoffs at all. Secondly, stationary users are much less affected by multipath fading. While no one standard for the air interface has been approved, the number of different standards to be included has, after much negotiations, been reduced from about fifteen to five. This is a decided improvement, through still far from ideal. The specification includes one TDMA standard, one FDMA standard, and one CDMA standard with three variations. There will probably be multimode phones that can cope with all these standards



The IMT-2000 system will incorporate three variations of CDMA. The modes differ in how duplexing is accomplished and how many carriers are used. All variations operate in a 5-MHz channel, as compared to 1.25 MHz for CDMA One (also called IS-95), the current CDMA PCS. The new CDMA standard is an amalgam of several proposals that eventually were combined into three. One variant, called cdma 2000 and proposed by users of North American IS-95 CDMA system, can use three separate carriers within a single 5-MHz channel, each modulated with a chipping rate of 1.2288 Mb/s. This is the same rate as used with IS-95, so this variation essentially uses three IS-95 signals in one larger channel, combining the data from the three to give some combination of greater numbers of voice calls and higher- speed data transmission.

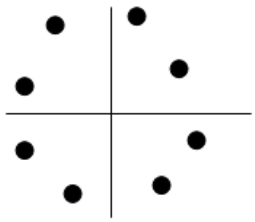
The other variation, proposed by a consortium of European and Japanese interests and called W-CDMA (for Wideband CDMA), uses a chipping rate of 4.096 Mb/s with only one carrier per 5-MHz channel and is therefore not backward compatible with IS-95. it also does not rely on synchronization of base stations by means of the American GPS satellites. This provides advantages in the case of indoor base stations where the reception of satellites signals is difficult.In addition to two ways of dividing the channel, there are two ways of providing full-duplex operation. You can recall that the IS-95 system, like all first- and second- generation wireless systems, provides full-duplex operation by using separate carrier frequencies for the forward and reverse channel. With a digital system there is another possibility called time-division duplexing (TDD)., in which different time slots are used for each direction, but the same RF channel is used for both.

TDMA (Time Division Multiple Access) Standard.

The other variation that seems likely to be incorporated in the third generation PCS standard is a wideband version of the North American TDMA system, with some elements incorporated from the European GSM system. This proposal is known as UWC-136 and was proposed by the Universal Wireless Communications (UWC) consortium.

8-DPSK

The new TDMA standard envisions a wide variety of channel widths, data rates, and modulation schemes, so as to allow a gradual migration from current TDMA and GSM systems to the third-generation standard. The plan is eventually to move to channels 1.6 MHz wide. The wider channel will support a channel bit rate of upto 5.2 Mb/s using 8-DPSK, that is, face-shift keying using 8 different phase angles, which allows three bits to be transmitted per symbol



(i) Each symbol represents three bits of data

Once the final standard is in place, all the IMT-2000 requirements should be supported. TDMA systems can use either frequency- or time- division duplexing.

Importance of IMT-2000 for Developing Countries

- Means to achieve universal service/access goals
- Diversification of the telecommunications services offering
- Provision of new services
- Factor of integration in the Information Society
- Development of connectivity
- Fast provision of voice and non voice services in uncovered regions.

V. Conclusion

The dramatic growth of mobile services in world has made a significant impact on the overall growth of the economy. Migration from 2G to 3G has been carried out cautiously taking into account the unique telecommunication environment in the world.

In general, it appears that the likely result of all the complicated negotiations is that the third generation of wireless communication standards will be only slightly less chaotic than the second. A fourth generation, with data rates of 150 Mb/s and more is already being considered. Perhaps by then it will be possible to arrive at one world wide standard. Don't count on it though.

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