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"Study of First Generation of Wireless Communication System (1G)"

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Abstract

Wireless communicationsystem or mobile communications originated with first generation of mobile phones, now-a-days called as 1G. Basically, this was an analog telecommunications system. This system was introduced in the year 1979 and were in use up to the mid of the 1980s. The present article reports the study of first generation (1G) of wireless communicationsystem. Basically 1G means the first generation of wireless cellular technology. These were the analog mobile telecommunications systems which were continued up to the 1980s and were superseded by 2G so called second generation of wireless communication system.

Introduction:

A mobile phone, cellular phone, cell phone, cellphone, handphone, hand phone or pocket phone, sometimes shortened to simply mobile or cell or just phone, is a portable telephone that can make and receive calls over a radio frequency link while the user is moving within a telephone service area[1,2].The word mobile is used because it is very easy to move it from place to place.

1G refers is the first generation of wireless communication system. Basically these are analog mobile telecommunications systems which were introduced in the year 1980s and were superseded by second generation (2G) of wireless communication system.

During the evolution of first generation of wireless communication system, different 1G cellular standards were developed and used in various parts on the globe, but the most widely adopted globally system were the Nordic Mobile Telephone(hereafter referred as NMT) and Advanced Mobile Phone System (hereafter referred as AMPS) systems.The hidden benefits of digital technology over analog technology that 2G networks went on to eventually totallytook place of previous one. In the world, almost all the first generation of wireless communication system (1G) networks were vanished, however at some places, the first generation of wireless communication system (1G) continued to operate up to the year 2010s.

The predecessor to first generation of wireless communication system (1G) was themobile radio telephone (also known as 0G or zeroth generation of wireless communication system). In this system of communication, the portablephones would connect to a centralized operator. 1G refers to the very first generation of cellular networks[2]. Cellular systemis named because it uses a network of cells across the geographical area by using low-power radio transmission system[1].

Evolution of first generation of mobile technology:

The first **generation** of **wireless** communication system (1G) was developed in Japan in the year 1979 by Nippon Telegraph and Telephone (NTT). Initially, itwas started in Tokyo. But within very short span of time (i.e. only in five years), it was expanded to cover the whole of Japan. In figure 1, **Martin Cooper** of Motorola, shown here in a 2007 reenactment, made the first publicized handheld mobile phone call on a prototype Dyna TAC model on 3 April 1973 is shown.

The first commercial **cellular network**was developed in Japan by**NipponTelegraph and Telephone**(NTT) in the year 1979.

Figure 1: Martin Cooper of Motorola, shown here in a 2007 reenactment, made the first publicized handheld mobile phone call on a prototype DynaTAC model on 3 April 1973*

***Source:wikipedia.org**

In the starting phase, it was only in the metropolitan region of Tokyo. The first practical phone which uses this network was known as TZ-801 built by **Panasonic[3]**. Within very short span of time (i.e. only in five years), the **Nippon Telegraph and Telephone** (NTT) network covers the entire population of Japan and has got the position of first nationwide 1G/cellular network system howeverbefore the **Nippon Telegraph and Telephone** (NTT) network in Japan, **Bell Laboratories** built the first cellular network around **Chicago** in 1977 but trialed it in 1978 **[4]**.

In the year 1981, another company named as Nordic Mobile Telephone (NMT) was launched in European countries. In 1983, one more company named as Ameritech also launched the first **generation** of **wireless** communication system (1G) mobiles in the USA by using Motorola mobile phones. After that the use of mobile communication system was followed by several other countries across the world.

As before the cellular era, the **Nordic countries** were holding the position of the pioneers in wireless communication system. These countries jointly work and designed the Nordic Mobile Telephone (NMT) standard which were first time launched in the country Sweden in the year 1981**[5]**. Nordic Mobile Telephone (NMT) was the first mobile phone network in the world to have the feature of international **roaming**.

In the year 1983, the first 1G cellular network so called first **generation** of **wireless** communication system cellular network, was launched in the United States. It was totally Chicago-based**Ameritech**using the **Motorola Dyna TAC** mobile phone.

In the early to mid-1980s, first **generation** of **wireless** communication system (1G) was superseded by second **generation** of **wireless** communication system 2G (also called second generation) cellular technologies such as **GSM** and **cdmaOne**. However, first **generation** of **wireless** communication system (1G) also used digital signaling in order to connect the radio towers to the rest of the telephone system.In that technology, thevoice itself (during a call) is encoded to digital signals in second **generation** of **wireless** communication system (2G) whereas first **generation** of **wireless** communication system (1G) is the only **modulated** to higher frequency, typically 150 MHz and more. Most of the first **generation** of **wireless** communication system (1G) networks had been discontinued by the early 2000s in maximum region of the world. The last operating first **generation** of **wireless** communication system (1G) network was closed down in Russia in 2017.

Transmission System:

In data Communication, transmission system are the links which carry messages between two or more devices. The transmission system can be classified into two categories named as wired media or guided transmission system and wireless media or unguided transmission system (Figure 2). These two systems are explained as follows:

a) Wired media or Guided transmission system: In this system, there is a physical connection made up of wire or cable. Through this connection data in the form of signals are propagated between the nodes. These are normally of three types:

i) Twisted pair cable,

ii) Co-axial cable and

iii) Fibre-optic cable and

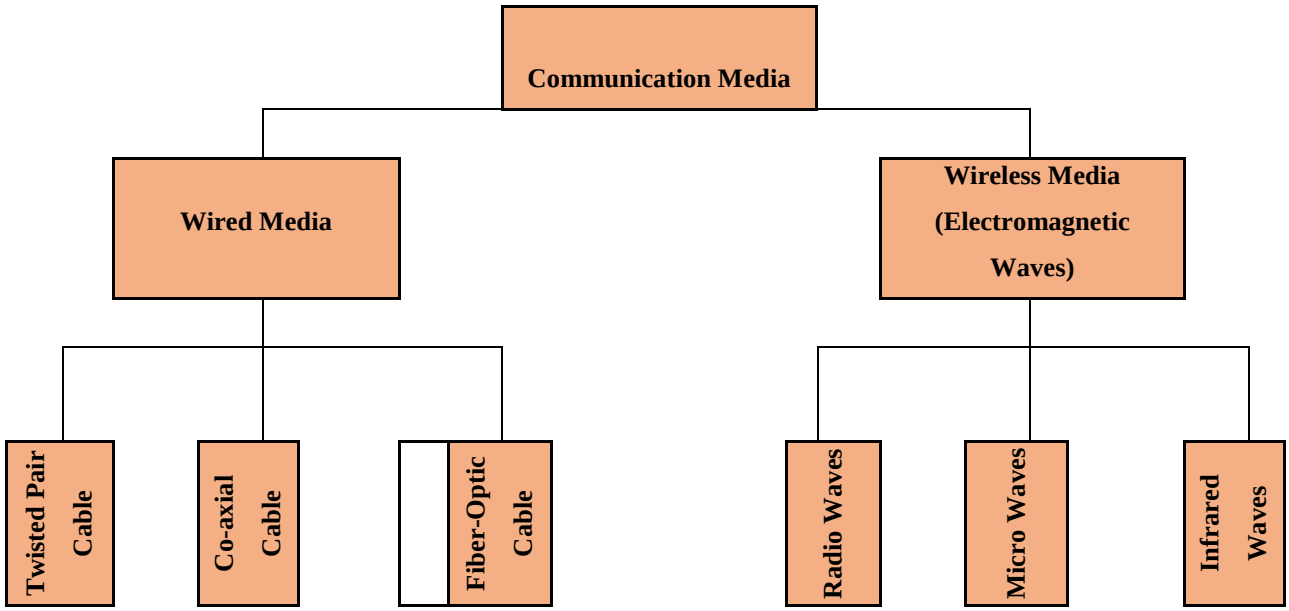

Figure 2: Classificationof Communication system*

*Source: Reference [6]

b) Wireless media or Unguided transmission system: In this system, there is no physical connection. The data is transferred in air in terms of electromagnetic wave through an antenna.These are also of three types:

i) Radio waves,

ii) Micro waves and

iii) Infrared waves

Technology used:

The previous wireless communication system were push-to-talk systems and especially wireless phones were used in military and maritime applications mere. The main difference between the existing wireless communication systems and first generation of wireless communication system (1G) was the introduction of cellular technology.The 1G AMPS architecture is shown in Figure 3. In first generation of wireless communicationsystem (1G) technology, the land area was divided into small-small sectors so called cells. Each cell had its own base station, that uses radio signals and a transceiver for the purpose of communicating with mobile devices. The base stations were linkedwith the telephone networks. In these base stations mainly frequency modulation techniques were used for voice calls.

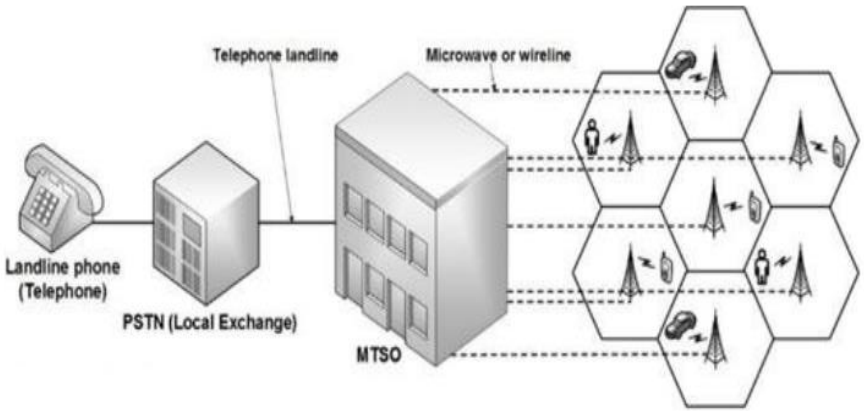

Figure 3: 1G AMPS architecture*

*Source: iaeng.org [7]

The specification of first generation of wireless communication system (1G) technology are shown in Table 1 given as follows:

Table 1

Specification of 1st generation of wireless communication system (1G)

Technology	First generation of wireless communication system (1G)
Year	1979
Use cases	Analog system, Dropped calls, Giant cell phones
Frequency	30 Khz
Bandwidth	2 kbps
Average speed	2 kbps
Range	N/A

*Source: drawingcapital.substack.com

Drawbacks of first generation of wireless communication system (1G):

- Analog systems did not hold up sufficient encryption systems. As a result, the security was aindispensable issue and tapping could not be controlled.
- Analog signals were also susceptible to interferences. As a result, the communication was boisterous.

Adoption of new technology:

In all over the world, after Japan, the earliest commercial cellular networks launched in the year 1981 in Sweden, Norway and Saudi Arabia, after that in Denmark, Finland and Spain in 1982, the U.S. in 1983 and Hong Kong, South Korea, Austria and Canada in 1984. By the year 1986, networks had also launched in Tunisia, Malaysia, Oman, Ireland, Italy, Luxembourg, Netherlands,United Kingdom, West Germany, France, South Africa, Israel, Thailand, Indonesia, Iceland, Turkey, the Virgin Islands and Australia also[8]. Generally, African countries were slower to take up first generation of wireless communication system (1G) networks, while Eastern European were among the last because of some political reasons[9].

It has been found that in Europe, the United Kingdom had the largest number of cellular subscribers as of 1990 (numbering 1.1 million) in the world, however Sweden were having the second largest market with 482 thousandin the world [9]. Although in all over the world, Japan was the first country with a nationwide cellular network.Thenumber of users was significantly lower than other developed economies with a penetration rate of only 0.15 % in the year 1989[7]. Up tothe January 1991, the highest penetration rates were found to be in Sweden and Finland. Both these countries were having above 50 % closely followed by Norway and Iceland also. In the world, the United States had a penetration rate of 21.2 %while in most other European countries, this penetration rate was found to be below 10 %[10and11].

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