Wireless LANs

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ABSTRACT

There are three digital wireless technologies: CDMA (Code Division Multiple Access), TDMA (Time Division Multiple access), and GSM (Global System for Mobile Communication).

Ethernet is a standard LAN protocol that operates at moderately high speeds and with inexpensive connection hardware can bring digital networking to almost any computer. Wireless LANs use electromagnetic airwaves (radio or infrared) to communicate information from one point to another without relying on any physical connection. Having a wireless LAN can benefit the user in various ways, being its major incentives an increase in mobility, flexibility, relative low cost and time saving. On the other hand, satellites are a very important source of communication, bringing the opportunity to transfer information from any part of the world.

SINOPSIS

Este artículo presenta la forma en que opera la tecnología inalámbrica digital: CDMA (Code Division Multiple Access), TDMA (Time Division Multiple Access), GSM (Global System for Mobile Communication) y también la comunicación vía satélite.

El Ethernet es uno de los protocolos estándar para LAN que opera a una velocidad moderadamente alta con una conexión al hardware no muy costoso y que puede brindarle una red digital a casi todas las computadoras. Además, los LANs inalámbricos utilizan ondas aéreas electromagnéticas: de radio o infrarrojas, para enviar información de un lugar a otro sin utilizar cables.

El tener un LAN inalámbrico puede beneficiar al usuario de diferentes maneras: 1) aumenta su movilidad o desplazamiento, 2) aumenta su flexibilidad, y 3) economiza tiempo.

Los satélites son un medio de comunicación muy importante, los cuales permiten transferir la información desde cualquier parte del mundo.

I- INTRODUCTION

Today there are more than 60 million wireless customers, according to the Cellular Telecommunications Industry Assoc. (CTIA), so it's difficult to imagine that cellular service was invented about 50 years ago. The business of wireless started as just as a whisper some 25 years ago in selected markets, and grew steadily from a $3 million market to one that now takes in close to $30 billion in annual revenues.

The market for wireless communications has enjoyed remarkable growth over the recent years. The major motivation and benefit from wireless is the increase in mobility. On this days, wireless technology reaches almost every place on the face of the earth. Hundreds of millions of people exchange information every day using pagers, cellular telephones and other wireless communication products. The wireless telephony and messaging have gain a lot of success in the past years and, at the present time; it is hardly surprising that wireless communication is beginning to be applied to the field of personal and business computing. By beneficiating from a wireless technology, people is able to access and share information on a global scale nearly anywhere they attempt. In the following pages we will try to explain different wireless technologies. Some of the topics that will be discussed here are: why the wireless LAN's and wireless local area networks can be used, and a brief description of some protocols that have been developed will be presented, with emphasis on IEEE 802.11 and in wireless communications, including cellular phones and satellites.

II- WIRELESS ROOTS

Wireless services started with a blueprint that relied on cellular technology. Cellular's name connotes that each geographic region of coverage is broken up into cells. Within each of these cells, there are both a radio transmitter as well as a control equipment. The first cellular service, which operated at 800 MHz, used analog signals. Analog means that the signals are sent using a continuous stream or wave. When a cellular phone customer turns on his phone, a signal is sent that identifies him as a customer, makes sure that he is a paying customer, then searches out a free channel to fit his call.

On the other hand, PCS, or Personal Communications Services which operates at 1850 MHz, followed years later. New entrants into the wireless market chose digital technology instead of analog. These companies saw the promise in building out PCS systems based on digital, and hoped to benefit from its continued growth. The may be onto something... The Strategis Group, a consulting company, predicted that, by the new millennium, some 23 million folks will be PCS subscribers.

Some cellular operators did see this evolution coming, too. They, too, looked to benefit from digital technology by backing a technique that combined both mediums: digital and analog, known as D-AMPS 136, the next upgrade from cellular. This was intended to improve on an analog-only network. The upgrade was done to protect their investment in the cellular network while still being able to provide some of tomorrow's services that their customers will demand. While digital upgrades are growing, and more and more operators are switching over to digital, by some estimates half the world's wireless users still use the basic analog system.

Unlike analog, which sends signals using a continuous stream, digital technology works by sampling pieces of the wave, chopping it up and then sending it in bursts of data. Digital technology basically encodes the voice into bit streams. It is this delivery that makes digital more suitable to carry data, say fans of the technology, not to mention more secure. Champions of digital say that it provides faster data speeds, which will come in handy when the Internet meets the airwaves. Other benefits of digital include better usage of "bandwidth", or the power of the frequency, and a less chance of a corrupted call. These features, and others including security, have been touted by the new PCS systems around the country.

One of digital's drawbacks, however, is its different technologies that result in lackluster coverage area. There are three digital wireless technologies: CDMA (Code Division Multiple Access), TDMA (Time Division Multiple Access), and GSM (Global System for Mobile Communication), so phones that work with one technology may not necessarily work on another network that supports another technology.

Drawbacks aside, digital is shaping up to be the technology of the future. If customers switch in their landline phones for one phone, their wireless phone, it will most likely be based on digital technology. This phenomenon, called wireless local loop - or using wireless as one would use a fixed phone - is especially taking off internationally where telephone infrastructure is scarce and very expensive to install. Wireless phones are the quick and easy way for a wireless operator to get phones and phone services out to customers. And with the tidal wave of new data applications being designed and implemented for digital networks, digital looks like the next generation technology title winner.

III- WIRELESS LAN's

The basic technology has been in place for local area networks (LANs) to blossom in both the public and private sectors since the success of the Ethernet project and other similar digital protocols [1]. Ethernet is a standard LAN protocol that operates at moderately high speeds with inexpensive connection hardware and can bring digital networking to almost any computer. In our days, organizations of every size have the necessity to access and share information over a digital network; the power of networking is beginning to be realized. There was a big disadvantage: LANs were limited to the physical, hard wired infrastructure of the building. Even with phone dial-ups, network nodes were limited to access through wired, land line connections. Many network users, especially mobile users in businesses, the medical profession, factories, and universities, to name a few, find benefits from the added capabilities of wireless LANs.

IV- HOW WIRELESS LANs WORK

Wireless LANs use electromagnetic airwaves (radio or infrared) to communicate information from one point to another without relying on any physical connection [2]. Radio waves are often referred to as radio carriers because they simply perform the function of delivering energy to a remote receiver. The data being transmitted is superimposed on the radio carrier so that it can be accurately extracted at the receiving end. This is generally referred to as modulation of the carrier by the information being transmitted. Once data is superimposed (modulated) onto the radio carrier, the radio signal occupies more than a single frequency, since the frequency or bit rate of the modulating information adds to the carrier.

Multiple radio carriers can exist in the same space at the same time without interfering with each other if the radio waves are transmitted on different radio frequencies. To extract data, a radio receiver tunes in one radio frequency while rejecting all other frequencies.

In a typical wireless LAN configuration, a transmitter/receiver (transceiver) device, called an access point, connects to the wired network from a fixed location using standard cabling. At a minimum, the access point receives, buffers, and transmits data between the wireless LAN and the wired network infrastructure [3]. A single access point can support a small group of users and can function within a range of less than one hundred to several hundred feet. The access point (or the antenna attached to the access point) is usually mounted high, but may be mounted essentially anywhere that is practical as long as the desired radio coverage is obtained.

End users access the wireless LAN through wireless LAN adapters, which are implemented as PC cards in notebooks or palmtop computers, as cards in desktop computers, or integrated within hand held computers. Wireless LAN adapters provide an interface between the client's network operating system (NOS) and the airwaves via an antenna. The nature of the wireless connection is transparent to the NOS.

A- Advantages of a Wireless LAN

1- ***Increased Mobility*** - having a wireless LAN can benefit the user in various ways, being one of its major incentive the increase in mobility. Different from conventional wired network connections, network users can move about almost without restriction and can access LANs from nearly anywhere.

Uses for wireless network access are, for example, medical professionals can obtain not only patient records, but real time vital signs and other reference data at the patient's bedside without relying on reams of paper charts and physical paper handling. Factory floor workers can access parts and process specifications without impractical or impossible wired network connections. Warehouse inventories can be carried out and verified quickly and effectively with wireless scanners connected to the main inventory database. Even wireless "smart" price tags, complete with liquid crystal display (LCD) readouts, allow merchants to virtually eliminate discrepancies between stock point pricing and scanned prices at the checkout lane. The list of possibilities is almost endless.

2- ***Increased Flexibility*** - one can visualize without too much difficulty a meeting in which employees use small computers and wireless links to share and discuss future design plans and products. This "ad-hoc" network can be brought up and torn down in a very short time as needed, either around the conference table and/or around the world.

Car rental establishments already use wireless networks to help facilitate check-ins. Traders on Wall Street are able to use wireless terminals to make market trades. Even students of university campuses have been known to access lecture notes and other course materials while wandering on campus.

3- ***Economical***- sometimes it is more economical to use a wireless LAN. Wireless LANs offer the connectivity and the convenience of wired LANs without the need for expensive wiring or rewiring.

For example, in old buildings, the cost of asbestos cleanup or removal outweighs the cost of installing a wireless LAN solution. In other situations, such as a factory floor, it may not be feasible to run a traditional wired LAN.

V- WIRELESS LAN CONFIGURATION

Wireless LANs can be simple or complex. At its most basic, two PCs equipped with wireless adapter cards can set up an independent network whenever they are within the range of one another. This is called a peer-to-peer network (Figure 1). On demand networks such as in this example.

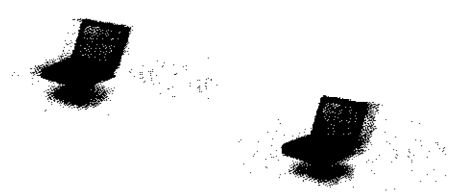

Figure 1: *A wireless peer-to-peer network*

Installing an access point (AP) can extend the range of an ad-hoc network, effectively doubling the range at which the devices can communicate. Since the access point is connected to the wired network, each client would have access to server resources as well as to other clients (Figure 2). Each access point can accommodate many clients; the specific number depends on the number and nature of the transmissions involved. Many real world applications exist where a single access point services from 15-50 client devices.

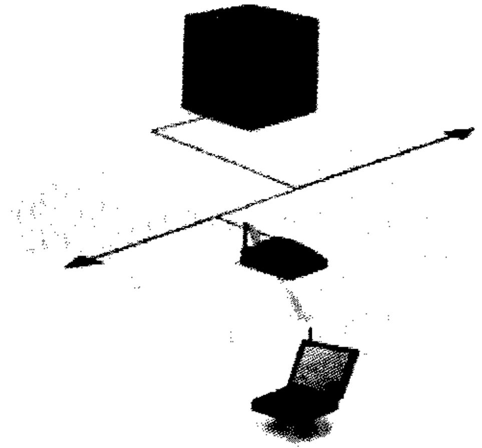

Figure 2: *Client and Access Point*

Access points have a finite range, on the order of 500 feet indoor and 1000 feet outdoors. In a very large facility such as a warehouse, or on a college campus, it will probably be necessary to install more than one access point. Access point positioning is accomplished by means of a site survey. The goal is to blanket the coverage area with overlapping coverage cells so that clients might range throughout the area without ever losing network contact. The ability of clients to move seamlessly among a cluster of access points is called *roaming* (Figure 3). Access points hand the client off from one to another in a way that is invisible to the client, ensuring unbroken connectivity.

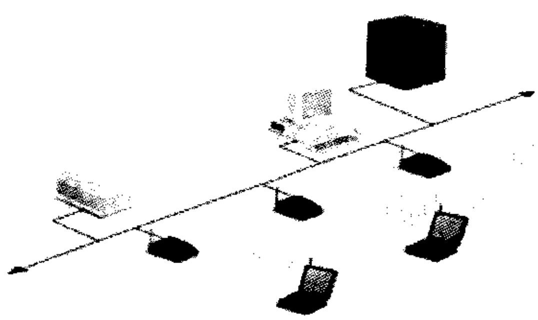

Figure 3: *Multiple access points and roaming*

To solve particular problems of topology, the network designer might choose to use extension points (EP) to augment the network of access points (Figure 4). Extension points look and function like access points, but they are not tethered to the wired network, as are APs. EPs function just as their name implies: they extend the range of the network by relaying signals from a client to an AP or another EP. EPs may be strung together in order to pass along messaging from an AP to far-flung clients, just as humans in a bucket brigade pass pails of water hand to hand from a water source to a fire.

Figure 4: *Use of an extension point*

One last item of wireless LAN equipment to consider is the directional antenna. Let's suppose you had a wireless LAN in your building A and wanted to extend it to a leased building B one mile away. One solution might be to install a directional antenna on each building, each antenna targeting the other (Figure 5). The antenna on A is connected to your wired network via an access point. The antenna on B is similarly connected to an access point in that building, which enables wireless LAN connectivity in that facility.

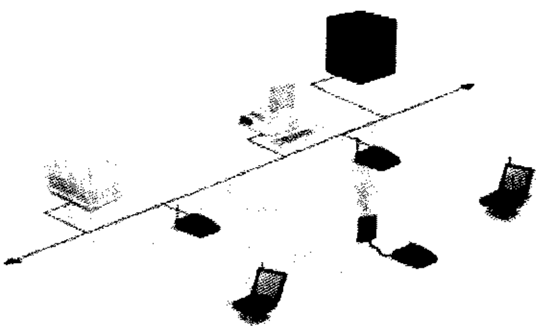

Figure5: *The use of directional antennas*

A- Mobile IP

Mobile IP was suggested as a means to attain wireless networking. It focuses its attention at the Network Layer, working with the current version of the Internet Protocol (IP version 4). In this protocol, the IP address of the mobile machine does not change when it moves from a home network to a foreign network, maintaining connections between the mobile node and the rest of the network [4].

When a person is moving, he let his home post office know to which remote post office his mail should be forwarded. When the person arrives at his new residence, he registers with the new post office. This same operation happens in Mobile IP. When the mobile agent moves from its home network to a foreign (visited) network, the mobile agent tells a home agent on the home network to which foreign agent their packets should be forwarded. In addition, the mobile agent registers itself with that foreign agent on the foreign network. Thus, all packets intended for the mobile agent are forwarded by the home agent to the foreign agent, which sends them to the mobile agent on the foreign network. When the mobile agent returns to its original network, it informs both agents (home and foreign) that the original configuration has been restored. No one on the outside networks need to know that the mobile agent moved [5].

Some drawbacks of how the configuration works is that, depending on how far the mobile agent moves, there may be needed some storage and forwarding of packets while the mobile agent is neither on the home nor on the foreign network.

B- IEEE 802.11 ARCHITECTURES

In IEEE's proposed standard for wireless LANs (IEEE 802.11), there are two different ways to configure a network: ad-hoc and infrastructure. In the ad-hoc network (Figure 6), computers are brought together to form a network "on the fly." There is no structure to the network; there are no fixed points; and usually every node is able to communicate with every other node. An example of this is the meeting where employees bring laptop computers together to communicate and share design or financial information. Although it seems that order would be difficult to maintain in this type of network, it have been designed to "elect" one machine as the base station (master) of the network with the others being slaves. Another algorithm in ad-hoc network architectures uses a broadcast and flooding method to all other nodes to establish who's who [6].

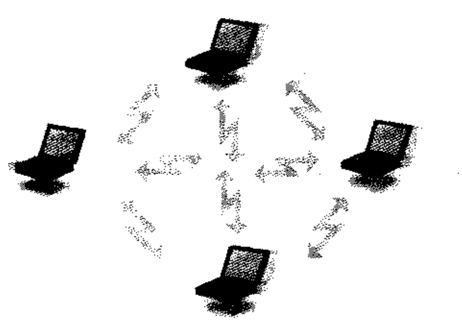

Figure 6: *Ad-Hoc Network*

In the infrastructure network (Figure 7), the second type of network structure used in wireless LANs is the infrastructure. This architecture uses fixed network access points with which mobile nodes can communicate. These network access points are sometimes connected into landlines to widen the LAN's capability by bridging wireless nodes to other wired nodes. If service areas overlap, handoffs can occur. This structure is very similar to the present day cellular networks around the world.

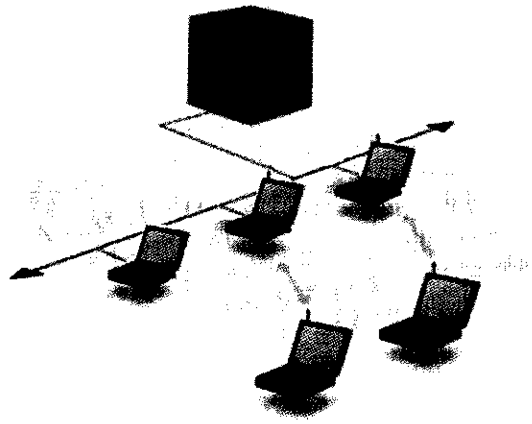

Figure 7: *Infrastructure Network*

VI- IEEE 802.11 LAYERS

The IEEE 802.11 standard places specifications on the parameters of both the physical (PHY) and medium access control (MAC) layers of the network. The PHY layer, which actually handles the transmission of data between nodes, can use either direct sequence spread spectrum, frequency hopping spread spectrum, or infrared (IR) pulse position modulation. IEEE 802.11 makes provisions for data rates of either 1 Mbps or 2 Mbps, and calls for operation in the 2.4 – 2.4835 GHz frequency band (in the case of spread-spectrum transmission), which is an unlicensed band for industrial, scientific, and medical (ISM) applications, and 300 – 428,000 GHz for IR transmission. Infrared is generally considered to be more secure to overhear, because IR transmissions require absolute line-of-sight links. With IR the transmission is not possible outside any simply connected space, as opposed to radio frequency transmissions, which can penetrate walls and be intercepted by third parties unknowingly. However, infrared transmissions can be adversely affected by sunlight, and the spread-spectrum protocol of 802.11 does provide some rudimentary security for typical data transfers [7].

The MAC layer is a set of protocols which are responsible for maintaining order in the use of a shared medium. This protocol, when a node receives a packet to be transmitted, it first listens to ensure that no other node is transmitting. If the channel is clear, it then transmits the packet. Otherwise, it chooses a random "backoff factor", which determines the amount of time the node must wait until it is allowed to transmit its packet. During periods in which the channel is clear, the transmitting node decrements its backoff counter. (When the channel is busy it does not decrement its backoff counter.) When the backoff counter reaches zero, the node transmits the packet. Since the probability that two nodes will choose the same backoff factor is small, collisions between packets are minimized. Collision detection, as is employed in Ethernet, cannot be used for the radio frequency transmissions of IEEE 802.11. The reason for this is that, when a node is transmitting, it cannot hear any other node in the system which may be transmitting, since its own signal will drown out any others arriving at the node.

Whenever a packet is to be transmitted, the transmitting node first sends out a short ready-to-send (RTS) packet containing information on the length of the packet. If the receiving node hears the RTS, it responds with a short clear-to-send (CTS) packet. After this exchange, the transmitting node sends its packet. When the packet is received successfully, as determined by a cyclic redundancy check (CRC), the receiving node transmits an acknowledgment (ACK) packet. This back-and-forth exchange is necessary to avoid the "hidden node" problem, as illustrated in Figure 8. As shown, node A can communicate with node B, and node B can communicate with node C. However, node A cannot communicate with node C. Thus, for instance, although node A may sense the channel to be clear, node C may, in fact, be transmitting to node B. The protocol described above alerts node A that node B is busy, and hence it must wait before transmitting its packet.

VII- DISADVANTAGES OF WIRELESS SYSTEMS

Providing Internet and WWW services on a wireless data network presents many challenges. Most of the technologies developed for the Internet has been designed for desktop and larger computers supporting medium to high bandwidth connectivity over generally reliable data networks. Because of fundamental limitations of power and form factor, mass market handheld devices tend to have:

1- Less powerful CPUs.
2- Less memory (ROM and RAM)
3- Restricted power consumption
4- Smaller displays

Compared to wired networks, wireless data networks present a more constrained communication environment. Because of fundamental limitations of power, available spectrum, and mobility, wireless data networks tend to have:

1- Less bandwidth than traditional networks
2- More latency than traditional networks
3- Less connection stability than other network technologies
4- Less predictable availability

Mobile networks are growing in complexity and the cost of providing new value-added services to wireless users is increasing every day people work to increase the efficiency of the wireless systems.

VIII- SATELLITE COMMUNICATION

Satellites: man made objects launched into a temporary or permanent orbit around the Earth. The satellites vary widely in size and design, ranging from a tiny sphere of several pounds equipped with only two radio transmitters, to heavily instrumented space laboratories weighing many tons [8].

Communication satellites: in telecommunications, the use of orbiting satellites to provide communication links between various points on Earth. Communications satellites provide telephone, television and data services between widely

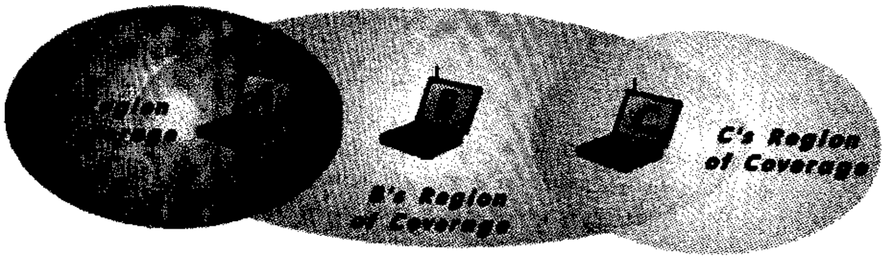

Figure 8: *The hidden node problem*

separated fixed locations (e.g., the switching offices of two different national telephone networks), between fixed locations and mobile users (e.g., shore stations and maritime vessels), and between mobile users (e.g., aircraft and motor vehicles). The technique basically involves transmitting signals from an Earth station to a satellite. The equipment on board the satellite receives the signals, amplifies them, and transmits them to a region of the Earth. Receiving stations within this region pick up the signals, thus providing the communications link [8].

In the decade following the passive reflector balloon-satellite *Echo 1*, communications satellites became a significant part of global communications. The *Intelsat 4* satellite, for example, launched in January 1971, was capable of handling 3,000 to 9,000 telephone circuits or 12 color television channels, or a combination of both. In addition, domestic communications satellites, such as Constar, Satcom, and Wastar in the United States and Anik in Canada, meet the specific needs of particular nations. Voice, television, and facsimile or high speed data (or both) are relayed [8].

Communications satellites are generally placed into an equatorial orbit, which enables them to circle the most densely populated regions of the Earth from west to east. Moreover, communications satellites comprising a network or system are nearly always launched to a distance of 22,300 mi (35,890 km) above the Earth. At this altitude, the motion of a satellite becomes synchronized with the Earth's rotation, causing the craft to remain fixed over a single location. If properly positioned, three communications satellites travelling in such a synchronous orbit can relay signals between stations around the world [8].

IX- WIRELESS TELEPHONE SYSTEMS

Radiotelephone: In addition to wireline telephones, there exist a number of wireless instruments that are connected to the public switched telephone network (PSTN). At the present time, these wireless telephones generally fall into one of three categories: cordless telephones, cellular radio systems, or personal communication systems. Eventually, these systems will be expanded to include global satellite based telephony [8].

Cordless telephones: Cordless telephones are devices that take the place of a telephone instrument within a home or office and permit very limited mobility (up to a hundred meters). Because they are plugged directly into an existing telephone jack, they essentially serve as a wireless extension to the existing home or office wiring. Cordless transceivers communicate with the plugged in base unit over a pair of frequencies in the 46-48 megahertz bands or over a single frequency in the 902-928 megahertz band.

X- MOBILE SATELLITE SERVICE (MSS)

A new variety of satellite communications is furnishing wide area voice and data communications to users on ships, planes, and trucks: Mobile Satellite Service (MSS) [9]. We owe this revolution in satellite communications to two (2) major developments: satellite antennas that can focus signals into narrow beams – projecting macro cells onto the Earth's surface – and fleets of satellites placed in low altitude orbits where they act like repeater stations on extremely tall towers.

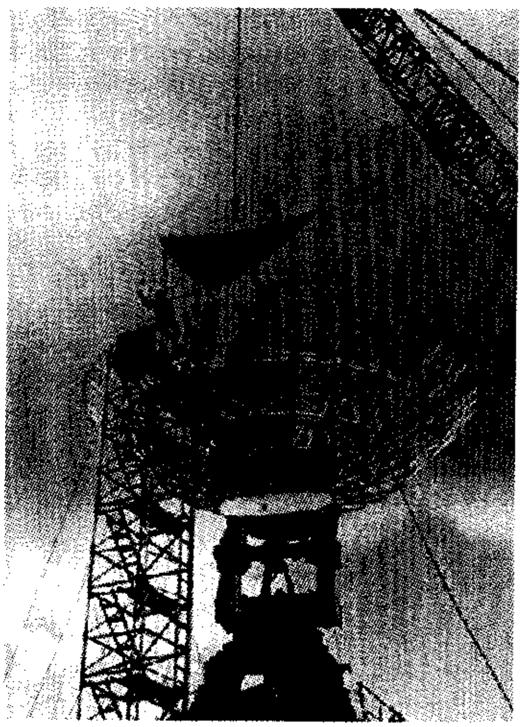

Figure 9: *Variety of satellites*

While the rest of the world was infatuated with high altitude geosynchronous earth orbit satellites (GEOS) systems, a gaggle of U.S. technology innovators and business leaders developed plans for new services built around low earth orbit satellites (LEOS) networks. Trading the wide area coverage of a single GEOS for the improved accessibility (to subscribers) of a fleet of satellites, LEOS proponents hope to make satellites a major player in the personal communications revolution. In 1993, the FCC allocated 33 MHz to LOES: 1,610 to 1,626.5 MHz and 2,483.5 to 2,500 MHz. Other LEOS players, such as Orbcomm, Spaceway, and Teledesic, plan to use frequencies below 1 GHZ and above 20 GHz.

XI- MOBILE SATELLITE SERVICE TECHNOLOGIES

Telecommunication satellites are essentially repeaters on tall towers. While their range is superior to terrestrial repeaters, it is achieved at a much greater cost.

Geosynchronous satellites (GEOS) are deployed 22,000 miles above the earth. At that altitude, their orbital velocity precisely matches the earth's rotation, so the satellite always appears to be in a fixed position relative to the earth's surface.

High elliptical orbit satellites (HEOS) and LEOS's are deployed at lower altitudes and consequently do not remain in fixed positions relative to the earth's surface. In fact, communication between LEOS and mobile users is possible at UHF and even VHF frequencies, enabling the use of low cost, mass produced components. Both "little LEOS's" and "big LEOS's" are planned. Little LEOS's operate below 1 GHz and are primarily targeted at low speed messaging applications. Big LEOS's operate above 1 GHz, offer voice as well as medium speed data service.

Satellites operate in five (5) major frequency bands (see Table 1).

Table 1: *Satellite communication above 1 GHz takes place in five major frequency bands.*

BANDS	FREQUENCY (GHz)
L	1.2 to 1.6
S	2 to 4
C	4 to 6
Ku	11 to 17
Ka	20 to 30

A mobile satellite link involves four (4) channels:

1- A mobile uplink
2- A mobile downlink
3- An earth station uplink
4- An earth station downlink

The most popular satellite frequencies are found in the C-band, used by VSAT networks to interconnect widely scattered fixed locations. Several MSS players target the L-band for the mobile uplink/downlink to reduce costs. Other target the Ka-band because they wish to offer higher bandwidth services. Earth stations often target the Ku-band because it offers a combination of high bandwidth, small antenna size, and minimal interference (the Ku-band is free of terrestrial microwave users).

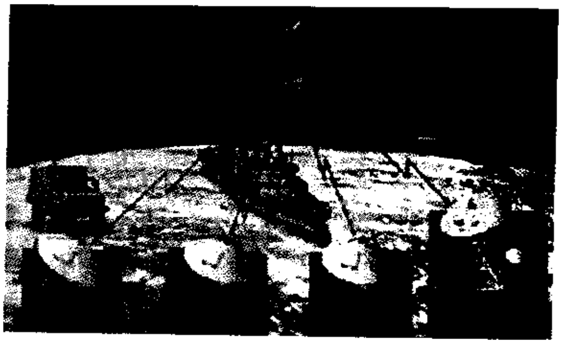

Figure 10: *Mobile Satellites*

XII- AMERICAN MOBILE SATELITE CORPORATION (AMSC)

Each satellite is designed to operate for 15 years and will be equipped with an onboard propulsion system to maintain geosynchronous orbit. A 28 cell nickel hydrogen battery will serve as a backup to the solar power array (for when the satellite is in eclipse) to provide the necessary 3.15 kW of power.

AMSC claims it will provide tool-quality voice and 4,800 bps data services. Each satellite will support 4,200 channels that are 5 kHz wide. The mobile downlink will operate from 1,530 to 1,559 MHz, and the mobile uplink from 1,631.5 to 1,660.5 MHz. The earth station feeders will operate in the 10 GHz (downlink) and 13 GHz (uplink) bands. Circuit switched service will cost $25 per month, plus $1.45 per minute of use. Packet switched data service will be competitive with wireless terrestrial services, priced at about $0.15 per 500 characters.

A- Celsat

This affiliate has proposed a hybrid personal communications network (HPCN) combining GEOS and terrestrial microcellular telephone networks. The company claims it will be able to cover the entire United States, charge a lower price and serve users equipped with 0.1W handheld transceivers.

The approach of Celsat is a satellite antenna 20m in diameter that projects more than 100 spot beams onto the earth's surface. The system will use CDMA to support transmissions at speeds of up to 144 kbps. The firm claims it can offer compressed video, fax and low speed voice and data service.

B- Comsat

Comsat is the U.S. signatory to Inmarsat. Headquartered in London, Inmarsat offers a variety of services over L-band frequencies allocated on a worldwide basis.

Standard A terminals operate over analog channel pairs on 1,636.5 to 1,645.0 MHz (4,800 bps uplink) and 1,535.0 to 1,543.5 MHz (1,200 bps downlink).

Standard C terminals operate on uplink frequencies between 1,631.5 and 1,646.5 MHz and downlink frequencies between 1,631.5 and 1,646.5 MHz, and downlink frequencies between 1,530.0 and 1,545.0 MHz at 600 bps in each direction. Standard C terminals are used primarily in messaging applications.

Standard M supports smaller, more portable terminals operating at 4.8 kbps (voice or data). Standard B terminals are intended as the digital replacements for Standard A and run at 16 kbps. Comsat's High Speed Data (HSD) service is a one way 56 kbps service featuring a 3 kHz return channel, and may be used in conjunction with switched 56 kbps services over the public telephone network [9].

XIII- CONCLUSION

Who will know that a technology from just a few decades ago will move the world as it is happening today. Thanks to the wireless technology, everyday tasks are been done easier and faster. The opportunities for the companies and the persons are wider and more expandable.

Basic technology has been in place for local area networks (LANs) to blossom in both the public and private sectors since the success of the Ethernet project and other similar digital protocols. Protocols that are intended to maintain an order in the share medium.

By using a wireless LAN, the person can be a beneficiary user in various ways. One of the major incentives is the increased mobility that wireless communication can bring. Different from conventional wired network connections, network users can move about almost without restriction and access LANs from nearly anywhere.

Increase in mobility is the characteristic that gives all wireless systems an enormous demand from users around the planet.

In regard to the Satellite Communication and Mobile Satellite Service, we can conclude that the wireless has been contributing into many different applications around the world, permitting the transfer of information from one place to the other, in a faster and efficient way. The wireless will also help us to continue exploring new technology concepts related to satellite communication. In fact, the integration of wireless is one of the best tools that we currently have.

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