MOBILE SATELLITE SYSTEM COMMUNICATION

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ABSTRACT

Satellite communication has nowadays become very important due to its applications. This research paper includes explanation about various types of satellites and their orbits. How the satellite phones can be used to communicate has also been explained. Including various advantages and disadvantages of satellite communication, an example of mobile satellite system has also been given.

I INTRODUCTION

1.1 History

In a 1945 Wireless World article the English science fiction writer Arthur C. Clarke (1917–2008) described in detail the possible use of communications satellites for mass communications. Satellite launching logistics, possible orbits and ways of the creation of a network of world-revolving satellites was examined by Clarke while pointing to the advantages of high-speed global communications. Three geostationary satellites would provide coverage over the whole earth's surface was proposed by C. Clarke.

The idea of the earth satellite vehicle was given by US military when Secretary of Defence, James Forrestal, made a public announcement on December 29, 1948 that his office was coordinating that project between the various services.

1.2. Mobile Satellite System

"Mobile Satellite communications systems" use satellites that are either static or revolving. The satellite remains in a fixed position with a geostationary system with respect to a given geographical location (the satellite is actually in a fixed orbit and moves in a consistent relationship to the Earth). The satellite can receive and transmit messages to any transmitter or transceiver with this type of system that is within the fixed geographical area visible to the satellite at all times. Based on geostationary satellites a communication system may have more than one satellite to cover a greater part of the Earth's surface. An orbiting communications satellite moves in an orbit so that it passes above a given geographical location at periodic time intervals. It means that earth bound transmitters come into the satellite's range at these periodic time intervals and transmit or receive only while the satellite is in range or "visible". Until the satellite is in range the transmitter can store messages. When messages are transmitted to the satellite, their storing can also be done in the satellite until the satellite comes into range of a receiving earth station. Not like a geostationary system, the whole of the Earth's surface can be covered by a single satellite. However, when the satellite is not in view there can be time gaps in coverage of given geographical locations. Thus by increasing the number of satellites there will be increase in

the coverage of the system by decreasing the time gaps when a satellite is not in view of a given location. Some of the applications are:

1) In military sector, providing robust and secure communications network
2) To provide communication when the terrestrial systems fail due to disaster and also to communicate family and friends during disaster.
3) World travellers can use a satellite phone to keep in touch with family without having to send loved ones a new telephone number for each destination.
4) Used by govt. and govt. agencies to transfer information before any disaster.

II TECHNICAL DETAILS

2.1. Types of Communication Satellites

2.1.1 Geostationary Satellite:

They are launched 36000 km above earth. This type of satellites seems to be stationary with respect to earth. With this type of system the satellite can, at all times, receive and transmit messages to any transmitter or transceiver that is within the fixed geographical area visible to the satellite. A communication system based on geostationary satellites may have more than one satellite to cover a greater percentage of the Earth's surface (2-3 satellites)

2.1.2 Non Geostationary Satellites:

They are not stationary they revolve in a circular orbit around the earth with a constant velocity. It means that it is such a system where earth bound transmitters or transceivers come into the satellite's range at some periodic time intervals and transmit or receive only while the satellite is in range or "visible".

Unlike a geostationary system, a single satellite can feasibly cover the whole of the Earth's surface. However, there may be evolution of time gaps while covering when the satellite is not in view of given geographical locations. They are of 3 types-

a) High Earth Orbit (HEO)
b) Medium Earth Orbit (MEO)
c) Low Earth Orbit (LEO)

Out of these LEO is used the most in mobile satellite communication .It is launched 500-2000 km above earth.

2.2. Satellite Phones

A satellite telephone is a type of mobile phone that connects to orbiting satellites instead of terrestrial cell sites. Functionality like voice, short messaging service and low-bandwidth internet access are supported through most systems.

It depends on the architecture of a particular system, that what will be the coverage. It may be entire Earth, or only specific regions. The size and weight of the early satellite phone handsets is comparable to that of a late-1980s or early-1990s cell phone, but usually with a large retractable antenna. Now a days the satellite phones

are same in size to a regular mobile phone while some prototype satellite phones have no distinguishable difference from an ordinary Smartphone. These satellite phones are mainly used by those living in poor

2.3 How Does the Communication Takes Place

There can be many types of mobile satellite communication .That can be satellite phone to cellular phone or there can be satellite phone to satellite phone communication. They can be described in brief as follows:

2.3.1 From Satellite Phone To Cellular Phone

- The caller enters the number she wishes to dial and presses the send key. The phone than do some processing and eventually find the nearest orbiting satellite and sends the call information to it.
- Gateway: The point to which the satellite relays the call to the nearest ground receiver. The gateway do the work to patch the calls through. If a call to India originates in America, the gateway won't be able to patch the call through the existing phone network. Than the gateway will transmit the call to the near most satellite, which will help to pass the call along till it reaches one that can help linking to the receiver. It depends on the location of the caller (transmitter) and receiver that how many times it may happen.
- The call comes from the satellite and is received by receiver's network. The format of the call has to be manipulated so that it may be received on a standard phone or cell phone. Once the received call is converted and the connection established, the call is said to be connected.
- The same goes in reverse when someone is calling a satellite phone (say Globalstar phone) from a cellular phone or landline .Calls are transferred to one of the Globalstar gateways then that gateway sends the call up to a relay satellite then back down to the Globalstar satellite phone user. Globalstar calls this their "bent pipe technology."

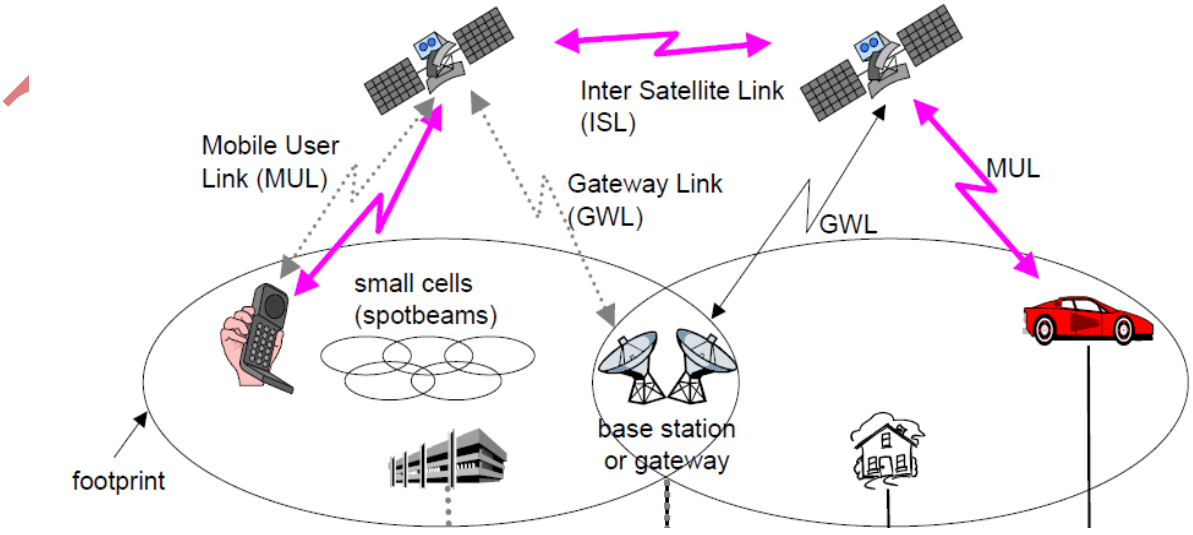

Fig.1: Method of Mobile Satellite Communication

2.3.2 From A Satellite Phone To Any Other Satellite Phone

This depends on service to service .For example ,in Globalstar service-Calls from a Globalstar phone to a Globalstar phone within the same foot print of the servicing gateway goes up from the Globalstar phone to the satellite then down to the gateway where it is then sent back to a Globalstar satellite then relayed down to the receiving Globalstar phone. In this scenario the public telephone system is never utilized. If a call from a Globalstar phone goes to another Globalstar phone outside the foot print of the originating gateway it works: The call firstly goes up to the satellite and then goes down to the servicing gateway then is transferred by the public telephone system or T1 line if the public telephone system is disrupted to the gateway serviced by the receiving Globalstar phone. This case even if the public telephone system is disrupted the Globalstar satellite service is still up and running.

2.4. An Example Of Mobile Satellite System-The Globalsar

Globalstar's constellation is made up of 40 (LEO) satellites with an additional four satellites in orbit (spare). The satellite design is not complicated it is rather simple. Each satellite consists of: two solar arrays, an antenna, a magnetometer, and a trapezoidal body. The constellation of Globalstar revolves at an altitude of approximately 1,500 kilometers of (876 miles). First generation Globalstar satellite weighed 550 kg. Globalstar satellites orbit with an inclination of 52 degrees. Due to this fact and including that the satellites lack inters satellite linking the constellation picks up signals from over 80% of the planet excluding the extreme Polar Regions and some ocean regions.

2.5. Advantages of Mobile Satellite Communication

The area of coverage is a good advantage in satellite base communication which far exceeds that of terrestrial system.

- The designing of satellite-to-satellite communication links with great precision can be done because the conditions between communicating satellites are more time invariant than those between two terrestrial wireless antennas.
- Within the satellite's area of coverage transmission cost is not dependent on distance. In terrestrial wireless system more cost will be incurred to cover as much area as satellite does.
- Broadcasting and point to point communication are important applications of it.
- The transmission quality is generally high in satellite communication than terrestrial although satellite links are subject to short-term outages or degradation.
- Without using relay with high capacity is capable of transmitting signal long distances
- Point to multipoint
- Installation of satellite circuit is rapid

2.6. Limitations of Mobile Satellite Communication

- Long signal delay
- Maintaining and repairing after launching of satellite is difficult.

- High cost and high risks on launching
- Communication using active communication satellite systems are limited by two things:
  a) Satellite transmitter power on the downlinks
  b) Receiver sensitivity on the uplinks

III CONCLUSION

3.1. Observation

This type of communication is very useful in military communication .It has a very incredible role before and after any disasters .It is also very helpful for the travellers.

Although it is very important and helpful, it suffers from some disadvantages-

There are large propagation delays, Repairing and maintenance after launching is difficult, high cost and high risks on launching .Moreover the terminals are very costly, so that everybody cannot afford it. It promises a new era of GLOBAL CONNECTIVITY.

3.2. Future Scope

- It has great scope in future.
- Light weight and cheaper satellites are being made.
- Smaller and cheaper mobile terminals are being made.
- New techniques to reduce propagation delays are being found.
- Inventions are leading to an era of publically using it.

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