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Chapter 1 : Satellite communication | calendrierdelascience.com

In the third type of mobile communication satellite system again a direct link can be provided to a mobile earth station but a dedicated satellite system would be required for this purpose. Different frequency bands are allocated to the satellites to perform mobile communication.

History[edit] The concept of the geostationary communications satellite was first proposed by Arthur C. Clarke , along with Vahid K. Sanadi building on work by Konstantin Tsiolkovsky. Its objective was to develop a secure and reliable method of wireless communication by using the Moon as a passive reflector and natural communications satellite. The first artificial Earth satellite was Sputnik 1. Put into orbit by the Soviet Union on October 4, , it was equipped with an on-board radio - transmitter that worked on two frequencies: Sputnik 1 was launched as a major step in the exploration of space and rocket development. However, it was not placed in orbit for the purpose of sending data from one point on earth to another. The first artificial satellite used solely to further advances in global communications was a balloon named Echo 1. The idea behind a communications satellite is simple: Send data up into space and beam it back down to another spot on the globe. Echo 1 accomplished this by essentially serving as an enormous mirror, 10 stories tall, that could be used to reflect communications signals. The first American satellite to relay communications was Project SCORE in , which used a tape recorder to store and forward voice messages. It was used to send a Christmas greeting to the world from U. There are two major classes of communications satellites, passive and active. Passive satellites only reflect the signal coming from the source, toward the direction of the receiver. With passive satellites, the reflected signal is not amplified at the satellite, and only a very small amount of the transmitted energy actually reaches the receiver. Since the satellite is so far above Earth, the radio signal is attenuated due to free-space path loss , so the signal received on Earth is very, very weak. Active satellites, on the other hand, amplify the received signal before retransmitting it to the receiver on the ground. Telstar was the second active, direct relay communications satellite. Relay 1 was launched on December 13, , and it became the first satellite to transmit across the Pacific Ocean on November 22, Syncom 2 was the first communications satellite in a geosynchronous orbit. It revolved around the earth once per day at constant speed, but because it still had north-south motion, special equipment was needed to track it. Its successor, Syncom 3 was the first geostationary communications satellite. Syncom 3 obtained a geosynchronous orbit, without a north-south motion, making it appear from the ground as a stationary object in the sky. Beginning with the Mars Exploration Rovers , landers on the surface of Mars have used orbiting spacecraft as communications satellites for relaying their data to Earth. The landers use UHF transmitters to send their data to the orbiters, which then relay the data to Earth using either X band or Ka band frequencies. These higher frequencies, along with more powerful transmitters and larger antennas, permit the orbiters to send the data much faster than the landers could manage transmitting directly to Earth, which conserves valuable time on the NASA Deep Space Network. This orbit has the special characteristic that the apparent position of the satellite in the sky when viewed by a ground observer does not change, the satellite appears to "stand still" in the sky. The advantage of this orbit is that ground antennas do not have to track the satellite across the sky, they can be fixed to point at the location in the sky the satellite appears. As satellites in MEO and LEO orbit the Earth faster, they do not remain visible in the sky to a fixed point on Earth continually like a geostationary satellite, but appear to a ground observer to cross the sky and "set" when they go behind the Earth. Therefore, to provide continuous communications capability with these lower orbits requires a larger number of satellites, so one will always be in the sky for transmission of communication signals. However, due to their relatively small distance to the Earth their signals are stronger. In addition, satellites in low earth orbit change their position relative to the ground position quickly. So even for local applications, a large number of satellites are needed if the mission requires uninterrupted connectivity. Low-Earth-orbiting satellites are less expensive to launch into orbit than geostationary satellites and, due to proximity to the ground, do not require as high signal strength Recall that signal strength falls off as the square of the distance from the source, so the effect is dramatic. Thus there is a trade off between the number of satellites and their cost. In addition, there are important differences in the onboard and ground equipment needed to support the two types of missions. Satellite constellation A group of satellites working in concert is known as a satellite constellation. Two such constellations, intended to provide satellite phone services, primarily to remote areas, are the Iridium and Globalstar systems. The Iridium system has 66 satellites. It is also possible to offer discontinuous coverage using a low-Earth-orbit satellite capable of storing data received while passing over one part of Earth and transmitting it later while passing over another part. Another system using this store and forward method is Orbcomm. MEO satellites are visible for much longer periods of time than LEO satellites, usually between 2 and 8 hours. In various patterns, these satellites make the trip around earth in anywhere from 2 to 8 hours. Example[edit] In , the first communications satellite, Telstar, was launched. It was a medium earth orbit satellite designed to help facilitate high-speed telephone signals. Although it was the first practical way to transmit signals over the horizon, its major drawback was soon realized. Because its orbital period of about 2. It was apparent that multiple MEOs needed to be used in order to provide continuous coverage. Geostationary orbit GEO [edit] Geostationary orbit To an observer on the earth, a satellite in a geostationary orbit appears motionless, in a fixed position in the sky. This is relatively inexpensive. In applications that require a large number of ground antennas, such as DirecTV distribution, the savings in ground equipment can more than outweigh the cost and complexity of placing a satellite into orbit. Examples[edit] The first geostationary satellite was Syncom 3 , launched on August 19, , and used for communication across the Pacific starting with television coverage of the Summer Olympics. It was the first geostationary satellite for telecommunications over the Atlantic Ocean. On May 30, , the first geostationary communications satellite in the world to be three-axis stabilized was launched: Satcom 1 was widely used because it had twice the communications capacity of the competing Westar 1 in America 24 transponders as opposed to the 12 of Westar 1 , resulting in lower transponder-usage costs. Satellites in later decades tended to have even higher transponder numbers.

Chapter 2 : Communications satellite - Wikipedia

2 Satellite Communications Systems Satellite communication systems use satellites to communicate between two remote terrestrial locations, a terrestrial location and a mobile.

Bring fact-checked results to the top of your browser search. How satellites work A satellite is basically a self-contained communications system with the ability to receive signals from Earth and to retransmit those signals back with the use of a transponder â€”an integrated receiver and transmitter of radio signals. A satellite has to withstand the shock of being accelerated during launch up to the orbital velocity of 28, km 17, miles an hour and a hostile space environment where it can be subject to radiation and extreme temperatures for its projected operational life, which can last up to 20 years. In addition, satellites have to be light, as the cost of launching a satellite is quite expensive and based on weight. To meet these challenges, satellites must be small and made of lightweight and durable materials. They must operate at a very high reliability of more than Intelsat VI, a communications satellite, after being repaired, NASA Marshall Space Flight Center The main components of a satellite consist of the communications system, which includes the antennas and transponders that receive and retransmit signals, the power system, which includes the solar panels that provide power, and the propulsion system, which includes the rockets that propel the satellite. A satellite needs its own propulsion system to get itself to the right orbital location and to make occasional corrections to that position. A satellite in geostationary orbit can deviate up to a degree every year from north to south or east to west of its location because of the gravitational pull of the Moon and Sun. A satellite has thrusters that are fired occasionally to make adjustments in its position. Once the fuel runs out, the satellite eventually drifts into space and out of operation, becoming space debris. A satellite in orbit has to operate continuously over its entire life span. It needs internal power to be able to operate its electronic systems and communications payload. A satellite also has batteries on board to provide power when the Sun is blocked by Earth. The batteries are recharged by the excess current generated by the solar panels when there is sunlight. Satellite components that can be exposed to radiation are shielded with aluminium and other radiation-resistant material. It can also monitor the temperature, electrical voltages, and other important parameters of a satellite. Communication satellites range from microsatellites weighing less than 1 kg 2. Advances in miniaturization and digitalization have substantially increased the capacity of satellites over the years. Early Bird had just one transponder capable of sending just one TV channel. The Boeing series of satellites, in contrast, can have more than transponders, and with the use of digital compression technology each transponder can have up to 16 channels, providing more than 1, TV channels through one satellite. Satellites operate in three different orbits: LEO satellites are positioned at an altitude between km and 1, km and 1, miles above Earth. MEO satellites operate from 10, to 20, km 6, to 12, miles from Earth. Satellites do not operate between LEO and MEO because of the inhospitable environment for electronic components in that area, which is caused by the Van Allen radiation belt. GEO satellites are positioned 35, km 22, miles above Earth, where they complete one orbit in 24 hours and thus remain fixed over one spot. In addition, communicating with satellites in LEO and MEO requires tracking antennas on the ground to ensure seamless connection between satellites. A signal that is bounced off a GEO satellite takes approximately 0. This delay poses some problems for applications such as voice services and mobile telephony. GEO satellites are usually used for broadcasting and data applications because of the larger area on the ground that they can cover. Launching a satellite into space requires a very powerful multistage rocket to propel it into the right orbit. The frequency ranges or bands are identified by letters: Signals in the lower range L-, S-, and C-bands of the satellite frequency spectrum are transmitted with low power, and thus larger antennas are needed to receive these signals. Signals in the higher end X-, Ku-, Ka-, and V-bands of this spectrum have more power; therefore, dishes as small as 45 cm 18 inches in diameter can receive them. This makes the Ku-band and Ka-band spectrum ideal for direct-to-home DTH broadcasting, broadband data communications, and mobile telephony and data applications. The ITU, which is based in Geneva, Switzerland, receives and approves applications for use of orbital slots for satellites. Every two to four years the ITU convenes the World Radiocommunication Conference, which is responsible for assigning frequencies to various applications in various regions of the world. In the United States the regulatory body that governs frequency allocation and licensing is the Federal Communications Commission.

Chapter 3 : Mobile Communication Satellite Systems â€“ The WritePass Journal : The WritePass Journal

A communications satellite is an artificial satellite that relays and amplifies radio telecommunications signals via a transponder; it creates a communication channel between a source transmitter and a receiver at different locations on Earth.

The process of communication can be of different forms like verbal, non verbal, print and electronic. An electronic communication system consists of three parts: Electronic communication can take place in one-way or two-way transmission mode. One-way communication mode is a simple communication wherein a receiver lacks the ability to communicate back. The two-way communications may be half duplex or full duplex communication wherein a receiver can communicate with the transmitter. A Satellite communication is a technology that is used to transfer the signals from the transmitter to a receiver with the help of satellites. It can be used in different mobile applications that involve communication with the ships, vehicles and radio broadcasting services. The power and bandwidth of these satellites depend on the specifications like complexity, size and cost. Satellites can be used in these applications: Satellite services are classified into three types based on the frequency allocation. Frequency allocation is a typical process done with the help of international coordination and planning. Satellite services include fixed satellite service, broadcasting satellite service and mobile satellite service. This article mainly focuses on the mobile satellite services and their types as mentioned below. Mobile Satellite Service Mobile satellite service MSS is the term used to describe telecommunication services delivered to or from the mobile users by using the satellites. MSS can be used in remote areas lacking wired networks. Limitations of MSS are availability of line of sight requirement and emerging technologies. Space segment User segment Control segment Space segment: Space segment is equipped with satellite pay-load equipment. The Pay load is used to enable the ability of the satellite for users in space communication. The user segment consists of an equipment that transmits and receives the signals from the satellite. The control segment controls the satellite and operations of all internet connections to maintain the bandwidth and adjust power supply and antennas. The mobile satellite services are classified into the following five types: This service is mainly used in shipyards and military ships. Maritime mobile satellite service In this type of service, the mobile earth station located on ships provide commercial and safety communication. MMSS service enables mobile satellite link between the communication earth station and the ship earth station or between two associated ships and other satellite communication stations in all positions in sea or in ports. A maritime terminal is a portable or fixed on the board ship, whereas the communication earth station is a maritime earth station located at a specified fixed point on the coast to provide a feeder link for MMSS. The ship earth station is a maritime earth station fixed on board ships or other floating objects that provide the communication links with the subscribers onshore via a communication earth station and a communication space craft. Land Mobile Satellite Service The Land mobile satellite service has a mobile earth station located on different types of trains and other transportation systems. This service consists of a personal location beacon terminal that acts as an earth station. This service can be used in different applications such as military applications remote and rural environments. The communication earth station is used as an earth station to be located in a specified fixed point on the coast to provide a feeder link for LMSS. The VES is a land mobile earth station fixed on the board or rail line to provide a communication link between the terrestrial subscribers through VES and communication spacecraft. The land vehicle or person alerts the service for distrain or safety in the LMSS system. Aeronautical Mobile Satellite Service A mobile satellite service in which earth stations are located onboard aircraft, survival aircraft, airplanes and helicopters is known as aeronautical mobile satellite service AES. This service is also used in business and private communication and traffic control. This service consists of various earth stations like a mobile earth station, an aircraft earth station and a ground earth station. Aeronautical Mobile Satellite Service A special emergency locator terminal which is either fixed or portable onboard is used as earth station and enables the link between the ground earth station and the aircraft earth station. The AES is an aeronautical earth station that is fixed on board to provide a communication link with the subscribers on land via GES and space craft. This is mostly used in the aircraft applications as it provides safety through the radio communication to control flight locations and the movements of light and the positions of aircraft on land as well. Personal Mobile Satellite Service This is a communication service provided by the satellite for supporting mobile, fixed and broadband communication systems. The satellites can be geo-stationary or non geo-stationary satellites. This service consists of two earth stations: It also consists of a PLB terminal which is used in this service for the coordination of the mobile system. Personal Mobile Satellite Service This type of service enables a link between a base earth station and personal earth station, or between a personal earth station, or between an earth base station and two satellites using the same satellite providers. It is a handheld terminal carried by an individual or fixed on board. It provides two communication links for subscribers by satellites through gateways or personal earth station. Broadcast Mobile Satellite Service A broadcast satellite system service is a one-way radio communication solution that transmits signals by earth stations, and retransmits the signals by space stations. The present broadcast mobile satellite service operates at a frequency of 12 GHz. Broadcast Mobile Satellite Service The broadcast satellite service system transmits data in three types of broadcasting forms: Audio broadcasting Video broadcasting Data broadcasting This service is equipped with very small terminals used for transmitting signals from small antennas. This service can be used in applications like ships, airlines and TV broadcasting systems. This is all about the mobile satellite service or communication system. You might have gained some valuable insights out of this article, after thoroughly reading it. However, for further details, suggestions, and comments, you can comment in the comment section below. He has 8 years of experience in Customer Support, Operations and Administration. Leave a Reply Your email address will not be published.

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Chapter 4 : Satellite Communications Basics Tutorial:: calendrierdelascience.com

Intra satellite handover Handover from one spot beam to another Mobile station still in the footprint of the satellite, but in another cell Inter satellite handover Handover from one satellite to another satellite Mobile station leaves the footprint of one satellite Gateway handover Handover from one gateway to another Mobile station still in.

Cells may vary in radius from 1 to 30 kilometres 0. The boundaries of the cells can also overlap between adjacent cells and large cells can be divided into smaller cells. N is typically 3. In other words, adjacent base station sites use the same frequencies, and the different base stations and users are separated by codes rather than frequencies. While N is shown as 1 in this example, that does not mean the CDMA cell has only one sector, but rather that the entire cell bandwidth is also available to each sector individually. Depending on the size of the city, a taxi system may not have any frequency-reuse in its own city, but certainly in other nearby cities, the same frequency can be used. In a large city, on the other hand, frequency-reuse could certainly be in use. Recently also orthogonal frequency-division multiple access based systems such as LTE are being deployed with a frequency reuse of 1. Since such systems do not spread the signal across the frequency band, inter-cell radio resource management is important to coordinate resource allocation between different cell sites and to limit the inter-cell interference. Cellular telephone frequency reuse pattern. Patent 4,, Cell towers frequently use a directional signal to improve reception in higher-traffic areas. If the tower has directional antennas, the FCC allows the cell operator to broadcast up to watts of effective radiated power ERP. This provides a minimum of three channels, and three towers for each cell and greatly increases the chances of receiving a usable signal from at least one direction. The numbers in the illustration are channel numbers, which repeat every 3 cells. Large cells can be subdivided into smaller cells for high volume areas. This can be used directly for distributing information to multiple mobiles. Commonly, for example in mobile telephony systems, the most important use of broadcast information is to set up channels for one-to-one communication between the mobile transceiver and the base station. This is called paging. The three different paging procedures generally adopted are sequential, parallel and selective paging. The details of the process of paging vary somewhat from network to network, but normally we know a limited number of cells where the phone is located this group of cells is called a Location Area in the GSM or UMTS system, or Routing Area if a data packet session is involved; in LTE , cells are grouped into Tracking Areas. Paging takes place by sending the broadcast message to all of those cells. Paging messages can be used for information transfer. Movement from cell to cell and handing over[edit] In a primitive taxi system, when the taxi moved away from a first tower and closer to a second tower, the taxi driver manually switched from one frequency to another as needed. If a communication was interrupted due to a loss of a signal, the taxi driver asked the base station operator to repeat the message on a different frequency. In a cellular system, as the distributed mobile transceivers move from cell to cell during an ongoing continuous communication, switching from one cell frequency to a different cell frequency is done electronically without interruption and without a base station operator or manual switching. This is called the handover or handoff. Typically, a new channel is automatically selected for the mobile unit on the new base station which will serve it. The mobile unit then automatically switches from the current channel to the new channel and communication continues. Mobile phone network[edit] GSM network architecture The most common example of a cellular network is a mobile phone cell phone network. A mobile phone is a portable telephone which receives or makes calls through a cell site base station , or transmitting tower. Radio waves are used to transfer signals to and from the cell phone. Modern mobile phone networks use cells because radio frequencies are a limited, shared resource. Cell-sites and handsets change frequency under computer control and use low power transmitters so that the usually limited number of radio frequencies can be simultaneously used by many callers with less interference. A cellular network is used by the mobile phone operator to achieve both coverage and capacity for their subscribers. Large geographic areas are split into smaller cells to avoid line-of-sight signal loss and to support a large number of active phones in that area. All of the cell sites are connected to telephone exchanges or switches , which in turn connect to the public telephone network. However, satellite phones are mobile phones that do not communicate directly with a ground-based cellular tower, but may do so indirectly by way of a satellite. There are a number of different digital cellular technologies, including: The transition from existing analog to the digital standard followed a very different path in Europe and the US. Structure of the mobile phone cellular network[edit] A simple view of the cellular mobile-radio network consists of the following:

Chapter 5 : Cellular network - Wikipedia

5 Partially adapted with permission from Mobile Communications: Satellite Systems - Jochen Schiller Basics Satellites in circular orbits attractive force F.

Access the video Telecommunications satellites Satellite telecommunication is the most mature of space applications. Starting 50 years ago with the launch of Telstar in and Syncom in , satcom has continued to grow ever since. At first, satellite performance was very limited. To compensate for this, very large ground stations with dish antennas more than 20 metres in diameter were required to establish links with them. The use of satellites was limited to long distance telephony and to the transport of television signals between studios. By , two out of every three intercontinental telephone calls were transmitted by telecommunication satellites. Satellites proved particularly useful for communicating with many of the countries in the less developed parts of the world. New technology and different kinds of demand have changed the way communications satellites are used. More powerful satellites and the use of higher frequencies have made it possible for many people to receive direct signals from the sky. At the beginning of the 21st century, more than million European homes were able to watch television programmes transmitted by satellites, either by direct reception or through cable distribution systems. Where space meets daily life Today telecommunications satellites are part of our daily lives. Did you know that: When you listen to the radio, it is very likely that the signal you are receiving has been distributed from the central studios by satellite? Many newspapers and magazines are produced locally but printed centrally? The content of the paper is sent to the printing plants using satellite links. Even when a news or sports event shown on television is taking place just a few kilometres away from the studios, it has probably been transmitted via satellite? Most news agencies use satellites to distribute text, audio and video to their affiliates? In many countries, access to the Internet is by satellite communication? Internet service providers often link their servers to the core of the Internet network by satellite. With the emergence of very powerful broadband satellites, users â€” equipped with their own broadband interactive satellite terminals â€” will get access to the Internet regardless of their distance from the nearest terrestrial node. Connecting the world There are many other ways in which satellites are used, some very specific, such as the communication systems of the national lottery networks in the UK and Spain, retail chains and banks in many parts of the world, remote post offices in small villages, and the control of water, gas or oil pipelines. Increasingly, satellites are being used for tele-education, telemedicine or videoconference systems. Additionally, in most remote and some not-so-remote parts of the world, satellite communications continue to play a fundamental role in the infrastructure of telephone and other services. Mobile satellite systems, both regional and global, have been conceived to satisfy our demand to be connected at any time and in any place. Satellite telecommunications can also contribute to the satisfaction of a wide range of institutional requirements: There are many types of telecommunication satellites, with designs varying according to their purpose. They use different orbits, different frequencies and they transmit very different types of signals using a variety of power levels.

Chapter 6 : Telecommunications satellites / Telecommunications & Integrated Applications / Our Activities /

Iridium is a satellite communications company that offers voice and data connectivity anywhere in the world. Through our expansive partner network of over companies, Iridium is advancing the way enterprises, governments, and individuals communicate every day.

Related Introduction In this era of 21st century one cannot imagine human life without mobile communication. From mobile handsets to computers, smart-phones to laptops, iPads and Cable Television systems everything is part of this mobile communication era. As the countries are progressing, competition among them is increasing all over the world. With the advancement in technology lives of people are getting faster and busier, businesses and industries are expanding globally, therefore, the demand for mobile communication is increasing immensely with every passing day. Scientists, researchers and engineers are always looking for ways to serve the world with this demanding technology in every possible way. During the last 25 years there has been a tremendous growth in the field of satellite communication. The idea of using the Satellite Systems for mobile communication has appealed to many people in the past and it still continue to do so. There has been an extensive research going on in this particular area globally. A lot of progress has been achieved so far but it is a fact that advancement in technology can probably never end. As the demand for communication is increasing, means and resources to carry out this communication are often limited. For instance if communication of information is to take place between the countries that are hundreds of miles apart, across the ocean, the typical wired medium cannot always be used. And also how are we supposed to communicate when we are not connected to the land communication systems by any means? Here satellite systems come into play. With the help of satellite systems we can provide mobile communication services even to very fast moving vehicles, to the aircrafts during flights, to ships and submarines in oceans, and also to remote areas of earth where there is no communication infrastructure. So in this way we are able to provide services to the areas where application of wired cable medium is not always practically possible. Satellites are the object that revolves around the earth in fixed orbits. These satellites are at typically km to km above the earth surface. Our purpose of communication over long distances is served by these satellites. Another advantage of using the satellite systems for communication is that they can cover a very large geographical area over the earth surface to provide communication means. When we are using a satellite system we are not limited by the problem factors that we encounter on earth such as laying hundreds of miles of expensive cables, space and land to store machinery and equipment to handle this sort of communication, buildings to handle all the infrastructure needed etc. Therefore, Satellite Systems are often given a thought as a better alternative for mobile communication. Before we look into the details of how mobile communication takes place through these satellites, we need to first understand the satellite systems in general as well to have a better understanding of how the whole technology works. Satellites are sent into space from earth. When in space above the earth surface, these satellites are made to revolve around the earth in fixed orbits with the help of gravitational force of the earth. To understand the phenomenon we can take a very simple and well known example from nature and that is of the Moon. Moon is the natural satellite and as it revolves around the earth, it shines over a huge geographical region of the earth. In a similar fashion, man made artificial satellites, though not as big as the moon but still, covers a considerably large section of the earth to provide communication. These artificial telecommunication satellites can be in four different kinds of orbits above the earth surface depending on the purpose they were sent into space. These can either be geo-stationary orbits, elliptical orbits, medium earth orbit or low earth orbits. In geo-stationary orbits, as shown in Figure 1, the satellite remains at a fixed location over the earth surface which means it covers the same geographical region of the earth. Geo-Stationary Orbit Elliptical orbits are used when satellites are required to cover a certain geographical area of the earth for longer period of time than the other geographical region of the earth. Figure 2 displays in general a satellite in an elliptical orbit. Elliptical Orbiting Satellite Medium earth orbit is between km to km above the earth surface. While in low earth orbits, satellites revolve around the earth in circular orbit at about km above the earth surface. First is FSS Fixed Satellite Services , which is for long distance telecommunication services provided by different telecommunication networks on earth stations. Second is DBS Direct Broadcast Satellite services , which is used for direct Television signals broadcasting from large earth stations. And third is MSS Mobile Satellite Services , which is used to provide mobile communication services to different stations on earth. Earlier satellite communication used to take place by routing calls and information from public landline to an earth station first, and then forwarding them to the satellite. But now mobile communication can take place directly between a satellite and a station or handset on earth. This entire phenomenon fantastically sounds simple but there can be few problems as well in using satellites for mobile communications. For instance, keeping the satellite in its orbit is not an easy task. When a satellite is in its orbit, its orbit is also affected by the presence of other bodies such as the Moon and Sun. Moreover, our earth is not a perfect sphere so its own gravitational force on a satellite can vary at different locations and the Moon and Sun have their own gravitational forces as well that affects the path of a satellite. Under all these circumstances, satellites do drift from their original path which needs to be adjusted in order to keep the satellite on track. To transmit and receive signals, these telecommunication satellites have a number of antennas to receive signals from one mobile earth station and transmit it to one or more mobile earth station. There is a Doppler Shift as well in the transmitted signal which occurs because of the movement of the satellite and rotation of the earth about its own axis. Mobile communication satellite systems can provide services to those areas that cannot get services from networks on earth. These systems can be of three possible forms [2]. First is that a direct link to the gateway of satellite station can be given to a mobile earth station to connect to the network. Second is that a mobile earth station can be connected to a translator station through a radio link which is responsible to transmit the data from a mobile earth station to the gateway station through a satellite link. In the third type of mobile communication satellite system again a direct link can be provided to a mobile earth station but a dedicated satellite system would be required for this purpose. Different frequency bands are allocated to the satellites to perform mobile communication. L-Band has the uplink frequency of 1. The long wavelength of this band allows it penetrate building structures and also get least affected by rain. Therefore, less powerful antenna transmitters are required. Ka-Band uplink and downlink frequencies are 30 GHz and 20 GHz respectively for commercial use of mobile satellite mobile services and 44 GHz and 20 GHz of uplink and downlink frequencies for military use. This band has very large spectrum and high bandwidths available. But due to short wavelengths, it is largely affected by rain. Therefore, to increase the signal power very high power transmitters are required. On the other hand, Ku-Band has the medium range of frequencies. The uplink frequency is 14 GHz and downlink frequency is 12 GHz for fixed commercial use. Due to medium wavelengths, its signals can also penetrate many structures and are still able to provide high bandwidths but still they are affected by rain. As the earth terrestrial networks, satellites are also required to serve a number of users simultaneously. In TDMA, there are different time slots. Each mobile earth station transmits its data in chunks in a specific time slot at the same frequency. So the data of each user is differentiated in different time slots. In FDMA, different frequency bands are allocated to different users for both the uplink and downlink channels. However, TDMA is a better because of its lower distortions of inter-modulation. In FDMA, downlink bandwidth is divided among a number of users whereas in TDMA full downlink bandwidth is available to all users during a specific time slot allocated. Also in FDMA, we may have to decrease transponder power by one half to minimize the distortion due to inter-modulation. Each user can transmit its data at any time and can also use the same frequency bandwidth. Signals transmission are separated by using spread spectrum technology that is why CDMA is also called Spread spectrum Multiple Access. Spread spectrum scheme assigns to each mobile station a unique code to generate a pseudorandom sequence to separate signals transmission and to spread the transmission across the whole bandwidth available from the satellite. When the signals transmission arrives at the receiver, it can be extracted by using the same sequence generated initially. The only limitation of the CDMA scheme is that it is very expensive to implement and can support a very limited number of mobile earth stations at a time. As the science has advanced in technology, there are a number of mobile communication satellite systems now. Now we have a look at the different mobile communications satellite systems that exist today. These mobile communication satellite systems are divided into three groups namely: These satellite systems are connected to PSTN Public Switched Telephone

Networks and they provide connectivity and communication services to a mobile earth station all over the world. Which means a user with a satellite mobile handset connected to the INMARSAT satellite system can receive services while roaming in any part of the world without being dependent on local terrestrial public networks. So a satellite connection proves to be really helpful in case something goes wrong with the terrestrial network such as a natural disaster etc. In addition to dialling to a telephone or fax number directly, it can also provide image and video transmission services. It has a fully digital and portable terminal to provide high quality cellular voice and data transmission services. Along with new services, it provides very high quality voice services and very high data rates with a scope to increase them further in future. It comes with a small personal computer to communicate with the network headquarter whenever needed. This satellite has been purchase by the Iridium, Inc Company. In this satellite system, satellites are set into orbits in 6 different polar orbital planes with a total of 72 satellites at about km above the earth surface [4]. Satellites are divided into groups of 11 with equal distance among them. These are all Low Earth Orbit Satellites. Access of the mobile stations need to be synchronized to enable them to transmit and receive in the same time frame slot. Each satellite can handle more than calls at a time. All the satellites can route traffic to each other as well. This satellite system is designed in such a way that global coverage is achieved and gateway stations, which need to be connected to public switched telephone network on earth, required are less in number. This system consists of 48 satellites divided into groups of 6. These satellites are set into orbit in eight different planes at km above the earth surface and are inclined at 45degrees and degrees to the equator. There is no exchange of data among these satellites as in the Iridium System. Therefore, a mobile earth station can only get access to the satellite link when the satellite has a line of sight path to the gateway earth station. Mobile stations can access the satellite using L-Band frequency band. Six spot beams are used to cover the same geographical area on earth as is required by the Iridium satellite system.

Chapter 7 : Introduction to Mobile Satellite Communication System and its Services

Any mobile satellite device located anywhere inside a satellite coverage beam can communicate with other satellite devices, regardless of how remote the location, whether at land, air, or sea. Cost The primary downside of satellite communications is their cost - both to acquire the devices and to use it.

Iridium Satellites are able fulfil a number of roles. One of the major roles is for satellite communications. Here the satellite enables communications to be established over large distances - well beyond the line of sight. Communications satellites may be used for many applications including relaying telephone calls, providing communications to remote areas of the Earth, providing satellite communications to ships, aircraft and other mobile vehicles, and there are many more ways in which communications satellites can be used. Communications satellites provide a number of advantages Flexibility: Satellite systems are able to provide communications in a variety of ways without the need to install nw fixed assets. Satellite communications are able to reach all areas of the globe dependent upon the type of satellite system in use, and the ground stations do not need to be in any one given location. For this reason, many ships use satellite communications. Deployment of a satellite communications system can be very speedy. No ground infrastructure may be required as terrestrial lines, or wireless base stations are not needed. Therefore many remote areas, satellite communications systems provide an ideal solution. Provides coverage over the globe: Dependent upon the type of satellite communications system, and the orbits used, it is possible to provide complete global coverage. As a result, satellite communications systems are sued for providing communications capabilities in many remote areas where other technologies would not be viable.. When considering the use of a satellite some disadvantages also need to be taken into consideration. Satellites are not cheap to build, place in orbit and then maintain. This means that the operational costs are high, and therefore the cost of renting or buying space on the satellite will also not be cheap. As distances are very much greater than those involved with terrestrial systems, propagation delay can be an issue, especially for satellites using geostationary orbits. Here the round trip from the ground to the satellite and back can be of the order of a quarter of a second. Specialised satellite terminals required: Even though the operator will operate all the required infrastructure, the user will still need a specialised terminal that will communicate with the satellite. This is likely to be reasonably costly, and it will only be able to be used with one provider. Telecommunications satellite links Communications satellites are ideally placed to provide telecommunications links between different places across the globe. Traditional telecommunications links used direct "cables" linking different areas. As a result of the cost of installation and maintenance of these cables, satellites were seen as an ideal alternative. While still expensive to put in place, they provided a high bandwidth and were able to operate for many years. In recent years the bandwidth that can be offered by cables has increased considerably, and this has negated some of the gains of satellites. Additionally the geostationary satellites used for telecommunications links introduce a significant time delay in view of the very large distances involved. This can be a problem for normal telephone calls. However satellite communications systems provide significant levels of flexibility and mobility provide the opportunities for many satellite communications systems. Although the initial infrastructure costs are high, often new remote stations can be added relatively cheaply as new lines do not need to be installed to provide communication to the new remote station, unlike wire based telecommunications systems or many terrestrial wireless links were repeater stations may be needed. Communications satellite applications There are many different ways in which communications satellites can be used: Satellite systems have been able to provide data communications links over large distances. They were often used in place of intercontinental submarine cables which were expensive and unreliable in their early days. Nowadays cable technology has significantly improved to provide much higher levels of capacity especially as a result of fibre optic technology and their reliability has also greatly improved. As a result satellites are less frequently used to replace terrestrial cables, although in some instances this remains the case. The concept of using a mobile phone from anywhere on the globe is one that has many applications. Although the terrestrial cellular network is widely available, there are still very many areas where coverage is not available. In these situations satellite phones are of great use. As an example satellite phones are widely used by the emergency services for situations when they are in remote areas, even of countries that might have a good cellular network, but not in remote areas. They may also be for communications in rural areas where no cellular coverage may be available. They also find uses at sea, and in developing countries, or in uninhabited areas of the globe. While terrestrial broadcasting is well established it has a number of limitations: Direct broadcast satellite, DBS, technology enables both these issues to be overcome. The high angle of the satellites means that for most latitudes a high angle of signal direction means that hills do not provide a major coverage issue. Also operating around 12 GHz, more bandwidth is generally available enabling more stations - both television and radio - to be accommodated. Satellite communications summary Although the basics of satellite communications are fairly straightforward, there is a huge investment required in building the satellite and launching it into orbit. Nevertheless many communications satellites exist in orbit around the globe and they are widely used for a variety of applications from providing satellite telecommunications links to direct broadcasting and the use of satellite phone and individual satellite communication links.

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Communications Satellites: Making the Global Village Possible. by David J. Whalen. In years, when humankind looks back at the dawn of space travel, Apollo's landing on the Moon in may be the only event remembered.

This orbit is synchronized with a side real day i. This orbit can have inclination and eccentricity. It may not be circular. This orbit can be tilted at the poles of the earth. But it appears stationary when observed from the Earth. The same geo-synchronous orbit, if it is circular and in the plane of equator, it is called as geo-stationary orbit. These satellites are considered stationary with respect to earth and hence the name implies. Geo-Stationary Earth Orbit Satellites are used for weather forecasting, satellite TV, satellite radio and other types of global communications. The above figure shows the difference between Geo-synchronous and Geo- Stationary orbits. The Axis of rotation indicates the movement of Earth. The main point to note here is that every Geo-Stationary orbit is a Geo-Synchronous orbit. Signals transmitted from a MEO satellite travel a shorter distance. This translates to improved signal strength at the receiving end. This shows that smaller, more lightweight receiving terminals can be used at the receiving end. Since the signal is travelling a shorter distance to and from the satellite, there is less transmission delay. Transmission delay can be defined as the time it takes for a signal to travel up to a satellite and back down to a receiving station. For real-time communications, the shorter the transmission delay, the better will be the communication system. As an example, if a GEO satellite requires 0. MEOs operates in the frequency range of 2 GHz and above. This relatively short distance reduces transmission delay to only 0. This further reduces the need for sensitive and bulky receiving equipment. The higher frequencies associated with Mega-LEOs translates into more information carrying capacity and yields to the capability of real-time, low delay video transmission scheme. This will act as very low earth orbit geosynchronous satellites. These crafts will be powered by a combination of battery and solar power or high efficiency turbine engines. HALE platforms will offer transmission delays of less than 0. Orbital Slots Here there may arise a question that with more than satellites up there in geosynchronous orbit, how do we keep them from running into each other or from attempting to use the same location in space? To answer this problem, international regulatory bodies like the International Telecommunications Union ITU and national government organizations like the Federal Communications Commission FCC designate the locations on the geosynchronous orbit where the communications satellites can be located. These locations are specified in degrees of longitude and are called as orbital slots. The FCC and ITU have progressively reduced the required spacing down to only 2 degrees for C-band and Ku-band satellites due to the huge demand for orbital slots.

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