Mobile Communication Satellite System Design Consideration & Market Analysis

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Abstract: Fromthe mid-1960s,telecommunication services are used to provide by satellite. Later significant expansions available in the public and private sector which provide payload, transmission, and antenna and launch capabilities. Satellite television and global positioning system (GPS) navigation are now become new form of mobile communication in satellite communication. For the use of communication in maritime sector the Mobile-satellite services being used from the start of the 1980s.Aeronautical, personal communication and land mobile services are the frequent use of mobile satellite communication.

Index Terms: International Telecommunication Union(ITU), European Telecommunications Standards Institute(ETSI), Geostationary satellite (GEO),Global System for Mobile(GSM), Geo mobile radio (GMR), Low earthorbiting(LEO), Local AreaNetwork (LAN), Terrestrial wireless communication.

1 INTRODUCTION

Every space craft are designed to service for a limited time like The Garuda spaceship is considered to provide service for leastof 12 years. As the technology expand over days these 12 years seems eternity if we consider, for example, the explosive growth of the Internet over the past *3* years. Cellular telephone service growth provides a related example of the rapid growth of modern technology. The SAIS on the GSM standard with its wideband channel was considered with these instances in notice. Consequently, for small user terminal it can support substantial data rates. GPRS is proficient of distributing on the order of 115 kb/s. EDGE can support 384 kb/s where applicable. Such augmentations are accomplished by the upgrade of ground segment and have been long ago. The system is already positioned to support the so-called 2.5G wireless technologies and third generation UMTS/IMT-2000 services as well. As we know the 2.5 G machineries are packet-based and, therefore, assiststreamlined access to internet applications[3]. A telephone call via satellite is now possible in almost everywhere in the world by using the appropriate device. It is now also possible to provide the GSM and Satellite service both by using the stand-alone satellite receivers and dual-mode phones. By using the non-geostationary satellites and personal communication services (S-PCS) these cutting-edge progresses were primarily made possible[2].

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2 DESIGN PRINCIPLES

Mobile satellite communication system is aimed to function in a visibly defined geographical coverage area, therefore a regional GEO satellite system was chosen. A well-defined coverage area ensures that a maximum amount of precious satellite resources is concentrated on the desired revenue producing areas. The satellite air interface standard was based on the ubiquitous global system formobile communication terrestrial cellular standard for taking the advantages of its variety of service and as well as the accessibility of a large number of regular subsidiary hardware.Figure 1 representsthe network architecture of Mobile satellite communication.

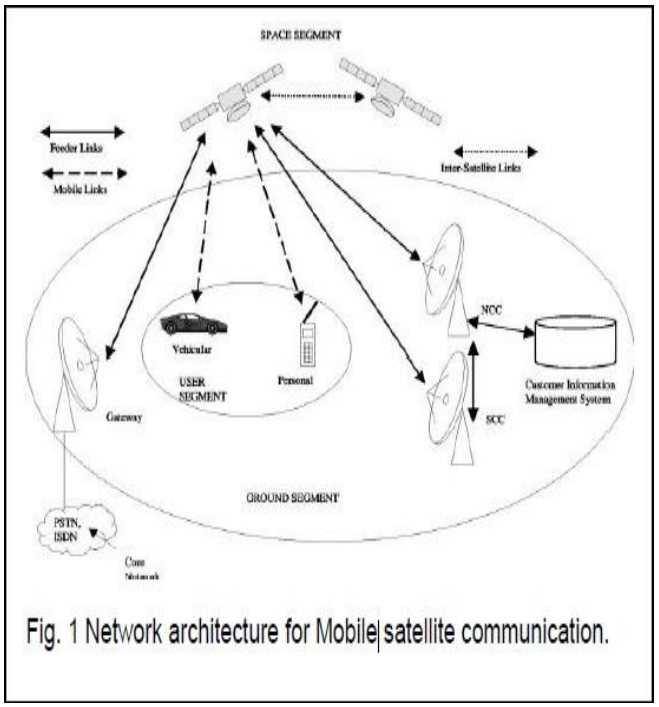

Fig. 1 Network architecture for Mobile satellite communication.

Inter-system roaming is enables in a GSM-based system which affluences the incorporation of terrestrial hardware. An optimally personalized SAIS defined by LMGT and Ericsson in a conjointly constructive supportive determination. For service acceptance and customer loyalty frequently dropped calls have to be solved and the earth-satellite links were predictably deliberate to ensure this

service. Handset form factor a vital element of customer recognition, eased by the strong links which is analogous to what is likely in modern cellular handsets. Customer acceptance and hefty system use is depend on the low cost of service and equipment which is indispensable for a mobile satellite system. The regional GEO satellite system enable the system remain in low cost[3].

Into three classes the network design can be explained:

i. User segment
ii. Ground segment and
iii. Space segment.

Following are the design principles for mobile communication satellite systems:

2.1 The User Segment

Several terminals are consists in the User segment of mobile satellite communication system. It embraces of user terminal units. Operational environment and application are highly associated with it. Those terminals are also can be alienated into two modules. Mobile terminals offer full flexibility throughout the procedure. It is separated within two classes:

a) Mobile group terminals and
b) Mobile personal terminals

Palm-top devices and hand-held are also the same as Mobile personal terminals. On board mobile platform like car is the example of other mobile personal terminal.Ship, cruise liner, train, bus or aircraft on board mobile facilities for a communal conveyance are served by Mobile group. These are group usage systems which enable a cluster of user to participate in this service. Portable terminals are another form of terminal present in Mobile communication satellite system. For briefcase user or lap-top user these portable terminalsare most often used for. In the unsustainable mode of procedure these terminals are quite able to transport information from one site to another[3].

2.2 The Ground Segment

Backhaul and control function in the C-band and the link function in the T-bandare the sub division of the ground segment. For each spacecraft there is one SCF and NCC. SCF stands for satellite control facility and a NCC stands for network control center. The complete control and administration of the system including source supervision call setup and tear down, call detail records, and billing support. National service providers (NSI's) accomplish the subsection of system properties as assigned by the NCC and it also wrought the regional gateways. Local interface and billing for thesystem users are provided by these gateways which also provide user and wired infrastructure connectivity like PSTN, private network and public land mobile network. Mobile, fixed terminals handheld devices are the part of the user segment. Data, digital voice and fax service also included in these terminals. No change required to the space segment as the system is based on GSM at the physical layer and as it is backing GPRS and EDGE enabled service which proofs its forthcoming viability. Mobile communication system in satellite this feature is a very significant characteristic[3].

2.3The Space Segment

The users network and gateways connectivity are provided by the space segment. Most recent types of satellites are capable to undeviating links between users and the space segment. More constellations of satellites are now part of this through a connected set of orbital. Precise orbital form for each satellite collections and hybrid satellite assemblages deploy in these segment. ELLIPSO network which delivers in equatorial section and elliptical orbits to concealment Northern Province. It present a quantified certain quality of service (QoS) for an anticipated province of exposure the special of a space sector's orbital constraints is resolute in initial phase. To deliver incessant global coverage carefully designed satellite constellation needed. Mechanical and marketable chucks of the network also have to take into account for a successful launch of mobile satellite communication. In the space segment different networks are united. Both time and space it can be shared in the non-geo stationary satellite systems. Satellite distribution properties between diverse systems situated inside a mutual section at diverse times are referred as time sharing. In geostationary satellite system this type of sharing is also relevant. In contrast, the allocation of satellite properties between diverse networks situated in altered provinces is known as space sharing. Incessant exposure over a specific zone is not assured by time or space sharing[3].

3 OPERATIONAL FREQUENCY

There is a range of a frequency band in Mobile satellite system reliant on the type of services accessible. For mobile satellite system the ITU assigned spectrum in the L/ S bands. Because of the series of services and systems amplified for the mandate for BW has enlarged in a better assortment of operational occurrences. The range is now prolonged from range of VHF to Ka band and ultimately straight onto the V band[2].

4 TRAFFIC CHANNELS

Traffic channels for mobile-satellite networks vary significantly with data rate. Like terrestrial equivalent it embraces a parallel channel structure. This is predominantly imperativewhen seeing integration between the particular networks. Geo mobile radio (GMR) specified the subsequent reflects the channels suggested by ETSI[2]:

- At the rate of data 24 kbps : Satellite full-rate traffic channel (S-TCH/F)
- At the rate of data 12 kbps : Satellite half-rate traffic channel (S-TCH/H)
- At the rate of data 6 kbps : Satellite quarter-rate traffic channel (S-TCH/Q)
- At the rate of data 3kbps : Satellite eighth-rate traffic channel (S-TCH/E)

5 ORBITAL TYPES

There are different types of orbit used for Mobile communication. Orbital types are branded in satellites in significant amount. Mainly there are four types of orbits used in mobile satellite communication. Amongst themgeo-stationary satellites are castoff as the lone base for endowment of such amenities. The power and antenna gain of geostationary appearances have amplified over the years, united with developments in receiver machinery. It

has been conceivable to diminution user's terminal dimension to a little imminent in the variety of device. A satellite delivers unvarying exposure to all zones inside its antenna track. It does not inevitably malicious that a mobile station in line-of-sight of the satellite subsequently obstruction from structures, plants, etc. The degree of geographical coverage is one of the most substantial ideologies in appraising the competence of a mobile network. 100% geographic coverage in global mobile system is improbable to ever accomplishand surely not within the first few years of operation. Shorten signal strength in urban and built up areas creating communication unbearable in persuaded circumstances[2].

6 RADIO FREQUENCY

The system operate at 120.832 Mbit/s and uses coherent QPSK. Thus the symbol rate is 60.416 mega symbols per second and a pre-demodulator noise bandwidth of 72 MHz is sufficient. It should not, however, be essential to use FEC for sub-burst which is to be received only at earth stations which are close to the center of the down beam footprint or which have the higher value of G/T required of standard earth stations before 1986. A pseudo-random binary sequence is added to the modulating signal of all burst, starting at the end of the unique word, to disperse strong lines in the emission spectrum that are due to repetitive sequence in the bit pattern when the multiplex is lightly loaded, and thus to ensure that the mandatory limits on the downlink PFD are not exceeded[2].

7 Modulation Techniques

Spectral efficiency is defined as the minimum spectral content of a signal which gives adequate bit error rates and in addition, signal formats which reduce the out-of-band interference allowing closer channel packing and reduced inter symbol interference. The classical formats like PSK and QPSK are still popular and will continue to be used. But on the downside, they provide out-of-band interference because of their spectral side lobes. In practice, these are suppressed by filtering, but filtering takes away their constant envelope attribute. In fact, the envelope goes to zero when there are 180 degree phase transitions between the date bits. This therefore requires the use of linear amplifiers, in lieu of the more efficient nonlinear power amplifiers. Some of the advanced modulation techniques are able to alleviate some of the previously cited problems by using modulation schemes such as MSK, GMSK and other continues phase modulations. Their benefit stems in part from the fact that the phase transitions between symbols are not impulsive but continues. These new techniques will find increased use in wireless and satellite communications applications because of the paucity of spectrum[5].

8 Market Analysis

Mobile communication market for satellite networks now has a great opportunity to enter the market. The employment of GSM as a simulated global standard creates an impact on the perceived market. At the starting of S-PCN in 1990, there were only 10 million cellular subscribers, which now become 50–100 million world-wide at the end of 2000. Those figures are just less than the total subscriber present in EU. That was happen just because of the difficulty the satellite operator's countenance when inconvenient to expect long-term inclination. In cellular market GSM is not inimitable in its comprehensive attainment. Coexisting with the GSM coverage pattern the worldwide mapping of the accessibility of cdmaOne would consequence in a parallel way. Systems like NEW ICO & GLOBALSTAR seem to entail development on complicated technology but it is also vital to echoes user necessities and market demand. Suppressed number of users and service costs are one of the main concerns of user and service necessities which have to be admiring at an initial stage of the design procedure. Developmentshave made in The NEW ECO in service launch which permitted the mobile internet access to be merged into the devise. Market analysis is important for a potential new satellite system for its business perspective. In a system design phase it is used to initiate possible satellite traffic features. satellite beam capacity, channels availability, power supplies and required EIRP/channel all of those required traffic measurement is done by system engineers to make sure the traffic prediction model is up to date. Each satellite change their coverage area in relation to the Earth in the instance of non-geostationary satellites, so for the traffic areas for smaller traffic perceived by a satellite will revolution unremittingly as it exceed over those regions.

Market forecast studies regulate the needs of spectral obligatory to withstand claim for a precise service group. By sectoring the market into particular terminal/user types this can be attained from which related bit rates and services can be realistic. Personal communication networks for satellite have the difficulty of extremely reliant on the triumph or collapse of other mobile communications engineering. Contest with other counterpart is not practicable for satellite. For filling the gaps in coverage satellites play a balancing role. It depends on the construction of terrestrial mobile networks which determined the impact of this complementary role. The establishment of terrestrial networks depends on stability of a satellite system takes to travel from preliminary stage to realism. A precise market forecast shared with a satellite execution program is a need for assemble the markets recognized in a price which allow a lucrative service to be transmit[3].

8.1Target Market

Southeast Asian area, Northern China in the north, Pakistan in the west, and Japan in the east is the primary target market for the system including the 5,000 islands of Indonesia in the south also. Over *3* billion people are encompasses in the coverage area who have little or no access to awired communication infrastructure. For instance The Indonesian archipelago is a span of islands that expanse some 4,000 miles from east to west. Construction a wired substructure to interrelate such a country is a tremendous challenge which is not difficult to imagine. For this the mobile service is concentrated on a securely defined market region which recognized as a quickly increasing industrial world sector. The pricing of the premeditated services is projected to be at a level well inside the grasp of middle-class business people as the user is supposed to be an active business itinerant. A huge addressable user people are already in the system. There are also approaches taken for high-end traveling business

people and seek to provide complete globalcoverage. Low earth orbiting (LEO) systems involves with a huge number of satellites in itself and has a consequent high execution price tag. The Iridium system is conveyed to have cost some $7 billion which is more than final cost of ACeS system[3]. In region where population density is low or where economics dictate, wire line service is not economically viable; space based wireless services will arrive faster and at much less cost. These gaps may be filled in and may even become the main source of communication in the region. In particularly, this may include many parts of Africa, Asia, and South America[4].

8.2 Fundamentals of Success

Defining success in the context of mobile communication satellite systems is a commercially feasible enterprise that, by insinuation, makes money for its investors and related stakeholders. For successful systems there are some elements which can make the system more feasible for success:

Market Consideration: We have to consider the market in the background of the service to be accessible including the type and volume of users projected to subscribe to the services. The target market should be understood and analyzed well that it can turn into a viable system in every aspect.

Compact commercial strategy: For gaining the required assistance a properly measured business case is needed. The menu of services to be obtainable, predictable price to be changed for those services, rate of system expansion and positioning, and accurate time-to-market program would include in the system.

Secure funding: Adequate finance is desirable to perceive the project through to accomplishment.

Development cost: It's obvious to have a low development cost which can ensure the maximum use of typical low risk technology. You also have to ensure a minimum development of new or unverified methods, technology, or equipment.

Appropriate retrieving of the system: Once originated, the system should be raised smartly and made accessible for procedure with least interruption[3].

8.3 Market Breakdown

There are three major areas we can identify where the mobile satellite communication makes an impact. Those are Rural/remote service, Maritime service and aeronautical service. For aeronautical services, passengers are the only user in aircraft. In-flight entertainment which is supported by the system use the LAN formation on the airliner and a terminal situated into the traveler place. By just connect into it in their individual terminals of the aircraft's LAN they can communicate anywherethey want. For maritime services, passenger of consignment ships, cruise liners and investigate craft are mainly the targeted user. The on board LAN configuration is also used here for commercial use. Moreover, for S-UMTS terminals offshore podium like oilrigs will also be an objective similar to the VSAT configurations extensively set up today. For land mobile satellite services, for countryside and distant services S-UMTS will largely provide region in order to balance T-UMTS. Office workers supported atpastoral or isolated regions, intercontinental industry trekker travelling one region to other of the planet exclusive of UMTS sort of service exposure, trade automobile, including Lorrie's and trucks, and personal cars operating in distant regions are the target user for this type of service[2]. In those cases, there are few facts of enough market stipulate to bear 2 G resembling services through satellite. The entire major satellite PCN operator experienced the economic difficulties at the beginning. The opening of 3G technologies offer the chance to distribute a huge exclusive choice of applications and services generate a bunch of new markets, present the upcoming market prospect for satellite service provider. In this situation satellite communication are more capable to emerge despite all the factors. NEW ECO, ELLIPSO and INMARSAT satellites are ingoing the UMTS/IMT-2000 markets at the similar time as their counterpart. At the first few years it may happen that there may have some gap in coverage area and possible to be slow in the some early years for TUMTS/IMT-2000. For satellite network this state is perfectly matched to the comprehensive exposure accessible by a satellite network. To institute the services for mobile based satellite as a feasible substitute to their counterpart's only time will confirm us that satellite operators are capable to utilize this prospective or not[2].

9 Conclusion

The explosive growth in terrestrial wireless communication, both indigenously and internationally, has evoked an economic interest in providing an extension of this growth to satellite basedmobile communications. As the satellite system technology developed, it became possible to provide personal service by the use of satellite in orbital regimes other than geostationary orbit. Satellite provides the medium for a number of specialized markets in commercial telecommunications. In the course of more than 30 years they have come to supply a major share of long-distance links in the public telephone network and in this field the technology can be said to be mature. But for most other applications, satellite communication is still in a state of rapid development. Mobile communication satellite systems have long held the promise of extending familiar hand held cellular communication lo anywhere a traveler might find himself. One impetus to the fulfillment of this dream has been the success of theImmarsat system of communication satellites. With so many problems besetting potential providers of handheld satellite communications, it would seem that any new entrant would do so with great trepidation. Yet, significant contrasts in implementation philosophies and system embodiments between the various proposed offerings can cause dramatic differences in potential profitability and the overall value proposition. As wireless communication is undergoing an explosive growth period, and satellite based delivery will become a major player in this near revolutionary change.

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