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EMERGING ATM PROTOCOL IN SATELLITE COMMUNICATION

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ABSTRACT

This paper represents the necessity of satellite broadband communication system and application of wireless ATM protocol in a mobile satellite communication network. The technical challenges for future broadband satellite systems will be to assure seamless integration between satellite and wireless systems and without compromising Quality of Service (QoS). In the context of Internet access technologies, satellite networks have traditionally been considered for especial purposes or as a backup technology for users not reached by traditional access networks, such as 3G, cable or ADSL etc. This paper mainly focuses on the requirement of satellite broadband systems in the time frame of end-20th Century to mid-21st Century, the challenges and limitation faced by this technology by proposing various solutions and this paper presents the architecture and performance studies of demonstrations of broadband network interconnection using ATM via satellite.

Keywords: FCC (Federal Communications Commission), ITU, ATM (Asynchronous Transfer Mode), WATM (Wireless ATM Network), MAC (Medium Access Control), B-ISDN.

I. INTRODUCTİON

Broadband Satellite communication plays a crucial role in the global telecommunications system. The rapid globalization of the telecommunication industry and the exponential evolution of the Internet are placing inexorable demands on global telecommunications. In the past years, satellite communications technology has been continuously evolving especially in the direction of providing broadband services. Satellite network"s broadcasting capacity and bandwidth flexibility provides a broad range of coverage throughout the globe. Satellite"s traditional role has been to deliver primary service to geographic areas where terrestrial communications don"t – or can"t – exist. Satellite communications networks offer many possibilities and opportunities in bridging the digital divide and spanning broadband services to remote sites.

The continued growth in demand for fast Internet access and multimedia services provides a basis for the development of broadband satellite systems despite the recent global economic decline. Using a fixed satellite dish and a PC card, it is possible to establish a direct home-to-satellite link in order to benefit from a range of services including TV on PC, fast Internet access, multicasting (where multimedia content (news, music, video, scientific data) is distributed to dedicated user groups). Geostationary orbit slots have been filled up by C-band (6/4 GHz) and Ku-band (14/12 GHz) satellite systems. Therefore, in recent years, attempts have been made to make use of the high-capacity offered by the Ka-band (30/20 GHz). After a number of successful technology demonstration satellite missions, Ka-band system applications involving hundreds of GSO (Geostationary Orbit) and NGSO (Non Geostationary Orbit) satellites were filed with the International Telecommunications Union (ITU) [1]-[2].

Therefore telecommunication industries planning to invest large amount of money for providing satellite based broadband services. The main challenge for Satellite broadband system is to harmonize the development of broadband wireless systems with B-ISDN/ATM, and offer similar advanced multimedia, multiservice features for the support of time sensitive voice communications, LAN data traffic, video, and desktop multimedia applications to the wireless user. Satellite ATM network model can be viewed as a solution for next-generation personal communication networks, or a wireless extension of the B-ISDN networks. The demand for more bandwidth increases day by day with the continuing innovation and development of satellite technology, which ensures the long-term viability of the commercial satellite industry expansion into the 21st century.

II. OVERVIEW

In telecommunications, broadband is wide bandwidth data transmission with an ability to simultaneously transport multiple signals and traffic types [3]. The US Federal Communications Commission (FCC) definition of broadband is 4.0 Mbit/s. The Organization of Economic Co-operation and Development (OECD) has defined broadband as 256 Kbit/s in at least one direction and this bit rate is the most common baseline that is marketed as "broadband" around the world [4]. Not everyone is able to access DSL (Digital Subscriber Line) or cable service, particularly in rural areas, where the subscribers may not be well served by the phone center. For those left out, satellite broadband can be the answer. Typically, a two-way Internet access via satellites rather than dial-up, capable of delivering speeds equal to or greater than 2 Mbit/s downstream, and 1 Mbit/s upstream would fall in the category of satellite broadband [5].

Satellite broadband is a broadband internet connection made via communications satellites instead of a telephone land line or other terrestrial means. Broadband satellite networks are being advanced to convey bursty Internet and multimedia

traffic in addition to the traditional circuit-switched traffic (mainly voice) on a global basis. These satellites accommodate direct network access for personal applications as well as interconnectivity to the terrestrial remote network segments. Satellites have a natural broadcast adequacy and thus expedite multicast communication. Finally, satellite links can accommodate bandwidth on demand by using Demand Assignment Multiple Access (DAMA) techniques.

III. SATELLITE ATM NETWORK MODEL

Figure 1 illustrates a satellite-ATM network model represented by a ground segment, a space segment, and a network control segment. The ground segment consists of ATM networks which may be further connected to other legacy networks. The network control center (NCC) performs various management and resource allocation functions for the satellite media. Inter-satellite crosslinks in the space segment provide seamless global connectivity via the satellite constellation. The network allows the transmission of ATM cells over satellite, multiplexes and demultiplexes ATM cell streams for uplinks, downlinks, and interfaces to interconnect ATM networks as well as legacy LANs. The satellite-ATM network consists of a satellite-ATM interface device connecting the ATM network to the satellite system. This interface is used for resource allocation, call control, error control traffic control etc. [6]. Satellite systems can be used in hybrid architectures as alternative, redundant systems to ensure the continuity of the telecommunication services for critical infrastructures. Integrated solutions are already provided by GILAT and CISCO using Very Small Aperture Terminals (VSATs) [7], or by Hugues [8].

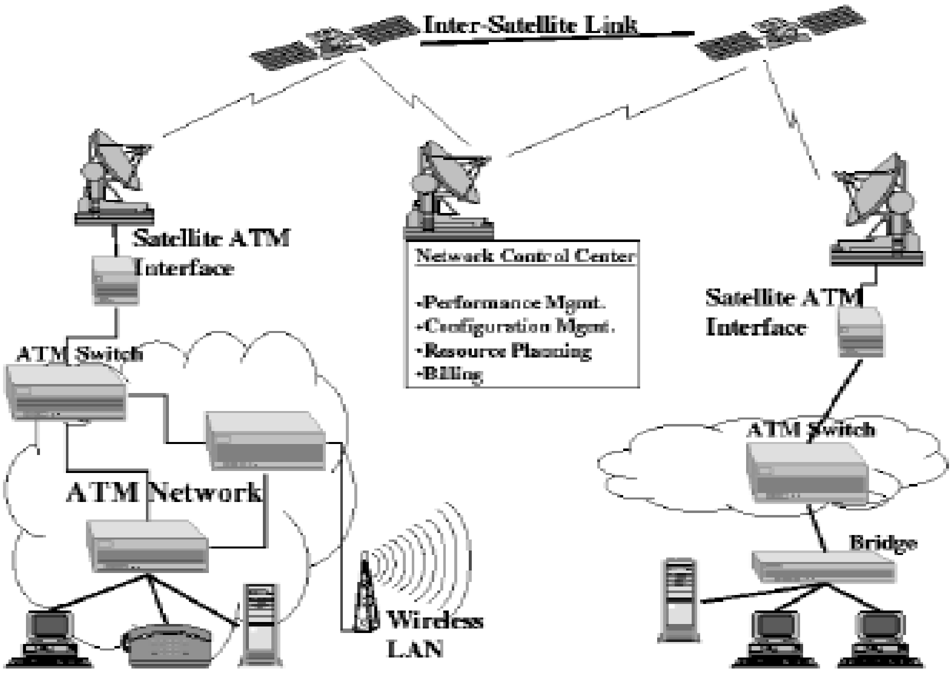

Fig. 1. Satellite-ATM Network Model [6]

Due to the success of ATM on wired networks, wireless ATM (WATM) is a direct result of the ATM "everywhere" movement. WATM can be viewed as a solution for next-generation personal communication networks, or a wireless extension of the B-ISDN networks. satellites can play a major role in the expansion of digital telecommunications at the national level and at the worldwide level by standardize the architectures and implementation processes of satellite networks using ATM, because ATM technology accommodate quality of service based networks that support voice, video and data applications WATM has the potential to bring wireless networks a new generation. Both ATM and wireless communities have put a lot of attention on Wireless ATM.

IV. CHALLENGES AND LIMITATIONS

a) Signal Latency: The round trip latency of a geostationary satellite communications network is almost 20 times that of a terrestrial based network [10]. Latency refers to time interval or delay takes a data packet to travel from one node to another. In other contexts, when a data packet is transmitted and returned back to its source, the total time for the round trip is known as latency. The dilemma often affiliate with satellite broadband is the high-latency that is caused by the long distances (up to a satellite in geo-stationary orbit) that the broadband signal has to travel. This high latency limits the use of many real-time applications which are often seen as one of the benefits of a broadband connection. Latency problems is minimized through spoofing, caching TCP/IP acceleration.

b) Line of sight: Satellite broadband requires completely clear line of sight between the dish and the satellite orbiting above earth, for the system to work. In addition to the signal being susceptible to absorption and scattering by moisture, the signal is similarly impacted by the presence of trees and other vegetation in the path of the signal. The signal may be diffracted, refracted, reflected, or absorbed by atmosphere and obstructions with material and generally cannot travel over the horizon or behind obstacles. This limitation can be overcome by proper designing of satellite ATM infrastructure.

c) Interference: Satellite communications are affected by moisture and various forms of precipitation (such as rain or snow) in the signal path between end users or ground stations and the satellite being utilized. This interference with the signal is known as rain fade. The effects are less pronounced on the lower frequency 'L' and 'C' bands, but can become quite severe on the higher frequency 'Ku' and 'Ka' band. Rain margins are the extra communication link requirements needed to account for signal degradations due to moisture and precipitation, and are of acute importance on all systems operating at frequencies over 10 GHz [9]. Interference problems can be minimized by using larger satellite communication dish which will definitely help to accumulate more of the satellite signal on the downlink and also to accommodate a stronger signal on upper link. In other words larger parabolic reflector can be used to increase the overall channel gain and signal-to-noise ratio, which accord for greater signal loss due to rain fade without the S/N ratio descend below its minimum threshold for effective communication.

d) Capacity Limitations: spectrum used by Satellite broadband communication system is limited and it is shared by all satellite network users. As more customers are added or if the existing customers begin to utilize more capacity, exhaustion of satellite capacity can become a significant issue. Therefore there are so many efforts have been made to make use of high-capacity offered by the Ka-band (30/20 GHz).

V. MODERN SATELLITE NETWORKS

Next generation satellites will no longer act as "bent pipes"; they would associate Inter-Satellite Links, on board switching, more power, and larger-aperture antennas that will enable satellites to handle more bandwidth, data buffering and signal processing. The 1990's have been characterized by the trend of reaching the end user with DTH (Direct to Home) satellite services.it is expected that in future communication satellites are expected to play an important role in providing global PCS (Personal Communication Services). With the advancements in performance of satellite receivers and decreasing cost, satellite receivers equipped with dish antennas are now becoming a household commodity. Satellites are the best option for universal access for data services as they solve the main hindrance towards this goal, namely distance.it is expected that Design of next generation satellite networks (the so called 3rd generation satellites) is highly influenced by the global trend of user instead of network oriented services. Due to the accelerated advancements in the cellular market, the telecommunication industry is planning to invest large amount of money in Mobile Satellite Services (MSS).This type of service requires;

- Low power and simple user terminals.
- Interconnectivity with the ground cellular network and PSTN (Public Switched Telephone Network).
- Satellite constellations that provide global coverage with possibly some allowance for diversity.
- Onboard signal processing, baseband amplification and switching.
- Inter satellite links and handoffs for LEO.

- Data security and authentication.
- Dynamic channel access schemes to support a variety of applications and higher layer protocols.

Quite a few of the above performance requirements go in favor of "Small" and "Big" LEO satellites. The lower altitude of LEO satellites allows simpler receivers due to smaller attenuation, lesser propagation delays and also allows easy launch (a high altitude aircraft can accomplish the launch). Due to these reasons, LEO satellites are becoming a candidate (though some systems use MEO satellites) choice for providing network services. On the downside, the spot beam property results in constellations that need a large number of LEO satellites) for global coverage. Managing and coordinating this large number of earth stations as well as complex handover schemes between satellites is a major drawback for LEO systems. On the other hand GEO satellites can provide both large and narrow footprints with multiple transponders. This combined with the ability to switch data between spot beams are the major factors that go in favour of GEO system [10]

VI . CONCLUSION

Nowadays satellite network has become fortitude for communication in various fields like military services, mobile networks, internet etc. The role of satellites is changing from the traditional telephony and TV broadcast services to user oriented data services. This trend is expected to continue in the future. Due to this reason, 3rd generation MSS will use smart satellites that will incorporate functions such as switching, buffering and beam switching in addition to signal reproduction. Modern Broadband satellites networks systems will use on-board processing and ATM and/or "ATM-like" switching to accommodate two-way communications. There are several limitations and challenges which are needed to be overcome by using various methodologies as discussed in the paper by exploring new possibilities. Small and large LEO constellations are expected to become a candidate in the cellular market. At the same time the popularity of GEO systems is not expected to diminish. In order to meet the increasing demand for real time traffic, channel access and link layer protocols will have to be optimized to ensure smooth operation over the satellite channel. The conclusion presents an opinion about need and the future of broadband satellite networks.

REFERENCES

[1] EVANS, J. V.: „Ka-band network design considerations", Satell. Commun. J. (Intertec/Primedia Publications), November 1999, pp.44–50

[2] 4 VENKATARAMAN, R., EVANS, A. L., and ROSE, J.: „The Future of Satellite Communications", Communicate (Dmg World Media Publications), May 1999, pp.34–37

[3] Glen Carty. Broadband Networking. McGraw Hill Osborne. p. 4. ISBN 007219510X

[4] Broadband Internet Access at: http://en.wikipedia.org/wiki/Broadband_Internet_access

[5] www.wisegeek.com/what-is-satellite-broadband.html Comparative Approaches in the Economics of Broadband Satellite Services by Mark Dankberg, President & CEO, Viasat, Inc and John Puetz, President, MasterWorks Communications

[6] Sastri Kota, R. Goyal, Raj Jain, "Satellite ATM Network Architectural Considerations and TCP/IP Performance," Proceedings of the 3rd K-A Band Utilization Conference, 1997.

[7] GILAT Network Systems (GNS): Cisco VSAT NM & SkyEdge Hub, http://www.gilatnetworks.com/

[8] Hughes Web Site, for Enterprise, Banking/financial, Backup for Continuous Communications. http://www.hughes.com

[9] Takashi Iida Satellite Communications: System and Its Design Technology, IOS Press, 2000, ISBN 4-274-90379-6, ISBN 978-4-274-90379-3

[10] Bruce R. Elbert, "Ths Satellite Communication Applications Handbook",1997 Artech House, Inc, MA.

[11] S. Haykin, Adaptive Filter Theory, 4th ed., Pearson Education Inc., Delhi, India, 2002.