Broadband Satellite Access

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Abstract — This article provides a general description of satellite broadband available today, without being an exhaustive guide, but identifying opportunities for development and implementation according to the increasing demands of the Internet access market and in general of Broadband.

Keywords — HTS, High Throughput Satellite, satellite business continuity, Digital Divide, Multi-beam.

I. INTRODUCTION

Traditionally, satellite communication systems have played a significant role in supporting services such as TV broadcasting, digital messaging, enterprise Virtual Private Networks (VPNs) and point-to-point telecommunications and data services.

The growing demand for multimedia applications on the Internet provided a major opportunity for broadband access network services both for businesses and residential users.

The massive growth of Internet, social networks, and open data distribution has resulted in new generation of applications with higher throughput requirements and communication demands. Service providers, network and Internet access providers are faced with a challenge to meet the higher capacity needs of the end user and wider service offerings.

In the consumer market the growing awareness of the Internet, social networking, peering, Entertainments, Infotainments, and activities ranging from shopping to remote working at home, are driving the boosting demand for more & more bandwidth. Education and entertainment content delivery also has become one of the driving applications on the Internet.

During business globalization and boost of Mobile smartphones & tablets usage, an increase of virtual businesses ideas, enterprises, teams in competition for highly skilled workers, service providers and equipment vendors, is driving the demand for higher bandwidths or broadband.

Broadband is more than high speed, it has to comply with flexibility, scalability and application support. This concept has influence in the mass market, it is about delivering information, education and entertainment, enlarging to wider metropolitan areas but also on peripheral and rural areas. It has influence in the business market, it is about delivering efficiencies, productivity.

Satellite communication network systems were optimized to meet such new service demands. New architectures and networking concepts, designs and implementations based on performance-cost tradeoff studies were developed.

Satellite Services are supporting broadband deployment on Consumer & Business market providing Last Mile Access and/or Backhaul typically comparable and often higher in performance than ‘better known’ wired & terrestrial wireless broadband solution, with a concrete and immediate alternative solution for Digital Divide, Business Continuity and Data Offload.

II. SATELLITE BROADBAND SERVICES

The first advantage of satellite communications is the ubiquitous coverage.

A single satellite system can reach every potential user across an entire continent regardless of location, particularly in areas with low subscriber density and/or otherwise impossible or difficult to reach by other means. Current satellites have various antenna types that generate different footprint sizes, ranging from whole earth as viewed from space (about 1/3 of the surface) down to a spotbeam that covers most of Europe or North America, for example. All these coverage options are usually available by the same satellite. Selection between coverage is made on transparent (passive) satellites by the signal frequencies. Spot-beam coverage is most effective for access since it operates with ground equipment of reduced size and cost.

HTS (High Throughput Satellite) systems have very narrow spot beams of a few hundred miles across that have a width of degrees.

Another important advantage of satellite communications is the bandwidth flexibility.

Satellite bandwidth can be easily configured to provide capacity to customers in virtually any combination or configuration required. This includes simplex and duplex circuits from narrowband to wideband and symmetric and asymmetric configurations. Also the same bandwidth resource is intrinsically sharable in real time over multiple location increasing the total efficiency and usage.

HTS satellite networks can deliver rates up to 100 Mbps with small dishes (50 Mbps with 75 cm) and the backplane speed within the satellite switch could reach Gbps range. The uplink rate from a 1 meter user terminal can reach 10-15 Mbps (6-10 Mbps with 75 cm).

Then Costs have to be considered when deploying a broadband access; on satellite solutions they are independent from distance, differently by other technologies.

The wide area coverage from a satellite implies that it costs the same to receive the signal from anywhere within the coverage area.

Satellites also can enable service to an entire continent immediately after deployment, with short installation time for customer premises equipment (even few hours, and in some cases also without installer thanks to easy installation and self-activation). Once the network is in place, more users can be added easily.

Reliability and security using Satellite Communication are also other advantages.
Satellites are amongst the most reliable of all communication technologies, as demonstrate by intensive uses in Emergency and Disaster condition, or even in military field usage. Satellite links only require the end stations to be maintained and they are more robust for being disabled though accidental or malicious damage.

On Disaster recovery then, Satellite provides an alternative to damaged fiber-optic networks for disaster recovery options and provide emergency communications. Traditional satellite technology utilized broad single beam covering entire continents and regions.

Picture 1: Traditional wide footprint, Single Beam architecture, Optimized for broadcast services

Traditional architecture of most commercial satellites yield bandwidths of 3 to 10 GHz or less, with ground segment managed even by a single teleport integrated in the terrestrial Networks.

Next Generation satellites (HTS) with Ka-band spot beams provide coverage over a much smaller region than previously which is advantageous in providing more bandwidth. By shaping the antenna on the spacecraft into a tighter focus, the size of the footprint on the ground is reduced. Two benefits are created by this modification: the signal strength as seen from ground terminals increases allowing the use of smaller ground antennas, and the same frequency range can be utilized multiple times in different beams yielding greater total bandwidth.

Using frequency reuse through multiple spot beams, Ka-band satellites can be configured in a similar fashion to terrestrial cellular networks. Total available bandwidth increase to 90 Gbps with 82 Spot Beam (KA-SAT – Eutelsat), 140 Gbps with 72 Spot Beam (Viasat 1 – Viasat inc.), for example.

Picture 2: Artist view of KA-SAT coverage

In particular, the limiting factor is no longer the available spectrum, but the amount of power available to transponders and the weight of the entire payload to be launched.

Picture 3: New generation footprint, Multi-beam architecture, Optimized for IP applications

III. DIGITAL DIVIDE

Currently, the vast majority of broadband access is confined to cities and towns, where people live close to telephone exchanges and can access the Internet with rather inexpensive and efficient wire Technology, like ADSL, terrestrial wireless & Mobile Technology, like WiFi, WiMax and UMTS/Lte. However, vast numbers of citizens, in Europe like in USA and more in Africa or Asian countries, also live in rural, or even isolated regions, and broadband access provisioning is more costly, difficult, and complicated.

The satellite option is a compelling solution to the broadband problem for rural areas, known as the digital divide.

In rural and remote regions, the deployment of wired and wireless technologies is often not commercially attractive, substantially more expensive than alternatives. In a recent speech on Bridging the Digital Divide, European Commissioner for Information Society and Media, Viviane Reding said “Satellite services offer wide coverage and are therefore an interesting solution in isolated areas and in regions characterized by difficult topographies. They can also provide a medium-term solution when terrestrial roll-out is uncertain.”

Citizens and businesses in rural and remote areas should benefit equally from access to broadband as those in urban areas. They need the same high quality services as urban residents. Telemedicine and e-Health applications via Broadband improve the delivery of healthcare in rural and remote areas. E-Government applications via Broadband allow better access to and interaction with government, and e-learning applications substantially improve the quality of education in more remote regions.

Satellites enable all these applications without discrimination between users. The European Commission considers wide broadband coverage in Europe as crucial for fostering growth and jobs in Europe. Lack of access to a high-quality communications tool in rural European economies will remain a barrier to true integration of all in the wider economy.

Thus, one of the greatest challenges today is how to eradicate this 'digital divide' which separates the world into communications "haves" and "have nots" This problem has
Additionally, next generation (HTS) satellites (like Ka-Sat) are managed by multiple Gateways (Teleport) interconnected by Fiber Optics Ring, bringing an higher level of redundancy. It means that Infrastructure is performing a Gateway redundancy, where traffic of any gateway can be redirected to any other gateway in the ground network.

But also a Spot beam redundancy, where Satellite spots overlapping allows adjacent beams to take over traffic from a neighbour beam in case of failure.

Picture 6: Adjacent beams coverage is sufficient to assure traffic in locations covered by failed beam.

![Picture 7: Automatic redirection of subscribers traffic to guarantee seamless internet access.](image)

V. DATA OFFLOAD ACCESS

3G networks are currently overloaded, due to the increasing popularity of various applications for smartphones.

The rapid uptake and now mainstream use of wireless smart phones and tablets have led to an explosion in mobile data consumption. These massive consumption levels have created requirements for substantially more alternative network capacity to transport mobile traffic. Users already expect high-speed wireless access anywhere and anytime, and its usage is only expected to multiply as smart phones, tablet computers and other mobile devices continue to proliferate.

For example, while the United Kingdom’s Research reports that smart phone shipments reached 485 million in 2011, it expects the number to top 655 million in 2012 and leap to 1 billion in 2016.

It goes without saying that these and other usage trends are stressing mobile operators’ networks nearly to saturation. And the potential for network traffic jams will continue even as carriers upgrade their infrastructures to support faster 3G and 4G speeds.

Mobile service providers need a strategy to successfully handle mobile traffic demands so they can continue to deliver high-quality mobile experiences to subscribers, attract new customers, and retain happy ones.

Mitigating the traffic problem by moving mobile WAN traffic onto satellite networks is proving an easier and economical solution.

Satellite networks operate at broadband speeds in frequency spectrum licensed to Satellite Operator. If the mobile network operator has put the appropriate backhaul infrastructure in place, subscribers can move between the two network types in seamless mode.

![VI. CONCLUSION](image)

Broadband satellite services available now on market can really lift off sustainable and increasingly ubiquitous broadband access, but it can also transform their market niche to serious mass market by targeting enterprises market.

ACKNOWLEDGMENTS

Thank to Giorgio Tarchi, Key Account Manager, for supporting and helping with suggestion on Digital Divide contribution.

LITERATURE

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In December 2002, I participated at startup of Skylogic SpA (Eutelsat Group), initially as a Technology Consultant. Here I hold several positions with growing responsibility for technical & sales organization.

I was Reference for R&D & special projects at National (Civil Protection - Fire Brigade - Italian Army) and international (ESA-European Space Agency) level.

I am participating to launch of first HD channel on Satellite during Torino 2006 winter Olympic Games, to Cinema content Distribution with “lSide” ESA Project on 2009 and even the launch of first 3D Channel on 2011.

Then holding the position of Key Accounts & Special Project Manager for the B2B market within the Commercial Department, and later as Regional Sales Manager for the development of KA band services for the Eastern European market and Balkan area. Actually I’m in charge of Channel Manager for satellite KA band Professional Data Network for EutelsatBroadband Services deploying & coordinating Sales in the B2B Market.

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