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The Broadband Satellite System "IPSTAR": Applications in Asia-Pacific Region

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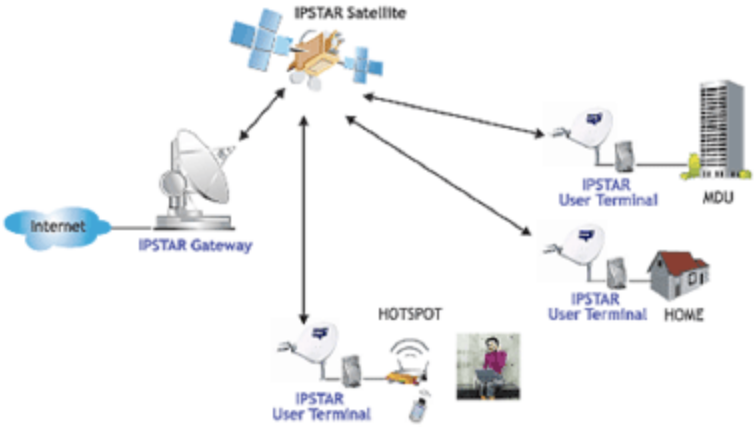
The increasing trend of data traffic has turned the world into an information society. Even so, a significant portion of the areas and populations of the world have remained outside the flow of data traffic keeping them information-poor. That is why the issue of "digital divide" has popped up. But it is the cost-effectiveness factor of delivering systems that has guided the changes taking place in information and communication technologies that will ultimately benefit the end users.

As a communication technology, satellites are now well established as delivery platforms for interactive multimedia as well as for broadcasting, streaming, and caching of content.[1] Fundamental shifts in satellite technology are now driven by market demand. IPSTAR satellite, also known as IPSTAR 1, is designed to provide broadband Internet and multimedia services, and targets those needing information and communication support in remote and rural areas. It is intended especially for people who have been excluded from high-speed broadband services and telecommunication infrastructure in Asia-Pacific region. The satellite company is currently serving 7,000 small communities in remote areas in Thailand. The IPSTAR is a new generation broadband satellite system addressing the matters of Universal Service Obligation (USO), which means ensuring everyone's access to data and voice services. [2][3]

IPSTAR Satellite System

In August 2005, Shin Satellite PLC (SSA) launched the next generation broadband satellite called IPSTAR. The purpose of the satellite is to serve growing regional demand for high-speed broadband Internet access and multimedia. The satellite is now delivering broadband solutions to residential, corporate and other consumers throughout the Asia-Pacific region. SSA contracted with the US-based Space System Loral, the satellite manufacturer who developed, designed and patented IPSTAR's core technologies.[4] IPSTAR-1 is built with a massive bandwidth capacity of 45 Gbps and has 114 transponders, which is equivalent to the capacity of 45 average satellites.[5] IPSTAR-1 was built for a life of 12 years.

IPSTAR is a geo-stationary orbit satellite operating from Ku-band spectrum for user applications. According to its website, the Ku-band spectrum provides the optimal solution for services with "high link availability" for user applications using a small-size antenna.[6]



Source: http://www.ipstar.com/en/tech_satt_desc.htm

Context

Satellite communication is today a "commodity" with customers interacting with space platforms directly as this technology has evolved. Earth terminals have become less expensive and more robust.[7] This is very much evidenced in the development of the IPSTAR broadband satellite system. It was manufactured and launched at a time when investors and financial organizations had begun to worry about the potential for broadband satellites to show profitability in a competitive environment.[8] Moreover, the market for such satellite was untested. Would such a satellite be adopted by communication providers in the Asian market? The United States, DirectTV and EchoStar had each marketed two-way Internet services that bypassed the terrestrial ISP with a direct transactional path to the satellite. Also, several ventures were in place to offer next-generation IP satellite services from the newly opened Ka (30 Ghz) frequency band.[9]

In the market for high-speed Internet access, however, the Asia/Pacific area is poorly served. High-speed access to data or information services is virtually non-existent in the areas outside cities in the region. There is a demand for relatively cheaper broadband service from most small and medium business enterprises, schools, hospitals and rural communities that cannot afford to erect their own VSAT networks.[10] This is where IPSTAR says it will provide low-cost and high-speed satellite broadband service.[11]

Background

Shin Satellite, founded in 1991 by former Thai Prime Minister Thaksin Shinwatra and later run by his family, has another three satellites in space - Thaicom 1, Thaicom 2 and Thaicom 3. Each of these satellites was designed to provide broadcasting services in Thailand and to other countries of the region.[12] Before developing IPSTAR, Shin Sat was offering an Internet via satellite service known as ProTrunk, which was a high speed Internet trunk connection to the global Internet network for local Internet Service Providers (ISPs). ProTrunk makes Internet connections from one of the Thaicom gateways directly to its customers'

networks via satellite, bypassing congested terrestrial lines in Thailand, Hong Kong and the United Arab Emirates.[13] But ProTrunk did little for the small and medium business enterprises, schools, hospitals and rural communities. That is why IPSTAR Broadband Satellite was developed for both Direct-to-User (DTU) services and for linking with terrestrial networks.[14] The new spacecraft differs from ShinSat's three conventional broadcasting satellites in that it has been designed to bring broadband Internet and other advanced telecoms services, such as video-conferencing, to remote corners of Asia.

Importance of the IPSTAR Satellite System

IPSTAR is considered to be a new generation broadband satellite that can serve both Internet backbone connection to fiber optic cables for ISPs and as a

last-mile broadband Internet service to consumers. It provides high-speed Internet of 4 Mbps forward/ 2 Mbps return.[15] The system's switching and routing capabilities are located in gateway and network control centers on the ground, an advantage for upgrading all electronics and software from earth. This way, upstream services will have "more capability and cost effectiveness" over time.[16]

Shin Satellite aims to provide low cost user terminals and increased bandwidth to compete more effectively with terrestrial broadband solutions such as Asymmetric Digital Subscriber Line (ADSL), Cable Modem and Fixed Wireless while retaining the key satellite advantages of large coverage, and fast and flexible service deployment.[17] The Satellite also has the capability to allocate its "precious on-board resources" appropriately as per the actual need to maintain communication links for ensuring quality of service. The satellite allocates optimum use of power among beams. The system has also power reserve for rain attenuated beams.[18]

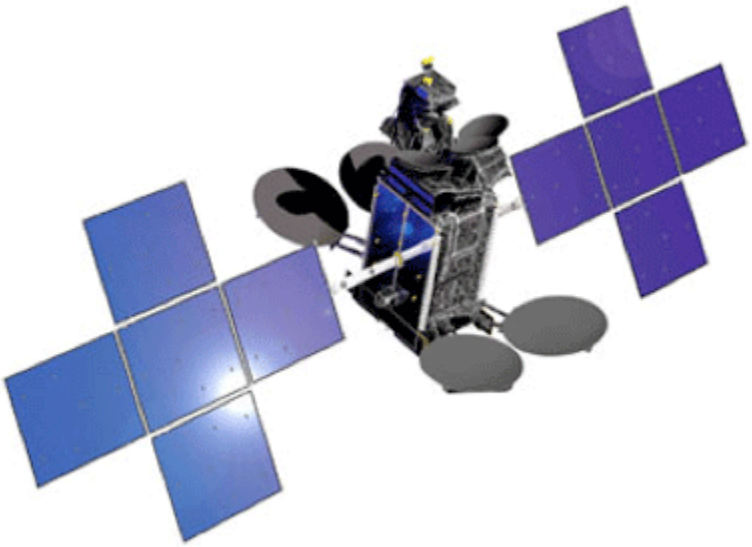
Vast footprint coverage and in place infrastructure in different countries of the region are advantages for the newly launched satellite system. IPSTAR's

footprint stretches across India, China, South-East Asia, Japan, Korea, Australia and New Zealand where there is the potential for market expansion as well as making profit.[19] Initially, Shin Satellite had 20,000 user terminals in 14 countries of Asia-Pacific region, but within two years that figure increased to 70,000 and the satellite can now serve 10 million subscribers in 18 countries of the region.[20][21]

Traditional satellite technology utilizes a broad single beam to cover entire continents and regions. With narrowly focused spot beams and frequency reuse, IPSTAR is capable of maximizing the available frequency for transmission. It has 20 times more bandwidth compared to traditional Ku-band satellites.[22] Despite

the higher costs associated with spot beam technology, the overall cost per circuit is expected to be much lower than existing shaped beam satellites.

High power levels, high-gain antennas and high levels of frequency reuse via multibeam antennas help high-data-rate broadband satellites in providing multimedia services. That is why Pelton found such a satellite system a "technological revolution."[23]



Broadband Access Application of IPSTAR Satellite
Source: http://www.IPSTAR.com/en/app_baa.htm

Broadband satellite has always suffered from high cost compared to other systems available. But IPSTAR technology is designed to increase system capacity and efficiency in a way that the cost of service will be considerably lower than that of conventional satellites. Though satellite service providers face competition from cable, mobile and fixed telephony systems, they are competing well in the new interactive formats.[24] Clearly, no other operator can match the wide geographic coverage of satellite footprints, as satellite signals can be local, regional, or international.

Applications and Market Prospects

Applications of any technology largely determine its market prospects. Applications of IPSTAR broadband satellite include broadband access, broadcast or multicast, video on demand, voice, video conferencing, intranet and trunking.[25] Through its broadband access application, it provides broadband Internet access for home users, for apartment-dwellers, for small and medium business enterprises, for schools and hospitals, and for public hotspots such as Internet Cafes.

Using IPSTAR broadband satellite, Sat-Ed System Co. in Thailand started the "Room For Life" learning center project. Apart from facilitating distant education,

the IPSTAR system is also being used for educating farmers and rural women about new agricultural technologies and silk weaving.[26][27] Thailand had an Internet access penetration of only 11.9 per cent with more access in urban areas. By using Internet Protocol Television (IPTV) the "Room for Life" village learning center project of Sat-Ed has helped to build a "bridge across the digital divide and helped to provide access to education to everyone".[28] Not only students, but also adults are benefited by these learning centers. About the use of IPTV, facilitated by IPSTAR technology, in village learning centers, Hawker and Elder have written:

"…It allows adults to access content, often in a group, using the same technology that they use sitting in front of their TV at home… a remote control. With this remote control, they can navigate through a course; stop, fast-forward, rewind or pause to discuss what they have just learned. They can stop a course for the evening and go back and pick it up where they last left off. Coming soon will be the ability for the student to input their ID number into the system and the middleware will know where they left off so there is no time-consuming backtracking to find the spot. The Sat-Ed LMS will then track their progress and report back nightly by satellite."[29]

SchoolNet, the distance education program in Thailand, has also benefited from the IPSTAR technology as about 10,000 remote schools out of 40,000 covered in the project are using broadband Internet access and voice services. The IPSTAR providers claim that its technology has enabled "a reduction of cost in distribution of content and course materials, as this can be done electronically. Teachers and students alike in these schools can download course materials and content easily from the centralized server".[30]

In the context of communication access in remote areas, the global market for broadband satellite services is on a rising trend. In the Asia-Pacific, the market for broadband users has increased by 30 million in two years (from 36 million in 2003 to 67 million in 2005), while the broadband market has also increased from 86 million to 154 million globally in the same period.[31] From the perspective of technological aspects, IPSTAR has opened new markets. The Shin Satellite and its manufacturer Space Systems Loral are recognized for developing and applying technology that sharply reduces space segment cost 5-10 times for broadband Internet over satellite.[32] This has put the service-provider in a position to deliver commercially viable services at reasonable prices.[33] IPSTAR's services are now available through a network of local operators in 18 countries in Asia-Pacific region.[34] According to reports, Shin Satellite has increased revenue from selling terminals, and earned steady growth from bandwidth leasing in 2006. During this time, IPSTAR projected that 100,000 terminals would be brought online by the Telephone Organization of Thailand (TOT) and 100,000 terminals each in China and India.[35]

TOT has also set an ambitious revenue target of over 17 billion baht over the next five years from its use of wholesale bandwidth services from the IPSTAR

satellite. TOT will have to pay much less to Shinsat to lease the broadband satellite bandwidth over the period which is 3.25 billion baht.[36] The company has already partnered with local players in China and India to tap potential markets in those countries.[37]

Learning in the Room for Life
Source: http://www.sat-ed.com/learning_news.html

Telstra Australia signed contracts with Shin Satellite in early 2004 to build earth stations for offering customers low-cost and two-way satellite broadband outside city areas. IPSTAR's new service provider in New Zealand, Natcom (National Communications Corporation Ltd), is targeting niche markets - hotels, houses, farms, vineyards, golf courses, schools, bed and breakfasts and communities.[38] Natcom says it can lower the Internet installation and equipment cost by 700 dollars (from the existing 3,500 dollars to around 2,800 dollars per installation) with monthly connectivity fee of 89 dollars a month.[39] In 2006, another New Zealand company Orcon was planning to start rural satellite broadband service using the IPSTAR satellite system.[40]

Broadband Pacenet India Pvt. Ltd. is also offering a package of services in India using the IPSTAR satellite system. The service package includes "all IP-home and offices, community tele-service center and community internet service, e-learning network, disaster management and tele-medicine".[41]

Vietnam Telecom International (VTI) is in the process of adopting the VSAT-IP service of IPSTAR for providing rural communications to all parts in Vietnam with an aim to bridge the digital divide between rural and urban communities. VTI also plans to offer GSM (Global System of Mobile Communications) trunking services to two mobile operators, Vinaphone and Mobifone, to enable them to extend their networks without the additional roll-out costs associated with terrestrial infrastructure.[42]

Though IPSTAR has the technological potential for tapping unexplored market as well as ensuring universal service, it has to face real market challenges in terms of economy, regulatory, technical compatibility and political factors.

Economic and Market Challenges

After the launching of IPSTAR, Shin Satellite was working with two service providers in New Zealand, ICONZ and Bay City, to reduce the cost of a new package option. However, the reduced cost was still "slightly more" than the offerings of its terrestrial competitor, a telecom group in New Zealand.[43] So applications using IPSTAR will not necessarily be the most cost-effective inside Telecom's coverage area of its XTRA Jetstream service. Installation cost is what has made the difference between the two types of service. Outside the Jetstream coverage, a big number of target households still require the support of IPSTAR system.[44]

While Asymmetric Digital Subscribers' Line (ADSL) broadband services start at around $35 a month, with free connection and modem, wireless and satellite solutions are still considerably more expensive because of the hardware requirement. But with the rapid uptake of facsimiles, mobile phones and global positioning systems (GPS), the satellite and wireless connectivity can be more quickly adopted in rural areas.[45]

Though the Thai satellite company has taken steps to forge partnerships with both public and private telecom agencies of the Asian region, worries remain about whether the sluggish state telecom agencies, especially in the developing countries of Asia, will be able to push the unfamiliar technology to rural customers, or ensure good service quality.[46] As of 2005, partners signed contracts for using only about 10 per cent of the capacity of the satellite within four years. However, the break-even point is estimated at 20 to 25 per cent utilization of the system.

Technical challenges

The emergence of multicast protocols, such as the multicast diffusion protocols, speed up the data delivery in satellite systems. IP multicasters using satellite paths incorporate such protocols to sustain continuous communications needed for real-time applications like VoIP and IP conferencing.[47] On the other hand, the terrestrial Internet is a one-to-one unicast medium. That is why, given the cost and complexity, the greater opportunities exist in adding broadband Internet to data services through Internet Protocol (IP) Satellite or Direct-to-Home Internet service.[48] However, such satellite systems need to address some limitations. IPSTAR's technology is not suitable for global broadcast.[49]

Satellite's other inherent disadvantage is in service provisioning. Satellite broadband can cause delays as signals travel to and from satellites in the Geostationary Orbit . Latency is basically the time taken for the signal to travel up the satellite and back to a ground station and back up again to the satellite. Despite IPSTAR's flexible coding and power management, signal fading in adverse weather can affect throughput.[50] More importantly IPSTAR-1 satellite includes technology that was not launched in orbit before.[51]

Regulatory Challenges

An Asia Pacific Satellite Communications Council (APSCC) study identified some factors that hindered the services of satellite communication in the region. These include the separate licensing requirements required for satellite service providers, space segment operators and end users of radio spectrum. Licensing requires meeting the conditions of a multiplicity of concerned authorities, often resulting in multiple application forms and high licensing fees and delay in license approval.[52] Due to regulatory barriers, broadband service via satellite in many Asian countries had not taken off earlier.[53][54] As Inmarsat 4 (I-4) was launched successfully in November, 2005, the London-based company Inmarsat sought to offer a satellite-based broadband mobile Internet service called Broadband Global Area Network (BGAN) that includes the Asian region. So obviously the presence of another broadband satellite system has made the market for IPSTAR more competitive.[55]

The National Telecommunications Commission in Thailand proposed to issue three types of licenses for satellite owners and operators at the end of 2005. According to a draft of its licensing conditions, separate licenses will be issued for satellite operators, earth-station operators, and satellite service re-sellers.[56] Separate licensing mechanisms can be a barrier to delivery of more cost-effective services via broadband satellite. However, there is no regulatory policy concerning the selling of shares or using profits for satellite operating companies in Thailand.

Though the former Thaksin government levied a new excise duty for telecommunications, the Prime Minister's family-owned satellite company was suspiciously granted a tax exemption for its IPSTAR broadband satellite.[57] Change in political power was expected to bring the Shin Satellite under the tax net which may affect the company's financials.

Conclusion

Despite the socio-economic, regulatory and political challenges and constraints, the cost-effective and flexible nature of IPSTAR technology helped the Shin Satellite Plc. to be named as the "2006 Industry Innovator for Technology Development and Application" in the private sector by the Society of Satellite Professionals International (SSPI) at the Satellite 2006 Exhibition and Conference in Washington D.C.[58] The business venture of Shin Satellite, favored by the Thai administration at the time, causes some worries among investors as well as policymakers. However, the technical capabilities of the IPSTAR Broadband Satellite System have attracted regional broadband service providers in Asia-Pacific region. IPSTAR is a great step forward in making satellite technology cost-effective. Though there is an untapped market for IPSTAR technology in rural areas of the Asia-Pacific region, there are still challenges in terms of

infrastructure cost and the overall socio-economic condition of the targeted market, and also at the level of diplomacy.

NOTES

1. Originally called Shinawatra Satellite, Shin Satellite Public Company Limited was founded in 1991 after it was granted a license from Thailand 's Ministry of Transport and Communications permitting it to launch and operate satellites. It was the first company in Thailand to be allowed to do this, and the first privately-owned satellite company in Asia (Source: http://www.thaicom.net/).
2. ADSL - Twisted-pair copper wiring based system through which data is transmitted at a rate of 1.5-9 Mbps downstream (to the subscriber) and from 16-800 kbps upstream. (Flournoy, 2004).
3. Cable modem - it enables coaxial and fiber-optic lines of cable TV to connect to either analog or digital circuits or equipment (Flournoy, 2004).
4. Fixed Wireless - Reception and transmission of wireless communications in fixed locations - homes, schools and offices (Flournoy, 2004).
5. IPTV differs from normal TV-based delivery systems in that instead of being a passive device that you watch it is now a two-way interactive device. IPTV allows a person to interact with the content delivered to the TV. Using a simple remote control, a person can navigate through a series of high-quality videos and text pages, take tests using the remote control to answer the on-screen questions and be assessed on their results (Hawker & Elder, 2005).
6. The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. (Source: http://www.trimble.com/gps/what.html).
7. Geostationary orbit is located at 22,300 miles above the earth surface from where a satellite can cover one third of the world. (Pelton, 2004).

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