Satellite Services Regulatory Issues and Broadband Internet

Role of Broadband

According to the Director of ITU/BDT:

Broadband:

- *has become a key priority of the 21st Century,*
- *is an enabler for economic and social growth*
- *is a tool for empowering people,*
- *creates an environment that nurtures the technological and service innovation,*
- *triggers positive change in business processes*

What is broadband? (1/2)

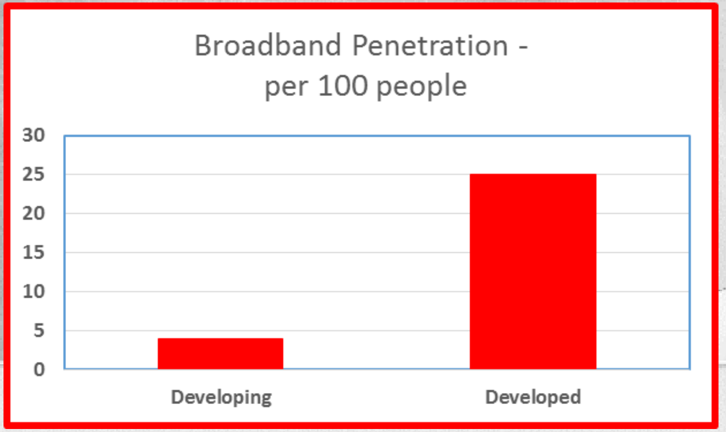
- “Broadband”, also referred to as “wideband”, is used frequently to indicate some form of high-speed access.
- Broadband is frequently used to indicate an Internet connection at 256 kbit/s in one or both directions.

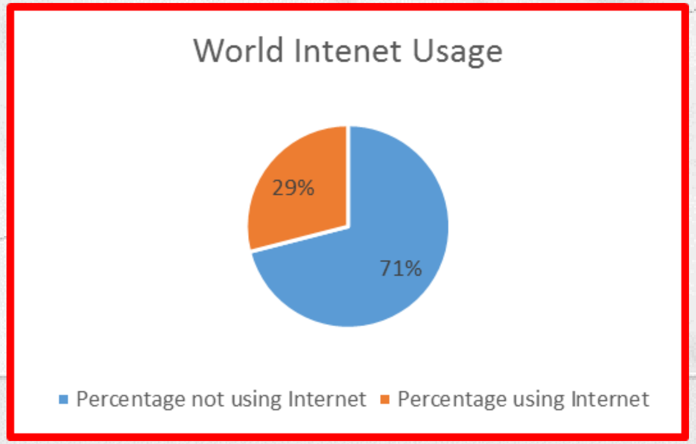
What is broadband? (2/2)

For the purpose of this presentation, the term broadband refers to data rates that correspond to the user rate of 2 Mbit/s and higher.

Why satellites for broadband delivery? (1/2)

- Penetration of broadband levels in developing countries remain low: 4 subscriptions per 100 people compared to 25 in developed countries





- The answer is to deploy a network that has wide coverage, is able to overcome long distances and inhospitable terrain and can be rapidly put in place. This is not an easy task.
- Satellite technology is ideally suited to achieve this task.

Why satellites for broadband delivery? (2/2)

- Compared with terrestrial installations, remote sites can be deployed very quickly with satellite access

- Satellite broadband enables new applications that provide services to mobile sites – for example, ships, trains, planes and vehicles.


Maritime Communications

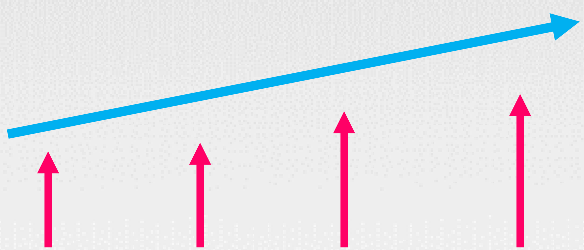

Oil & Gas


Aeronautical

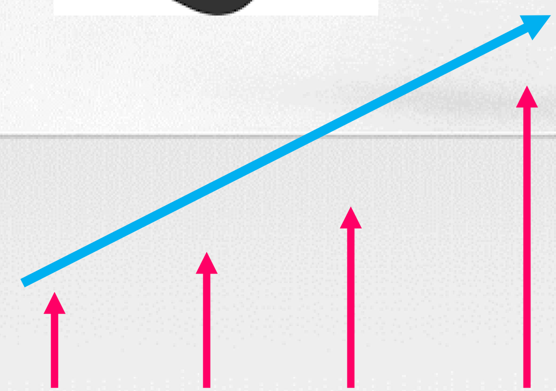

ISR

Trends in user application devices

Increasingly, Broadband is required on mobile personal devices



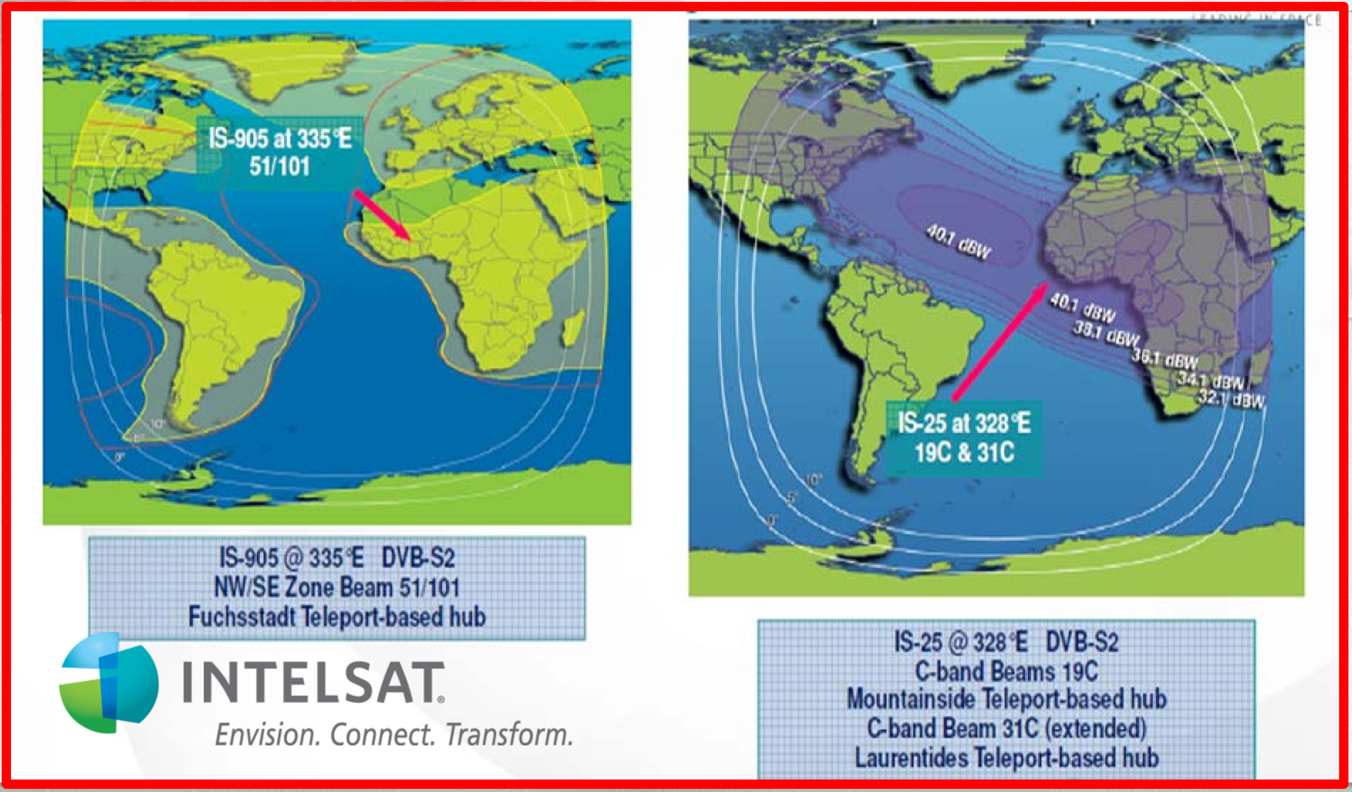
Fixed Broadband Growth



Mobile Broadband Growth

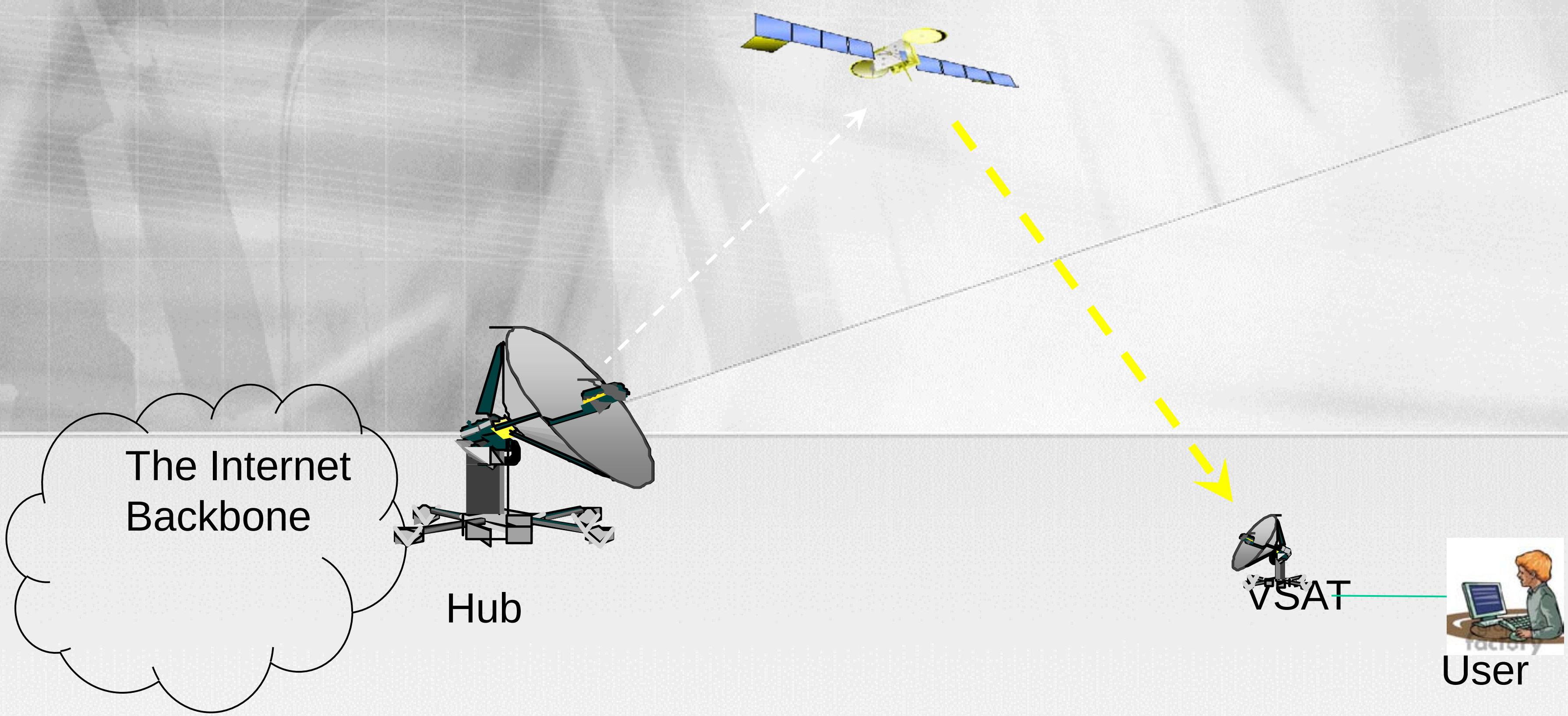
Broadband Satellite – Advantages (1/4)

- Ability to provide access to large geographical areas not served by telecommunications infrastructure and to serve as a “local-loop” in such areas



Broadband Satellite – Advantages (2/4)

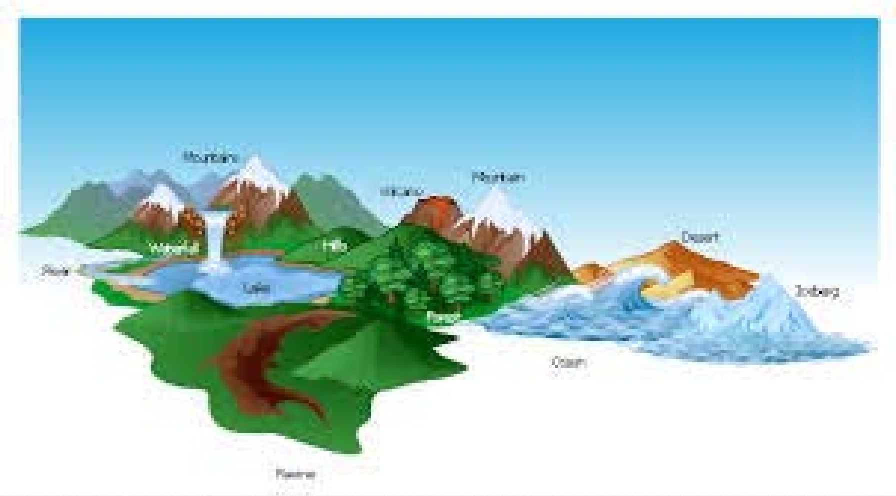
- Ability to serve as a "local-loop"



Broadband Satellite – Advantages (3/4)

- Instant infrastructure

- independent of terrain or distance



Broadband Satellite - Advantages (3/4)

- **Flexible Services Delivery:**
  - **Education**

  - **Health**

  - **e-government**

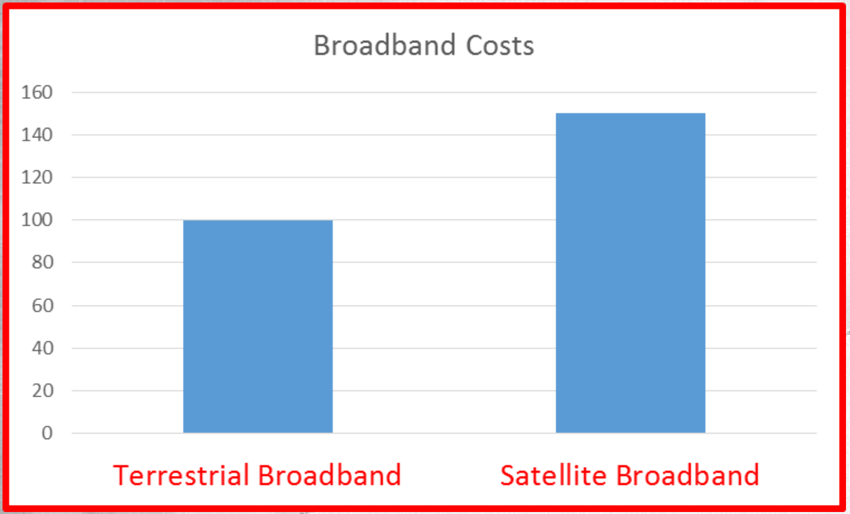
  - **e-commerce**

Broadband Satellite - Advantages (4/4)

- global, regional or national coverage- no ‘last mile issues
- very high availability (up-time) compared with terrestrial solutions like fibre/copper cable or terrestrial wireless
- reliability is unmatched in situations when natural disasters or acts of terrorism knock out other modes of communication.
- Although satellites are generally designed for a 15 year life they often provide service for periods of 18 years or longer.

Broadband Satellite – Some Disadvantages (1/2)

High Cost

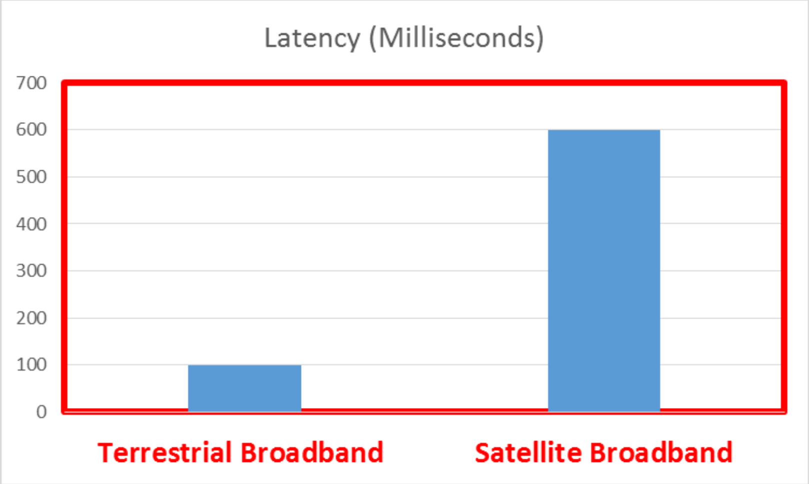


However….

New satellites with high capacity – of the order of 100 Gbit/s coupled with multiple beams and multiple gateways, is resulting in a 100 to 1 reduction in cost per Mbps when compared to the 1 Gbit/s Ku band conventional satellites.

Broadband Satellite – Some Disadvantages (2/2)

High Latency (when using GEO Satellite's)



However….

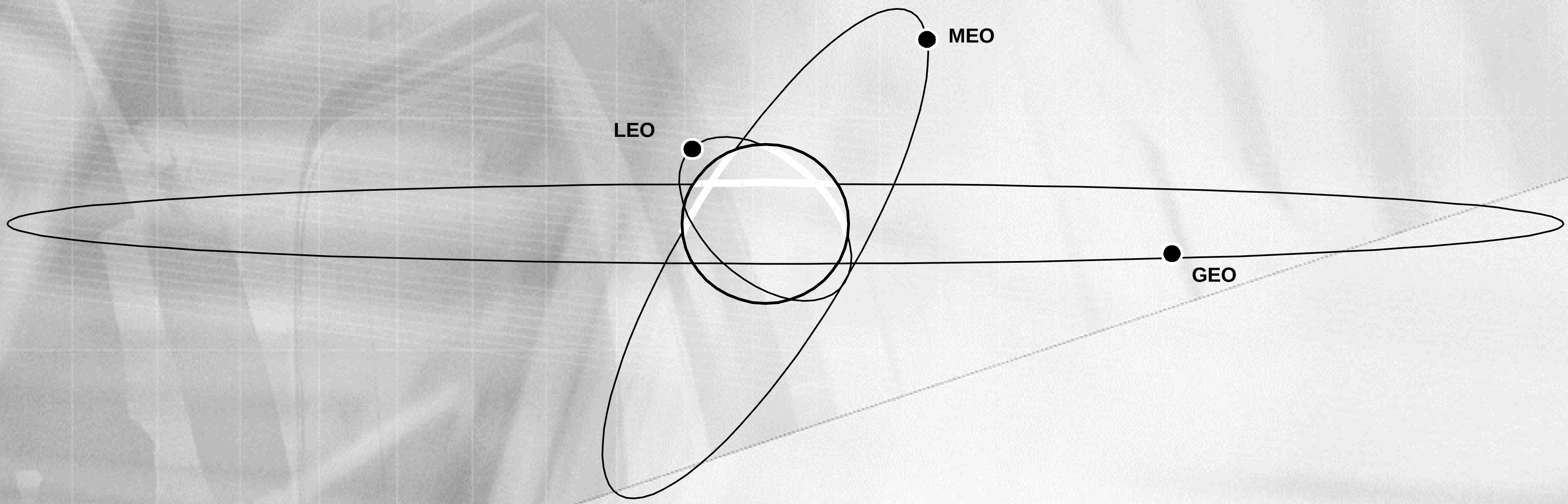
Since latency is due to the distance between the satellites and the earth, satellites in lower earth orbits have less latency than geostationary satellite networks.

Choice of Satellite System Configurations for Broadband

Depends on:

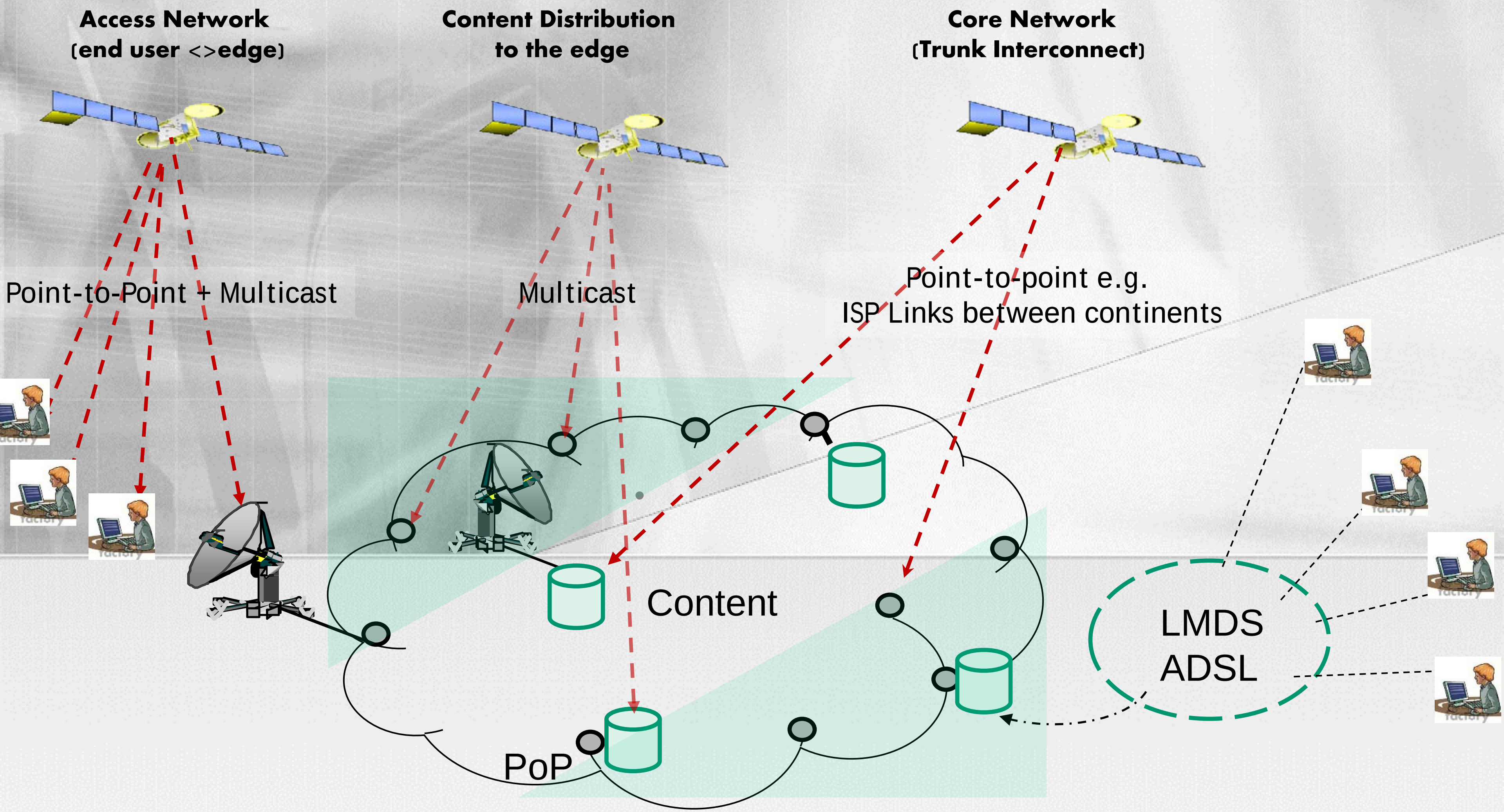
- requirement of geographical coverage
- type of service (IP broadband, broadcast or multi-casting, emergency communication, mobile satellite, fixed satellite, etc.)
- look angle of the satellite from ground stations (higher look angle means less ground noise),
- availability of spectrum orbit resource
- cost and designed life-time of satellite network, etc.

Satellite Orbits



- **GEO- 35,786 km above the earth, Large round trip delays**
- **MEO- 9,600-19,200 km above the earth, Short round trip delay**
- **LEO- 160-800 km above the earth , Very short round trip delay**

Global Broadband Satellite Network Scenarios



ADL: A symmetric digital subscriber line
LMDS: Local point multipoint distribution system
PoP: Point of Presence

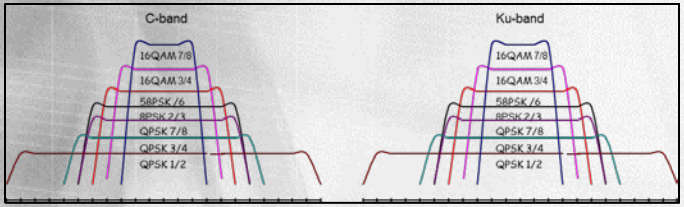
Source: Recommendation ITU-R S.1709-1

Resources for Satellite Broadband (1/3)

Need for Regulation

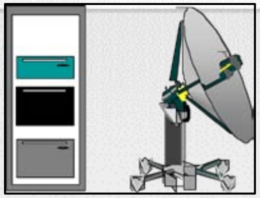
To ensure optimised of use of scarce segments resources:

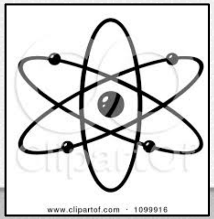
- Spectrum
- Satellite Power
- Orbital Slots



Need for investment

- Infrastructure: Hubs, VSATs
- Human Resource Development
- Technology Research





Resources for Satellite Broadband (2/3)

Current spectrum for satellite service

- C-band
  - Transmit 5.625 – 6.425 GHz
  - Receive 3.400 – 4.200 GHz
- Ku-band
- Ka-band

Resources for Satellite Broadband (3/3)

Requirement for additional spectrum for mobile satellite service

WRC -15 Agenda Item 1.10

“to consider spectrum requirements and possible additional spectrum allocations for the mobile-satellite service in the Earth-to-space and space-to-Earth directions, including the satellite component for broadband applications, including International Mobile Telecommunications (IMT), within the frequency range from 22 GHz to 26 GHz, in accordance with Resolution 234 (WRC-12)”

Satellite Technology for Broadband(1/?)

Introduction of multiple narrowly focused spot beams and frequency reuse makes the satellite capable of maximizing the available frequency for transmissions. Increasing bandwidth by a factor of 20 or more, as compared to traditional satellites translates into better efficiencies. Despite the higher costs associated with spot beam technology, the overall cost per circuit is considerably lower compared to shaped beam technology.

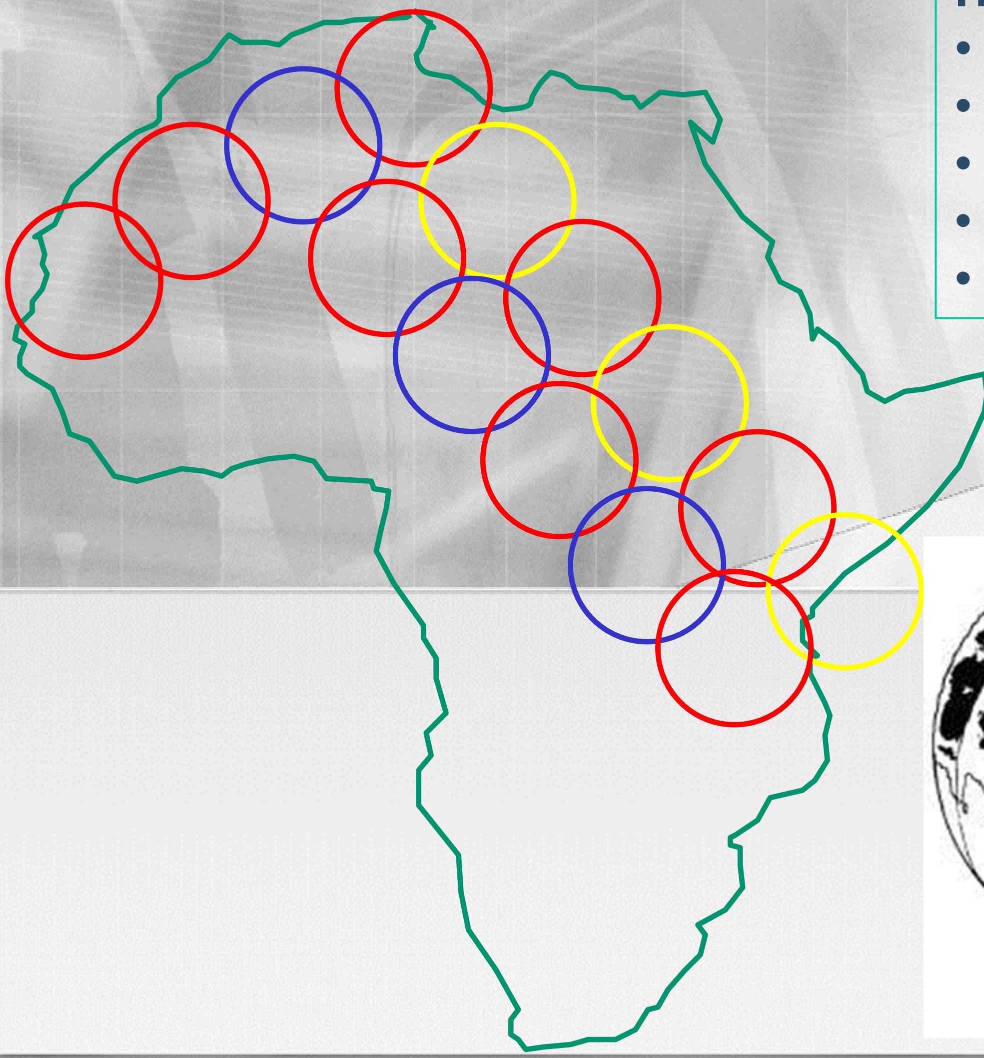
Satellite Technology for Broadband(1/4)

The new generation Ka band broadband systems deploy spot beam technology where satellite downlink beams illuminate a smaller area of the order of 100s of kilometres instead of 1 000s of kilometres. The coverage looks like a honeycomb or a cellular pattern. This enables frequency reuse that results in a drastic increase in the overall capacity of the satellite. This is analogous to comparing a direct-to-home (DTH) broadcast signal to a cellular phone signal. New generation satellite broadband is being customized to address target markets, reduce bandwidth costs, and increase capabilities to meet the growth in subscriber population.

The system capacity increase is 30 to 60 times the capacity of the Ku band FSS approach. This is what makes the spot beam technology economically attractive and a viable business proposition to meet the

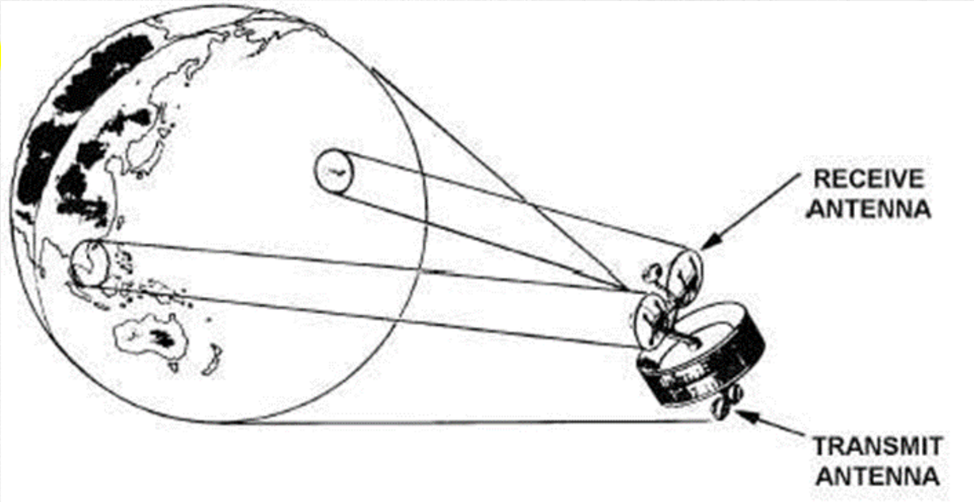
growing bandwidth demand of end users.

Satellite Technology for Broadband(2/4)



HTS: Key Design Decisions:

- Spectrum
- Throughput
- Architecture
- Coverage
- Efficiency



Satellite Technology for Broadband(3/4)

HTS can be developed in any frequency band: C, Ku, Ka. The frequency selection is driven by many considerations:

- Coverage and beam size
- Atmospheric conditions in the region that is being served
- Availability of a robust ecosystem of ground technologies

Satellite Technology for Broadband(4/4)

The demand for broadband is rapidly exhausting the available capacity of existing Ku band satellites. The high bandwidth available in the Ka spectrum and frequency re-use capabilities across multiple beams enables the delivery of more capacity at faster speeds to smaller dishes.

Case Studies of Satellite Broadband Initiatives (1/7)

Europe

- **At least 13 million households were still beyond the range of ADSL (Asymmetric Digital Subscriber Line) in 2012 and 17 million users access the Internet at speeds below 2 Mbps.**
- **A significant portion of the rural population all over Europe there is no access to terrestrial broadband.**
- **Although terrestrial broadband technologies are expected to play a vital role in the fulfilment of Europe’s broadband policy objectives, satellite broadband technology and especially the use of high throughput satellites with the use of multi-beam technology would play a major role in meeting these objectives at a much faster rate than their terrestrial counterparts.**

Case Studies of Satellite Broadband Initiatives (2/7)

Europe

For the provision of broadband Internet access services across Europe and also a small area of the Middle East, KA-SAT, owned by Eutelsat is an example of satellite based broadband system for IP services that deploys spot beam technology. Positioned at its geostationary orbit location at 9° East, KA-SAT features high level of frequency reuse enabling the system to achieve a total capacity of more than 70 Gbps. It represents 38 times the capacity of a standard telecommunications satellite operating in Ku band. Each spot beam generates an area of connectivity about 250 km wide having a capacity of 900 Mbps. KA-SAT has a 82 beam structure.

Case Studies of Satellite Broadband Initiatives (3/7)

Africa:

Africa had an Internet penetration of only 10.9 per cent in 2010. An intergovernmental commercial satellite organization called RASCOM (Regional African Satellite Communications Organization) through RascomStar-QAF 39 (a private company registered in Mauritius) implemented RASCOM's first communications satellite project.

RASCOM-QAF1R's Ku band (12/14 GHz) covering two zones over Africa (North and South) provides TV broadcasting and high-rate Internet and C-band covering one single zone over Africa is used for thin route trunking and bandwidth lease service. RascomStar-QAF TElecommunication Services gateways are the connection points of the service to terrestrial PSTN networks.

Case Studies of Satellite Broadband Initiatives (4/7)

O3b Networks

O3b Networks are expected to bring higher capacity, lower latency, lower cost broadband access to more than 150 countries across Asia, Africa, Latin America and the Middle East. O3b Networks (where O3B stands for the "other three billion," a reference to nearly half of the world's population that has little or no access to the Web) satellites will continuously circle the Earth. As each satellite passes a region, it will pick up the Internet traffic there and then pass it to the next satellite before going out of range. The O3b Satellite Constellation is designed for telecommunications and data backhaul from remote locations.

Case Studies of Satellite Broadband Initiatives (5/7)

O3b Networks

Scheduled for commercial service in early 2013, O3b's network was to initially be made up of eight satellites with plans to extend this to 16. The constellation is owned and operated by O3b Networks, Ltd. O3b satellites are deployed in a circular orbit along the equator at an altitude of 8 063 km (medium earth orbit). The satellites shall Ka band and provide optimal coverage between 45° North/South latitudes. Use of medium Earth orbit (MEO) will reduce the latency from 250 milliseconds (for a geostationary satellite) to approximately 100 milliseconds.

Case Studies of Satellite Broadband Initiatives (6/7)

Intelsat Networks

As of March 2011, Intelsat operates a fleet of 52 communications satellites. Intelsat enables management of customer's network across multiple satellite and regions with the use of only one hub station. This arrangement supports a number of applications, including: Web browsing, digital media streaming, e-mail, multicasting, file transfers, Wi-Fi hotspots, VPN, VoIP, extranet/Intranet, e-commerce, video conferencing, and distance learning.

Intelsat's commercial grade broadband access, faster than DSL, provides converged voice, data and video applications anywhere in the world. Intelsat ONE infrastructure of the Intelsat, allows multiple scalable networks to be built with a common hub platform using C band (4/6 GHz) and Ku band (11/14 GHz) frequencies. Intelsat's broadband network offers per-site data rates of up to 18 Mbps on the outbound and 5.5 Mbps on the inbound.

Case Studies of Satellite Broadband Initiatives (7/7)

Inmarsat: As of 2012, Inmarsat had a current fleet of 11-satellites that provided mobile voice and data communications globally – on land, at sea or in the air.

In 2010, Boeing, the US aerospace manufacturer, was contracted to build three Inmarsat-5 (I-5) satellites. The first is scheduled for completion in 2013, with full global coverage expected by the end of 2014. This is a new constellation of Inmarsat-5 satellites that will form part of a new USD 1.2 billion worldwide wireless broadband network called Inmarsat Global Xpress™. Each Inmarsat-5 will carry a payload of 89 Ka band beams – capable of providing capacity across the globe and enabling Inmarsat to adapt to shifting subscriber usage patterns over their projected lifetime of 15 years. The Inmarsat Global Xpress™ network will take advantage of the additional bandwidth available in the Ka band to offer download rates of 50 Mbps and upload speeds of 5 Mbps from mobile user terminals as small as 60 cms. Services will be tailored initially for the government, energy and maritime markets. The Inmarsat-5s will operate independently from the L band satellites offering complementary services for a wide range of mobile and fixed solutions. At present, Inmarsat's Broadband Global Area Network – BGAN – provides both simultaneous voice and data, globally, on land. With its standard IP data service, it provides the user with a data connection speed up to 0.5 Mbits/s

International Regulation Issues - Use of Spectrum and Orbital Resources (1/3)

Just like it was with WRC-12, WRC-15 is expected to deal with many pressing issues concerning the use of orbit-spectrum resource that is not in line with international regulatory procedures and has the potential to block new broadband satellites that could be used to serve developing countries.

Agenda Items 7 and 9.1 of WRC-15 deal with Satellite Regulatory Issues including issues that affect availability of orbital resources for broadband services

International Regulation Issues - Use of Spectrum and Orbital Resources$_{(2/3)}$

Regulatory Challenges:

WRC-12 and previous conferences had introduced notable reinforcement to the current regulatory regime that governs the access to these natural resources. In studying this issue, it has been brought to the attention of the ITU-R that considerable portions of satellite network filings in the phases of

advance publication and coordination are usually suppressed by the seven-year regulatory time limit. Recognizing the uncertainties of coordinating frequency assignments in certain orbital positions in a timely manner, notifying administrations usually submit diverse network filings in order to accommodate these uncertainties and to ensure the availability of these scarce resources.

On the other hand, some of these filings are kept in the coordination stage without being brought into use, rather than being suppressed. Consequently, this may result in increasing the coordination requirement and complexities for later-filed networks. As a result, these filings may appear to be an

excess to the needs of the notifying administration, whereas some of these filings may have not been brought into use for other reasons.

WRC-15

International Regulation Issues - Use of Spectrum and Orbital Resources 3/3)

Cleaning up of the ITU Master International Frequency Register poses challenges. The goal is to clean-up the radio spectrum and the satellite orbit for real satellite systems, provide them with maximum protection and place minimum administrative burden for their use. There has been a

tendency for hording or warehousing of orbital slots and spectrum giving rise to regulatory distortions.

The ITU World Radio Conference (WRC-15) shall consider possible changes to "Advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks". From the point of view of coordination of satellite networks and to achieve international recognition and protection for the frequency assignments, it is important to have an appreciation of these issues and their alternative solutions. These are expected to come up for debate during the WRC-15.

END

Questions?