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PROMOTING BROADBAND:

BROADBAND ISSUES IN PRIVATE SECTOR

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1 INTRODUCTION

The technological innovation and commercial development of telecommunications have gone hand in hand—particularly during recent decades—and the combined influence of economic, communications and technological developments are fast leading towards what is now known as the "information society". Broadband telecommunications are beginning to feature highly among these technologies, and their growing prevalence is testifying to their future potential for users, businesses and governments alike.

Broadband, which has been referred to as the infrastructure of the knowledge economy, is seen by countries around the world as crucial infrastructure for achieving their economic, social and scientific goals. High hopes have been placed for the revitalization of demand for the products and services of telecommunication sector through broadband, and many describe it as a panacea for a range of social and economic woes. Despite this, the take-up of broadband in many countries has been below expectations mainly due to its high cost and lack of appropriate policy aimed at promoting broadband.

1.1 Outline of the Paper

This paper addresses broadband promotion from private sector issues perspective. The paper introduces issues to consider, case studies, and ideas for promoting broadband by focusing on current issues, which hinder the promotion of broadband in Asia Pacific region. Issues such as low cost broadband in rural areas, promotion of WiMax technology, use of wireless broadband in countries with difficult terrain and other policy and regulatory issues relating to wireline and wireless broadband can be discussed. These issues are ranging from governments and/or regulators, to telecommunications suppliers and industry It, therefore, becomes necessary for all the concerned parties to come together to discuss different strategies and formulate appropriate policies that would result in the wide-spread adoption of broadband by the consumers.

1.2 Why Promote Broadband?

Generally speaking, the main reasons for promoting broadband can be given as follows:

- Benefits to users. Compared with narrowband, the increased speed and always-on nature of broadband enables the exchange of richer content, facilitates improved, expanded and more rapid communication, and allows the sharing of a connection with multiple users.
- Benefits to the economy. Broadband connectivity is helping to establish an "information society". It encourages innovation, stimulates growth in an economy, and attracts foreign investment.
- Returns on investment. Broadband holds the promise of new applications and services that will attract users and help recover infrastructure development costs.

1.2.1 Benefits of broadband to users

Richer content exchange

As the Internet matures and moves from being largely a luxury towards being a basic necessity, faster access to richer information becomes more important to users. Broadband allows more information to pass to the user's computer in less time than with slower connections. This increased speed can offer significant time savings and can significantly reduce frustration levels for users. This is especially true for those who download large amounts of information from the Web.

Broadband enables users to access and exchange high-quality graphics and other bandwidth-intensive content, such as 3D imagery in video games that would prove either impossible or difficult to use effectively over slower connections. There are many content-rich applications that have been identified as potential drivers of broadband take-up. This ever-growing list, for which many benefits have been cited, includes applications in voice, audio, video, e-commerce, e-education, e-health, government services, online gaming, and file sharing.

As mentioned above, communication applications such as e-mail and instant messaging have been major drivers of Internet usage. A key attribute of broadband in enhancing the effectiveness of these communication applications is that it can be offered as an always-on connection, usually priced at a rate that is independent of the time spent connected. In addition, broadband does not tie up a telephone line as a typical dial-up connection does. Thus, broadband facilitates communication through increased availability.

Furthermore, the increased bandwidth offered by broadband enables the use of other communication applications, such as video-e-mails, file and photo sharing, and videoconferencing. Moreover, broadband enables higher levels of interactivity than other communication channels, thereby providing a better user experience.

1.2.2 Benefits of broadband to the economy

For many countries, broadband forms part of the goal of establishing an information society. The idea is that people's lives will improve as they have access to better information and applications concerned with health, education, finance, and a range of other topics. For these economies, the promotion of broadband forms part of an overall plan to realise the benefits of access to information in digital form.

Additionally, many countries recognise that promoting broadband adoption encourages innovation, thereby stimulating growth within the economy. As a new technology, there is significant scope for innovation surrounding broadband as people interact with it and new applications are developed that take advantage of its characteristics.

Broadband networks can also help to attract foreign direct investment. This brings new money into the economy and serves as a conduit for transferring technological know-how.

1.2.3 Return on investment

The last few years have seen telecommunications suppliers around the world investing considerably in broadband infrastructure. Some of the investments have been very large and now there is a strong push from governments and suppliers to begin seeing returns on their investments. On inter-city routes, especially across the Atlantic, there is considerable excess capacity for data traffic. This has forced prices down below a level at which investments can be recovered. Without investment in broadband in the access network, there will never be enough demand to use the capacity of the undersea cables. Furthermore, low returns on existing investments reduce incentives to invest in next-generation communication services. For these reasons, the promotion of broadband take-up is now of high priority.

2 PROMOTING BROADBAND

2.1 Promoting Broadband *Demand*

Over and above differences in culture, landscape, and technological development, economies that have been successful in promoting broadband have several key factors in common. These four factors are first summarized below and then discussed in detail throughout the section. A successful broadband economy will be characterized by:

- **Informing the public about broadband**. Efforts to promote demand for broadband depend largely on the target market being aware of the products available, and aware of what benefits broadband can provide them. Increased exposure to broadband should boost take-up rates. Growth should be rapid once penetration reaches a certain critical mass.
- **Making effective use of broadband through applications and content.** Broadband adoption is much higher in countries where users make full use of current broadband applications. This may include high usage of IP telephony, video/audio via broadband, online gaming, and telecommuting. Content in local languages also plays a key role. Policies that encourage these uses should boost penetration rates.
- **An environment that fosters broadband innovation.** Economies must have policies and incentives in place that create a fertile environment for broadband content and application development. This includes important issues such as thoughtful intellectual property protection, adequate government funding for Internet research, and consumers ready to participate in developing new, high-bandwidth applications.
- **A competitive market structure that keeps prices low.** There is no substitute for true market competition in broadband to reduce prices. Subsidies, grants, regulatory obligations and other financial support are only temporary fixes and cannot replace a well-functioning market. Efforts to ensure the market runs efficiently will have the greatest effect on prices, and in turn on broadband adoption.

2.2 Promoting Broadband *Supply*

Fundamentally, the objective of broadband supply is to provide all those who would like broadband with the opportunity to access it. This section discusses issues, strategies and ideas for promoting the supply of broadband, while focusing on economies or regions where efforts have been particularly successful or interesting. The section also highlights possible roles for governments, regulators, telecommunication suppliers and the private sector in general.

A successful broadband economy can be characterised by:

- **Having a competitive market structure.** Strong inter-modal competition as well competition among the same technologies leads to lower prices, increased feature offerings, and more extensive broadband networks. Cross-ownership by operators will decrease broadband penetration and should be remedied. Competition policy authorities must continually monitor the competitive structure of the market and must be empowered to take action when necessary.
- **Having government programmes in place that focus on broadband.** Local, regional and national initiatives have been successful in connecting communities to broadband. Direct infrastructure investment by governments can play a key role in developing broadband networks, especially in underserved areas. Tax credits, low-interest loans, subsidies and other government programs can also be important methods of stimulating broadband supply.
- **Applying innovative ideas to expand the network.** Existing networks must be utilized to their full extent alongside new network investment. Innovative broadband networks such as wireless, satellite, railway and electrical can be used to supply broadband. Schools, hospitals, and community access centres can serve as initial broadband anchors in areas, eventually becoming the network access points from which future networks can expand.

Further information is available in the country case studies at http://www.itu.int/broadband.

3 FIXED WIRELESS BROADBAND

3.1 Introduction

Also known as "wireless cable," "broadband wireless local loop" or "wireless DSL," it offers some advantages over DSL and cable.

Fixed-wireless systems have a long history. Point-to-point microwave connections have long been used for voice and data communications, generally in backhaul networks operated by phone companies, cable TV companies, utilities, railways, paging companies and government agencies, and will continue to be an important part of the communications infrastructure. Frequencies used range from 1 GHz to 40 GHz. But technology has continued to advance, allowing higher frequencies, and thus smaller antennas, to be used, resulting in lower costs and easier-to-deploy systems for private use and for a whole new generation of carriers that are planning to use wireless access as their last mile of communication. The terms wireless broadband and broadband wireless are not used consistently, but generally both apply to carrier-based services in which multiple data streams are multiplexed onto a single radio-carrier signal. Some vendors also use the terms to refer to privately deployed networks. Some use the terms “wireless cable,” “broadband wireless local loop” or “wireless DSL” which all refer to the same thing.

Fixed wireless system uses microwave transceivers to transmit voice, video and data to customer transceivers. A radio transmitter/receiver, which communicates with provider’s central antenna site, is attached to a customer’s premise. The central antenna site acts as the gateway into the public switched telephone network or the Internet for the transceivers. The radio signal traveling over this network serves as the substitute for the copper wire or cable strand that connects customers to the network in traditional, wired technologies. Typically, it relies on Multipoint Multichannel Distribution Service (MMDS) technology for home subscribers and Local Multipoint Distribution Service (LMDS) for businesses.

Originally designed as an alternative to standard cable TV, fixed wireless is now aimed at providing high-speed Net services to businesses and consumers.

3.2 Advantages

- *Cost*: In rural areas, the segment connecting the subscriber to the exchange often accounts for more than 50 per cent of initial investment. On the other hand, wireless networks are free of substantial costs associated with the installation and maintenance of wires that run to customer’s premises, making them ideal for deployment in rural areas where substantial distances between customers may be cost-prohibitive for wireline technologies. The cost advantage of WLL is based on three factors:
  - Quick deployment compared to copper wire, meaning that revenue streams begin sooner and investment is recouped more quickly.
  - Cost structure: WLL typically tends to have a low ratio of fixed to incremental costs. Once base stations and the link to the telephone exchange have been installed, new subscribers can be added quickly and at relatively low cost.
  - WLL tends to be less prone to failure than copper wire and is less likely to be stolen or damaged, lowering maintenance costs. Furthermore, it is much easier to locate the point of failure in WLL networks than in hard-wired ones.
- *Flexibility*: New customers can be added easily (i.e. without the need to lay new sets of cables). Moreover, WLL systems are redeployable, which is particularly useful in the case of fast-growing areas or areas where subscribers switch providers or cancel contracts frequently.
- *Speed*: In order to lay cable, permission has to be obtained from municipal authorities or landowners which delays implementation. WLL systems can be implemented more quickly and less obtrusively than copper wires. Furthermore, obstacles of various kinds (hills, forests, rivers) can increase the cost of installing copper wire.
- *WLL systems can be used in the mobile mode*: WLL users can theoretically roam freely with their handsets within the coverage area of their base station, which can range up to 50 kilometers.

3.3 Remaining challenges

- *No global standard*: Most WLL systems are based on existing technologies.
- *Attenuation and Line-of-Sight*: WLL systems tend to suffer attenuation where there is heavy rainfall or extensive foliage. Many wireless technologies are subject to line-of-sight restriction, and there must be an unobstructed path from the central antenna to the customer's antenna. This might not be the case in difficult terrains, which creates the need for inexpensive wireless technology that is not subject to line-of-sight restriction.
- *Frequency*: The need to have frequency allocated for WLL imposes constraints on operators planning to use this technology. The price to be paid for this will raise costs.
- *Roaming*: Concerning the possibility for "roaming", incumbent mobile cellular operators may complain, arguing that the WLL service provider infringes on the exclusivity of their existing licenses (as has happened in India and Poland). The problem is more serious where spectrum is allocated at low cost for a WLL system which then competes with mobile cellular operators who have paid in some cases high spectrum fees in competitive auctions.
- *Low bandwidth*: Some WLL technologies have relatively low bandwidth, restricting ability for broadband applications and some of the most advanced services (one has to bear in mind, however, that provision of these most advanced technical solutions is probably not required for low-cost rural telecommunications).

Despite these hurdles, some expects solid growth for fixed wireless over the next several years, particularly in international markets saddled with sparse or inadequate wired telecom networks.

4 WiMax

4.1 Introduction

WiMax: Worldwide Interoperability for Microwave Access, sometimes referred to as “Wi-Fi on steroids”, it is a broadband access technology which provides wireless high-speed, carrier-grade Ethernet data communications over city-sized distances. It can be integrated into fixed and mobile networks. It is expected that WiMax will revitalize the fixed wireless broadband market that has seen several boom and bust cycles. For all the industry hope and hype placed on WiMax, the technology itself is in its infancy and is not ready to hit the market.

4.1.1 WiMax Forum

WiMax is the shorthand term for IEEE (Institute of Electrical and Electronics Engineers Inc.) Standard 802.16, which is also known as “Air Interface for Fixed Broadband Wireless Access Systems”. In 2001, the WiMax Forum was established with an aim to support wireless metropolitan-area networking products based on 802.16.

The Forum believes that WiMax need to have a basis in well defined standards and interoperability right from the start, which is something Wi-Fi didn’t gain for years after it was developed. Currently, it is working on standards certification and interoperability testing.

4.1.2 WiMax Standardization:

The initial version of the 802.16 standard, which was approved by the New York based IEEE in 2002, operates in the 10-to-66-GHz frequency band and requires line-of-sight towers. Its extension, the 802.16a, doesn't require line-of-sight transmission and allows use of lower frequencies (2 to 11 GHz), many of which are unregulated. It has a 31-mile range and 70Mbit/sec. data transfer rates. Additional standards have been worked through, and they cover:

- **802.16b:** Quality of Service
- **802.16c:** Interoperability, with protocols and test-suite structures
- **802.16d**: Fixing things not covered by 802.11c, which is the standard for developing access points
- **802.16e**: Support for mobile as well as fixed broadband

Intel’s WiMAX

Intel has much-promoted WiMax. Intel is gearing up for WiMax’ world premiere. As early as Apr. 18, the company started turning out a new generation of chips that it hopes will turn WiMax into the Next Big Thing in the wireless Web. Analysts expect a range of WiMax services to spring up over the next few years. If WiMax takes off, it could transform broadband by bringing high-speed service to millions more people around the globe, allowing Web surfers to roam at will and cutting subscription rates as new players pile into the market. Since the late’90s, techies have dreamed of beaming high-speed Internet over the airwaves. Several companies attempted to launch precursors to WiMax but never got off the ground. The infrastructure was too costly, and the competing technologies suffered a lack of common standards.

With WiMax, Intel has to bring on broad telecom companies, which aren’t traditionally Intel customers: They are the ones who will sell the service. So the chipmaker created a WiMax forum which such heavyweights as SBC, Sprint, and Nokia to hammer out common standards for its chips. To start with, WiMax, which Intel says will be up to six times faster than existing broadband service in the U.S., will be used to bring high-speed Internet to homes and businesses that lack service. But in a couple of years, WiMax will go mobile, allowing people to download movies, games, and other content without being tethered to a local hot spot, as Wi-Fi requires.

For consumers, WiMax could shake up the broadband world by helping to eliminate the cable and DSL duopoly that dominates the market. That could lead to lower prices and higher speeds. Upstarts could use WiMax to break cheaply into incumbents' markets. In the United States, big players will be able to enter each other's territories. For example, in February a Verizon Communications Inc. subsidiary, Verizon Avenue, began offering a WiMax-like service in Monterey, CA, a market currently served by rival SBC. Time Warner Inc., Comcast Corp., and other cable providers could make use of WiMax to deliver content outside the home. That would provide competition for cellular providers, some of which also aim to sell WiMax services alongside existing high-speed mobile networks.

Source: Business Week, April 25, 2005; by Cliff Edwards in San Mateo, CA.

4.1.3 WiMax Promise

While the detractors of WiMax technology believe that product certifications will take longer than the forum hopes, and that the WiMax will ultimately prove to be of only limited potential as broadband gap filler in carrier networks, the proponents of WiMax have high hopes for the future of the technology. They believe that affordability, ease of installation and interoperability of WiMax will prove the detractors wrong. Visant Strategy Inc., a market research firm based in New York, predicts that WiMax product sales will reach $1 billion by 2008. Another firm based in New York, Oyster Bay, expects the market for long-range wireless products based on 802.16 and the forthcoming 802.20 standard to reach $1.5 billion by 2008.

WiMAX Trends

The whole concept around standardization is to reduce equipment and component costs through integration and economies of scale that will, in turn, allow for mass production at lower cost. In particular, current chipsets are custom-built for each Broadband Wireless Access (BWA) vendor making equipment development and manufacturing both costly and time consuming.

With large volumes, chipsets could sell for as little as $25 and other WiMAX components could benefit from these mass volumes as well. We expect the cost reduction impact to be mostly on the CPE at an average selling price close to $100 by 2008. Base station costs are more complex due to the variety of types and scale. However base stations are less of a factor in the economic equation for operator deployments.

A notable initial benefit of WiMAX is to reduce customer confusion represented by the advent of a WiMAX compliance label. However the hype generated by the press and vendors has sent an overly optimistic picture of what WiMAX systems can actually deliver. In this report we provide an in-depth reality check about what to expect in the next five years. Both proprietary systems and WiMAX are aiming at improving the coverage and penetration limitations of existing systems. The fact is that no system can go beyond the laws of physics and every deployment will face different challenges.

Source: "WiMAX and Broadband Wireless (Sub-11Ghz) Worldwide Market Analysis and Trends 2005-2010" by MARAVEDIS, Telecom Market Research & Analysis

4.2 Case Study: WiBro in South Korea

WiBro, developed in South Korea, is an alternative approach to 802.16e. As a result, a political battle raged over whether WiBro should be the basis of the upcoming mobile WiMax, 802.16e. Samsung and other backers of WiBro argued that their technology was more advanced than 802.16e and therefore should be the basis for WiMax 802.16e. But, this move was resisted by the US interests including Intel. The scenario—adoption of WiBro by South Korea and China—created the possibility of fragmented market for vendors and two incompatible wireless zones for international operators and users. However, Intel and LG agreed to call a truce and work together on a single international standard combining the two. The WiBro's expertise in high speed mobility as well as the experiences of early operators deploying WiBro could accelerate the creation of an effective mobile WiMax. WiBro is expected to be launched early next year.

WiBro

WiBro is being incorporated into the WiMAX standard effort but can be viewed, for the time being, as a separate market development centred in South Korea that is valuable because it will be an early large scale deployment. WiBro will demonstrate the early capabilities of WiMAX systems for both fixed and mobile broadband communications that compares favourably for nomadic to mobile applications of 3.5G-4G cellular.

WiBro is likely to change opinions about the technical credibility and market merits while dispelling myths perpetrated by some that "WiMAX is too late" or offers nothing new. A major problem with the credibility of the WiMAX camp is that any delay or perceived delay registers as 'vapourware' and validation to the proposition that WiMAX will not shape up as a viable competition to existing wireless cellular or as some new breed of popular wireless broadband phenomena. WiBro is a central factor in proving that mobile WiMAX is real and is gaining more sales momentum.

The three operators who have been licensed spectrum by the Korean government are required to spend at least $1 billion US each on deployment of WiBro systems. Operators Korea Telecom, SK Telecom and Hanaro Telecom are required to start offering service in 2006.

These developments and emerging trends make WiBro developments and harmonization within WiMAX a key area of focus through 2005-2007.

Source: "WiMAX and Broadband Wireless (Sub-11Ghz) Worldwide Market Analysis and Trends 2005-2010" by MARAVEDIS, Telecom Market Research & Analysis

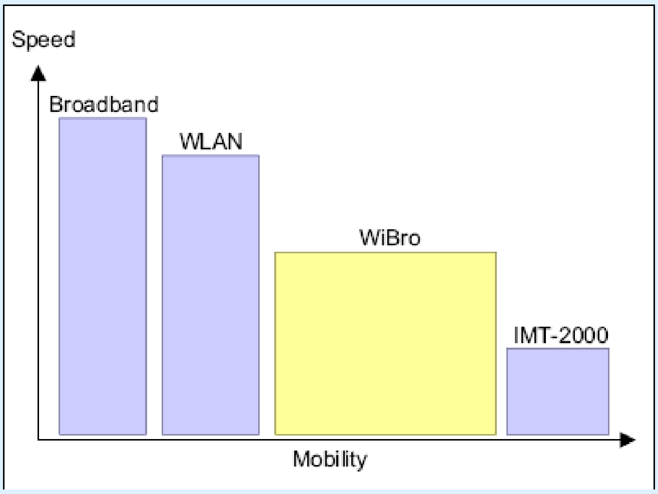
Korea's appetite for mobile Internet applications fuels development of a WiMAX-based wireless technology

Korea's policy-makers, broadband providers, and mobile operators have come up with a plan to develop a new data network that is more efficient at offering mobile data than current broadband or mobile networks. This plan is called WiBro for "Wireless broadband" and is based on the IEEE 802.16e standard using the 2.3 GHz frequency band. WiBro is a technology that fits well between WLAN and IMT-2000 in terms of mobility and speed (see below). It would offer a 512 – 1024 kbit/s connection to users for a flat monthly fee. Operators have not said how much they will charge but industry watchers assume the prices will be about USD 15.

All major telecommunication players in Korea have plans for the 2.3 GHz frequency allocation that was finalized in February 2004. KT, for example, has already introduced a "seamless" offering through its Nespot Swing, a bundled package that where users can roam between Wi-Fi hotspots and the CDMA2000 1x EV-DO network, when out of Wi-Fi range. Including WiBro coverage is the next practical step for the service.

WiBro has several advantages over WLAN and IMT-2000 for delivering data. While Wi-Fi is limited to a range of roughly 100 meters, WiBro will be accessible in a 1 km radius around a base station with connection speeds of 512 kbit/s guaranteed to moving vehicles at 60 km/h (see figure below right). Mobile carriers are especially interested in WiBro because of their significant investment in cell towers throughout the country that can quickly be leveraged to offer WiBro services. This upgrade can be effectuated simply by adding a second set of radios on the towers.

About WiBro



WiBro at a glance	
General	
Frequency:	2.3 GHz
Licenses:	Awarded by ministry
Bandwidth	
Per user:	512 - 1024 kbit/s
Total:	100 MHz
Maximum accessible speed for users:	
Practical:	60 km/hour
Theoretical:	250 km/hour
Pricing estimates	
Flat rate pricing:	15 USD/month, est.

Source: ITU case study: Republic of Korea at http://www.itu.int/osg/spu/ni/futuremobile/general/casestudies/koreacase-rv4.pdf

5 LOW COST BROADBAND IN RURAL AREAS

Rural areas of the developing world are the last frontier of the information technology revolution. Telephone and internet penetration there remains a small fraction of what it is in the developed world. Limited means of electronic communication with the outside world are just one source of isolation of rural communities and economies from the forces of national and global integration, albeit an important one. Without roads and electricity, the benefits of extending ICT access would be greatly diminished. Conversely, where these other elements of infrastructure are in place, those benefits can be multiplied.

The costs of ICT provision to rural areas tend to be higher than to more densely populated urban areas, and the ability to pay of potential subscribers lower. In recent years, a number of interesting experiments has been initiated to extend low-cost telephone and, in some cases, internet access to low-income rural communities.

5.1 Technology Options for Rural Broadband Access

The preferred technology, or technology mix, for providing low-cost broadband access will vary with local conditions. In any case, even using the lowest-cost technology available, cost of access provision is certain to vary across locations depending on the degree of remoteness from the backbone network and central node, user density and clustering, and the type of service and traffic. The major transmission technologies are discussed, along with their strengths and weaknesses in specific contexts. Then, access devices are briefly discussed. The purpose here is simply to provide some guideposts that may assist decision makers in weighing the relative attractiveness of different technology solutions in specific circumstances, not to offer a "one-size-fits-all" solution, which does not exist. In this area, technologies are evolving rapidly, so what looks attractive technically and financially today may appear less so in a few years' time.

5.1.1 Transmission Technologies

There are several options for signal transmission. There are at least two segments of transmission that need to be considered separately: long-haul transmission from a central exchange, usually located in a city (serving roughly between 100 and 10 000 subscribers) — the "last 100 miles" — to an access distribution point node (serving roughly between 10 and 100 subscribers); and the local-loop transmission from that distribution point to the end-users — the "last mile". A major investment component in rural networks is for the former, and the most important alternatives for these "backbones" are:

- *Terrestrial access*, usually via copper cable; a faster, higher capacity but also more expensive option is fibre optic cable.
- *Satellite access via VSAT* ("Very Small Aperture Terminals", which can be used for one-way or interactive communications via satellite). This involves either leasing capacity on other countries' satellites or launching one's own. Banks in remote areas of Brazil are currently linked via VSATs; the National Stock Exchange in India links brokers via rooftop VSATs. Using satellite access then involves a choice between Geostationary Earth Orbit Satellites (GEOS) and Low Earth Orbit Satellites (LEOS). Whereas GEOS are strategically placed in the geostationary orbit, at an altitude of 22 300 miles above the equator, LEOS travel in a lower orbit, allowing for faster signal transmission but also requiring multiple satellites to cover the same "footprint" as a single GEOS.
- *Microwave systems*, which cut down on the cost of material compared to cable over longer distances, while limiting theft and maintenance problems. These are generally used as key components of wireless networks and require line-of-sight signal relay.

The relative costs and advantages should not be seen as mutually exclusive, with long-haul network sometimes including "mix-and-match" approaches. For instance, Bhutan has chosen such an approach, combining international connections via satellite with microwave connections between cities and "last mile" connections that are often established via cable.

Transmission Options for Connecting Rural Areas: Key Cost Elements and Technical Features

	Cable		Satellite			Microwave
	Copper	Fibre Optic	Leasing Capacity	Launching Satellite		
				(GEOS)	(LEOS)	
COST	• Lower than fibre optic cable • Lower than satellite in less remote locations	• Higher than copper cable • Lower than satellite in less remote locations	• Higher than terrestrial access in densely populated locations, lower for remote/ inaccessible areas: hilly terrain, archipelagos. • So far, invariably too high to make system commercially viable	• Higher than terrestrial access in densely populated locations, lower for remote / inaccessible areas: hilly terrain, archipelagos. • Cost of increasing bandwidth is high may require launching of new satellites). • Ongoing cost of space segment is high and difficult to determine in general terms. • Cost of launching a satellite into geostationary orbit up to 20 times higher than launching a LEOS. • Unlike LEOS, GEOS are continuously visible from any point within potential service area (ca. 40 per cent of Earth's surface). Hence fixed ground antennae need not be continually reoriented to track the satellite, thus avoiding computer-controlled tracking equipment.	• Higher than terrestrial access in densely populated locations, lower for remote / inaccessible areas: hilly terrains, archipelagos. • Cost of increasing bandwidth is high (may require launching of new satellites) • Ongoing cost of space segment is high and difficult to determine in general terms. • LEOS more expensive than GEOS, but cheaper to launch. LEOS receive antennae are comparatively cheap. • Unlike GEOS, LEOS are not continuously visible from any point within the potential service area. Hence, more satellites needed to guarantee that at least one satellite is always above a specific service area. • LEOS require more fuel in order to maintain altitude due to the stronger pull of the	• Lower than cable over longer distances: higher than satellite for the most remote distances.

	Cable		Satellite			Microwave
	Copper	Fibre Optic	Leasing Capacity	Launching Satellite		
				(GEOS)	(LEOS)	
					Earth's gravity	
Technical Advantages & Drawbacks	• Can carry medium volume of data	• Can carry comparatively high volume of data. • Speedier access than through copper cables.	• Can carry comparatively low volume of data. • Flexibility: once installed, can support a variety of applications (internet, data, video, audio, voice and fax). Adding new applications or even sites is easy. • Reliability: reduced risk of poor-quality phone lines or outages, which are widespread in developing countries. • Able to broadcast applications to hundreds of sites in one transmission. This includes audio / video broadcast for training, distance learning, information databases and software updates.	• Flexibility: once installed, can support a variety of applications (internet, data, video, audio, voice and fax). Adding new applications or even sites is easy. • Reliability: reduced risk of poor-quality phone lines or outages, which are widespread in developing countries. • High orbit: hence delay in propagation of signals (for telephone conversations, this may cause problems through delays in voice transmission).	• Flexibility: once installed, can support a variety of applications (internet, data, video, audio, voice and fax). Adding new applications or even sites is easy. • Reliability: reduced risk of poor-quality phone lines or outages, which are widespread in developing countries. • No transmission delays.	• Reduced danger of theft and maintenance problems compared to cable. • The longer the distance, the greater the danger of • outages due to microwave repeater failure. This requires considerable maintenance.

At the local level, these backbones can then be linked either to land-line-based local loops (which can be costly in low-density rural areas, though single-pair overhead cables have only a fraction of the installation cost of underground copper cables) or wireless systems — whether wireless local loop (WLL) or mobile cellular. Unlike the latter, the former do not generally allow roaming, though they may at a cost in terms of bandwidth or signal attenuation. The use of CDMA technology permits fixed-WLL systems to accommodate a much larger number of subscribers in a given bandwidth than can most other wireless transmission technologies. WLL systems connect subscribers to the network using radio signals rather than wire to complete the “last mile”; they are often implemented as network extenders by the main fixed-line service provider (still in many cases a state or quasi-state monopoly). WLL has some major advantages over “wired” end-user access, but also some significant drawbacks. WLL is considered a highly promising technical option for low-cost telephone access in the rural areas of developing countries. WLL projects have been set up *inter alia* in Bolivia, the Czech Republic, Hungary, Indonesia, South Africa and Sri Lanka (ITU, 1998).

The advantages of WLL over landline “last mile” connections apply to mobile cellular as well. The cellular technology standard so far used in the main rural broadband access schemes, in particular the Grameen Village Phone system, is the Global System of Mobile Telecommunications, or GSM. Whereas three to five years ago, GSM was not very economical, its costs have fallen significantly in many countries as a widening installed base has given rise to economies of scale. Unlike WLL, mobile systems require no installation in premises. GSM can offer low-speed data applications like WAP, and GPRS is available at higher cost for higher-speed applications (it is a migration step to third-generation, or 3G, mobile phones). While more advanced “standards” such as UMTS (a full-fledged 3G technology) could provide greater bandwidth; they are very unlikely to replace GSM in developing countries in the near future since the cost of mobile phones would be prohibitive, transmission technologies would need to be adjusted or replaced, and micro- or pico cells would be needed to provide greater bandwidth.

Besides combining cable TV and internet access, it is also possible to deliver telephony over the internet, which could eventually do away with the need for “phone only” connections in all locations where the internet is available. Where the equipment for internet access is not available, however, its installation cost still poses a barrier, especially to low-income households. This alternative is particularly attractive for long distance phone calls, as the cost of an “internet phone call” is determined by the time spent connected to the local internet service independently of the distance between the two communicating parties. Again, this assumes that the user can establish access an internet service provider via a local phone call, which is not always the case in rural areas of the developing world. (The reasons for the dramatically lower cost of internet telephony include greater economies of scale through the shared and decentralized administration of the global internet infrastructure, as well as internet telephony’s better ability to maximize the use of available bandwidth.)

Phone access alone remains considerably cheaper than access to the internet, so that for poor households internet phone access will probably not be an attractive option in the near term. Central to the decision of whether to establish phone access alone or internet-plus-phone access is a calculation of the net costs after the higher up-front costs of establishing internet connectivity and the monthly charges for maintaining it are compared to the lower recurring costs of the phone calls. It should, however, be borne in mind that the internet may make phone calls cheaper even where neither the calling nor the receiving party has access to the internet — simply through a network of gateways between the internet and the telecoms network, with the internet thus functioning as a low-cost connection between two, possibly remote, high-cost local telephone networks.

5.1.2 End User Equipment Choices for Internet Access

A key question concerning internet access in rural areas is what sort of user interface offers the best technical solution at an affordable price. Are personal computers (PCs) or some other type of device preferred? Here again, different circumstances may dictate different choices. The case for PCs is that they can simultaneously be used for a variety of other “non-communication” purposes (word processing, spreadsheets, etc.).

The case against them rests on *i)* their cost and *ii)* their power and maintenance requirements relative to alternatives. The installation of multimedia user terminals (in a price range of $300-500 per terminal) can be an effective way of providing access to internet and multimedia services. E-mail, voice and video communications are becoming available through such non-traditional devices. Another such device is the personal digital assistant (PDA), whose technology is being merged inexorably with that of the mobile phone. These new devices, while still very expensive compared to a simple mobile phone, are cheaper than most PCs — and certainly than the laptop variety.

Moreover, there is no reason not to expect prices to experience the same steep declines as with earlier generations of mobile telephone and computer technology. The main constraint in using such devices in rural areas of the developing world is likely to be bandwidth limitations of mobile telecoms networks. The same constraint makes accessing the internet via a PC and a dial-up modem connection extremely slow and potentially costly for anything more than simple applications like e-mail.

E-mail-only appliances allow users to send and receive e-mail (albeit normally without attachments). In order to have e-mail access via a standard PC, the user requires a hard disk drive; needs to install e-mail software; has to configure connectivity options such as the dial-up access number; must boot up the hard drive every time he wants to establish access; needs to connect to a phone line (for the case of dial-up access, which is still widespread in developing countries) and disconnect once the e-mail has been sent. E-mail-only appliances are frequently much less complicated. They often dial up the e-mail provider at the touch of a button and automatically disconnect once an e-mail has been downloaded. Hence, e-mail-only appliances could be used in rural areas where low cost and minimal bandwidth usage are paramount concerns.

The Indian “simputer” is somewhere between a PDA and a PC, though closer to the former than the latter. Like a Palm Pilot®, the Simputer® includes a touch screen interface that does away with input devices like a mouse or keyboard. It uses a standardized interface language called IML (Information Markup Language). Thanks to these and an icon-driven interface, a high level of computer literacy is not essential for using the device. At a minimum, all it takes is the ability to point and touch an icon on screen with a stylus. The simputer is also designed to withstand the harsh environmental conditions found in rural areas of the developing world. Initial target markets are government offices and private companies. It is still too early to know how it will fare in the marketplace, especially in the face of competition from low-cost PDAs.

An additional advantage of such simple solutions is that they might make it easier for rural inhabitants to learn how to use the internet (if only limited features) by doing away with the need for PC management skills. Another expected advantage would be lower lifetime maintenance costs and slightly lower power requirements per unit. This should be weighed against the fact that in many locations — especially in many tele-centers — there is also demand for “traditional” use of PCs, e.g. for word processing or work with spreadsheets. In this case, PCs are likely to be the preferred option. Generally, however, there is nothing to be said against mixing e-mail-only appliances with PCs. The installation of several e-mail appliances for less than the cost of an additional PC can help meet the demand for email access while freeing up the limited number of PCs for “PC-only” tasks.

To reiterate, the choice of technology for rural access provision needs to be made taking into account the specific circumstances of the project in question, with the main criteria including the type of service required, the likely amount of traffic, user density, and the average distance of users from the central node. While generally a cable backbone–WLL combination seems attractive, this might be less appropriate in larger countries with considerable distances (where establishing the cable backbone would hence incur high costs). Assuming government covers the fixed costs, particularly remote locations might call for a VSAT–WLL combination. The same holds for locations that are not necessarily remote but where the geographic givens (e.g. mountainous or archipelagic terrain) make the establishment of cable or microwave connections difficult.

Finally, the wireless option can be attractive for the local loop in developing countries, given the ease of expansion of the network. For medium-density rural areas, mobile cellular systems are likely to be cost-competitive, since the existing GSM network infrastructure can be expanded relatively easily. The same could be said for fixed-WLL, *viz.* where extension of the landline network via WLL should be possible at relatively low cost in medium-density rural areas. Still, most poor people in rural areas of the developing world cannot afford to become individual subscribers to telephone services, whatever the technology — assuming access is available — and will continue to rely on shared access models like those described in the previous section. For these, especially in low density rural areas, it may well be that fixed-WLL is an attractive solution, depending on remoteness. While the VPP program demonstrates that GSM can be made profitable in low-income areas, the rural areas served until now could be characterized as medium- to high-density ones not far removed from urban centers, so extension of an existing GSM network has been possible.

Relying on the existing cable TV infrastructure may be an option where this is already extensive, as in India. This could significantly lower the up-front costs of establishing connectivity. It is possible to use cable TV connections to provide internet as well as phone access, a service that is currently already offered in several OECD countries. Cable TV provides considerably higher data transfer speed than standard telephone lines. Presently, roughly 30 million Indian households (about 15 per cent) have cable TV access, a much higher penetration rate than for telephones. According to Digitalpartners.org, a non-profit organization aiming at developing market-based technology solutions for the poor, this expansion can be attributed to very low monthly subscription fees of Rs. 60-150 ($1.28-3.20), an active second-hand market for low-cost televisions, and an explosive growth in the number of small-scale entrepreneurs providing cable service, whose costs are far lower than those of the corporate sector.

Indeed, in India, cable services are among the cheapest in the world, cheaper than telephone service. To provide internet access via cable TV, however, requires the operate to make a substantial investment (in the range of $45 000 to $100 000 in India) in a cable modem terminator system (CMTS), which the small entrepreneurs cannot easily afford, while the cable modem installed at customer premises ranges in price from $275 to $330 and monthly charges for households are around $20 — far beyond the means of a poor household.

Source: OECD DEVELOPMENT CENTRE: PROVIDING LOW-COST INFORMATION TECHNOLOGY ACCESS TO RURAL COMMUNITIES IN DEVELOPING COUNTRIES By Georg Caspary and David O'Connor

Case Study: ICT Access for Rural Communities in Bhutan

Bhutan, a landlocked country, far from regional markets, with no major industries, and few export products, has everything going against it in a traditional economic model. It is physically away from opportunities, knowledge and information than many other countries. Thus, the need for ICT and its use are very large, as are the associated potential benefits.

Bhutan Telecom (BT) has expanded the national network to provide services to some rural areas. However, as about 80% of the people still live in rural and isolated areas depending on subsistence farming, rural teledensity is less than 1%. The very low teledensity in rural areas calls for the need to establish mechanisms to bridge the gap between the rich and poor, the information 'haves' and 'have-nots', the urban and rural.

The main factor that has aggravated the Digital Divide in Bhutan is the **huge amount of capital investment required** to extend ICT services into rural and underserved areas, at very low commercial returns. Harsh geographical terrain and sparsely distributed population pose additional hurdles. Lack of stable commercial power supply, in rural and isolated areas, escalates project costs, as solar power supply systems need to be deployed at repeater and terminal sites.

Demand, however, for ICT services in the rural areas is ever increasing. The new rural population realizes that the three basic infrastructures required for balanced development are motor roads, electricity and access to ICT. It is thus likely that demand would far exceed planned forecasts.

The Rural Plan 2000 envisaged coverage of 90% of the rural villages. The plan proposed deployment of DRMASS, as this technology was widely used in Bhutan then and BT employees were familiar with its installation, operation and maintenance. However, this technology was becoming obsolete and the manufacturer discontinued further production of such equipment. BT therefore had to study the possibility of deploying various technologies for rural connectivity, including the widely acclaimed and rapidly evolving wireless Internet Protocol (IP) technology, which supports both voice and data.

BT has satisfactorily deployed VoIP over wireless technology in two geographically distinct sites in Bhutan during 2002, as a pilot project. There is continuing project called "ICT infrastructures project" utilizes the findings of the pilot project and will complement the Rural Plan 2003 through building ICT access infrastructures to serve 10 more rural communities including schools, by way of extending the VoIP component of the Rural Plan being implemented by BT. Thus, the project will build upon the resources that will be in place through the Rural Project.

Technology Choice

Facilitating ICT access to rural and remote areas is a challenging task. Making the right technology choice is a much more difficult task. A feasible and future-safe technical solution must emphasize scalability, cost-effectiveness and a choice of vendors offering compatible equipment. Furthermore, the solution should provide adequate reliable connectivity capabilities for both voice and data.

Rural Bhutan is characterized by settlements dispersed over wide areas across mountains and narrow valleys. Thus, wireline telecom is not a feasible option. BT has successfully integrated and tested multi-vendor IP (packet) radios on a pilot basis at two geographically distinct sites in the country and found it feasible for satisfactory rural connectivity.

The wireless IP-based technology is a forward-looking technology and promises to be the most cost-effective for rural communications. This technology utilizes packet radio as the transport mechanism (using repeaters) to deliver services. The low power requirements and falling costs of wireless IP-based equipment make this ideal for multiple repeaters. IP is run over this infrastructure to provide voice and data services to rural and isolated areas.

IP over wireless infrastructure for rural communications is being tested in many parts of the world with the cooperation of the ITU. Advantages include:

- Global trend towards IP and IP-based networks;
- Ability of the network to carry both voice and data effectively;
- Low power consumption of wireless IP-based equipment making them ideal for repeaters;
- Faster rollout times;
- Lower maintenance costs;
- Greater network flexibility and scalability;
- Cost-effective for rural deployment;
- Wirelines extendable up to 7 km from the nearest wireless access point;
- Possibility of remote network management; and
- Power saving mode features.

Source: ITU Project document: Project of the Royal Government of Bhutan

6 EV-DO

Evolution Data Only or **Evolution Data Optimized**, often abbreviated as **EVDO**, **EV-DO**, **EvDO**, **1xEV-DO** or **1xEvDO** is a wireless radio broadband data protocol being adopted by many CDMA mobile phone providers in Brazil, Japan, Korea, Israel, the United States, and Canada as part of the CDMA2000 standard. 1xEVDO is pronounced "One Ex-E:- Vee-Dee-Oh." It is commonly referred in the industry as DO (Dee-Oh). Compared to 1xRTT networks currently being used by operators, or the GPRS and EDGE networks employed by their GSM competitors, 1xEV-DO is significantly faster, providing access terminals with download speeds of up to 2.4 Mbit/s. Only terminals with 1xEV-DO chipsets can take advantage of the higher speeds.

It should be noted that 1xEV-DO is not part of the cdma2000 roadmap, since the architecture is not dependent on a switched voice network to operate. Instead, the 1xEV-DO standard can be found in IS-856. The initial design of 1xEV-DO was developed by Qualcomm and Lucent in 1999 to meet IMT-2000 requirements for greater than 2 Mbit/s downlink for stationary communications. Initially, the standard was called High Data Rate, and renamed to 1xEV-DO, Rev. 0 after it was ratified by the ITU. When deployed with a voice network, 1xEV-DO requires a separate radio channel of approximately 1.25 MHz. A successor to 1xEV-DO is planned for deployment in 2006 and 2007, and is known as 1xEV-DO Rev A. Rev. A offers fast packet establishment on both forward and reverse link, along with air interface enhancements that reduce latency and improve data rates.

A competing standard called 1xTREME was offered to the ITU by Motorola, Nokia, and Texas Instruments. This standard was ratified by the ITU, and placed into the evolution of CDMA as cdma2000 Rev. C and Rev D. This standard became known as 1xEV-DV, for Evolution-Data/Voice, since the channel structure was backwards with IS-95 and cdma2000, allowing an in-band network deployment (1xEVDO requires an overlay network when deployed in mixed mode.) It should be note that from both a technical and financial perspective 1xEV-DV was more attractive to operators, as the capital spent for the network deployment and management of disparate 1xRTT and 1xEVDO networks is both significant and difficult. However, the equipment was not available for 1xEV-DV in time to meet market demands, so wireless operators instead deployed 1xEV-DO service instead.

With the dual announcement of Verizon and Sprint's deployment of 1xEV-DO in 2004, and similar announcements by smaller operators in 2005, Qualcomm in March of 2005 suspended development of 1xEV-DV chipsets, and focused their efforts towards improving the 1xEV-DO product line.

7 Case Studies on Broadband Applications

Voice and Mobile Computing

The tech industry's leaders have been promising ubiquitous computing for more than a decade, but only now is it feasible for tens of millions people. The rise of the Internet and world standardization on wireless broadband technologies laid the foundation. A hot topic now is the blending of mobile and fixed-line communications. The next-generation cellular networks and the ability to switch to Wi-Fi access on the fly let mobile workers connect anywhere.

The big advantage of the phone-based network over Wi-Fi is that it is available wherever cellular service exists. By including software that allows for easy switching between Wi-Fi and cellular connections, anybody can switch with one or two clicks. Samsung, Motorola, LG, and others will offer phones that switch seamlessly between cellular networks and corporate Wi-Fi connections later this year. Voice calling is becoming just like e-mail or instant messaging – an application that comes free with your broadband service.

With the faster speeds of 3G, mobile operators like DoCoMo in Japan are beginning to be able to offer these solutions to their corporate customers. For instance, it is offering a handset that combines a cell phone with Wi-Fi. So when employees are in the office, they will have a Wi-Fi connection to the fixed network. But once they go outside, they will have access via our mobile network with the same phone

Source: BusinessWeek July 25,05

Mobile Broadcasting in South Korea

Video-on-the-go has long been a dream of cell phone companies worldwide. Carriers have spent the better part of a decade building networks capable of carrying fast video streams. But just as those networks are starting to work well enough that consumers might actually want to tune in, new technologies are emerging that could steer eyeballs away from the services.

The new systems will allow broadcasters to beam programming to tine screens on the move, using technology akin to today's TV rather than more expensive cellular networks. One of the most promising, *Digital Multimedia Broadcasting* – or *DMB* for short – will soon go live in South Korea. On Mar. 28 Seoul awarded licenses to six broadcasters who will start DMB programming by mid-summer. Mobile consumers will be able to watch everything on cellular handsets equipped with special chips, which Korean giants Samsung Electronics Co. and LG Electronics Inc. have started producing. Once the rollout is underway, the Korean researchers who developed the technology hope to persuade Europe to adopt it before next year's World Cup soccer competition in Germany.

The state-funded Electronics & Telecommunications Research Institute (ETRI) spent $40 million developing DMB over the past three years. ETRI expects mobile video receivers to become a $35 billion annual business globally by 2010.

The state-funded Electronics & Telecommunications Research Institute (ETRI) spent $40 million developing DMB over the past three years. ETRI expects mobile video receivers to become a $35 billion annual business globally by 2010.

The combo of TV and cell phones makes sense. While some of the 11 million receivers ETRI expects Koreans to use by 2009 will be handheld TVs and car-based units, the vast majority will be integrated into phone handsets. That's because they already have the most important component: a screen.

However, DMB isn't the only technology out there. Nokia is pushing a standard called DVB-H (for Digital Video Broadcasting-Handheld) that has wide industry backing, while Qualcomm has its own version, MediaFLO. Samsung has also developed a DVB-H phone. One big advantage of DMB is that it is hitting the market roughly a year ahead of Nokia's and Qualcomm's initiatives. And DMB is based on an existing European standard for digital radio, so European broadcasters will be able to add video at relatively little extra cost, whereas DVB-H and MediaFLO would require allocation of new frequencies and more expensive investment. Cellular networks, meanwhile, weren't designed for the volume of data that broadcast video requires. ETRI researchers say DMB will free up expensive telecom pipelines for higher-margin data services such as music-on-demand or video phone calls.

Source: BusinessWeek April 18,05, by Moon Ihlwan in Seoul

8 Policy and Regulatory issues relating to Wireline Broadband

8.1 Competition Policy

Competition is the key to growth and innovation in telecommunications market. The creation of a competition policy, therefore, becomes important because it induces suppliers to become more efficient and to offer a wide range of services at lower prices. Appropriate competition policy can prevent imperfect competition, monopoly behavior and market failure and improve economic efficiency. The competition related focus of regulators is on established operators with market power. Two different types of government interventions are used to apply competition policy—*behavioral intervention*, in which a Public Authority attempts to modify market activity through regulation of a firm behavior, and *structural intervention*, in which the government actively intervenes in the market to effect the overall structure of the industry.

A difficulty for regulators is that broadband seems to be pulling together previously distinct markets, thereby changing the entire communications landscape. This converged market place now includes, amongst others, telecommunication providers, cable TV companies, satellite TV companies and ISPs. This makes efforts to ensure a competitive broadband market complex and highly dependent on the overall environment.

Convergence can increase competition by promoting inter-modal competition, but in certain circumstances, it can also reduce competition because multiple services can be provided over the same network. This may serve to strengthen monopolistic tendencies.

8.1.1 Ways to Competition

While market prices for broadband depend on many factors, there are three elements of successful markets that are common among successful broadband economies.

- **Competition via open access:** Prices invariably fall when DSL and cable providers are compelled to open up their networks to competitors. This process is sometimes called unbundling the local loop (ULL).
- **Strong competitive carrier:** While open access is a first step, the best way for prices to fall is when there is a competitive carrier with deep pockets which is strong enough to compete effectively with the incumbent.
- **Inter-modal competition:** In addition to competition within a sector, prices fall when several broadband technologies compete for the same customers. The existence of strong DSL, cable, wireless and metro Ethernet providers in a market will ensure prices remain low.

8.1.2 Case Study: Broadband Competition in Japan

Japan's immensely competitive market is also characterised by all three elements and has quickly become one of the world's leaders, boasting the lowest broadband prices in the world. Japan reached this milestone after Softbank Corp.'s Yahoo! BB entered the market and pushed ADSL market prices down 50 per cent on the local loop.

In addition to having open access and a strong competitor, Japan has inter-modal competition from a wide group of technologies including cable, DSL, fibre, and wireless services. The interaction of these three factors has had an astounding effect on broadband in Japan.

Mobile Broadcasting in South Korea

Until 2001, high-speed lines were available only from NTT. Then Softbank began offering broadband for about $22 a month-just over half what NTT was charging. Yahoo! BB's low prices and innovate services have made it a very strong competitive carrier. In the year following Yahoo! BB's entry in the ADSL market, the number of ADSL subscribers increased five hundred per cent (from 922'000 in Oct 2001 to 4'640'000 in Oct 2002). Not only did the number of subscribers increase, fierce competition led to faster broadband speeds, with ADSL speeds jumping from 1.5 Mbit in 2001 to 12 Mbit, and fiber speeds reaching 100 Mbit.

Early on, Softbank saw the potential of cheap phone calls. So in 2002, Yahoo! BB began including a free Net phone with its Internet service. From the beginning, its role was to stimulate the Japanese communication market. Then, in October, 2003, the government created a special area code-050-for Internet protocol phones and mandated that NTT connect calls to them. That was a turning point-suddenly people could use their IP phone like a normal line. Today, some 4.5 million people-95% of provider Softbank Corp.'s broadband customers-use the Yahoo! BB voice service. By 2009, some 27 million Japanese households will have Net phones, predicts researcher Gartner Japan.

Now, Softbank is trying to persuade broadband customers to add more profitable services. One hope is television, delivered via the same broadband lines. Last year, Softbank launched BBTV, which streams 24 TV channels for an extra $10 a month. While Yahoo! BB is the giant in the market, it faces growing competition. Some 3.5 million homes receive broadband and IP phone service from rivals, including NTT, No. 2 cell-phone carrier KDDI Corp., and a host of regional players. And Yahoo! BB's broadband, delivered via DSL over copper wires, may soon be eclipsed by higher speed fiber optic networks, with speeds of 100 megabits per second.

Source: BusinessWeek JUNE 27, 200, By Ian Rowley, with Hiroko Tashiro, in Tokyo

8.1.3 Case Study: Broadband Competition in Korea

Korea is one of the best examples of a well-functioning market because all three elements are in place to bring down prices. DSL suppliers all have access to Korea Telecom's (KT) local loop and have bid down DSL prices. Second, while KT remains the largest DSL provider, Hanaro Telecom was first to market with DSL and still has roughly one third of the market share. Hanaro's owners include major Korean companies such as LG, Samsung and SK Telecom. Korea also has multiple types of broadband available to most subscribers. Users can connect via DSL, Cable, LAN, satellite or WLAN. The combination of market dynamics has helped Korea develop a subscriber base per capita that is nearly twice the level of the next leading country in the world. This strong competition on all fronts has given Korea some of the lowest broadband prices in the world.

8.2 Regulating Access:

Competition has had profound effects on broadband markets, specifically in Korea and Japan and policy makers around the world can use competition regulation to help foster other successful broadband markets. While extremely important, this is not a simple task.

The concept of essential facilities is an important one in telecommunication regulation. They are defined by WTO (World Trade Organization) as facilities of a public telecommunications transport network or service that: 1. are exclusively or predominately provided by a single or limited number of suppliers, and 2. cannot feasibly be economically or technically substituted to provide a service. Local loop and local exchange switching are two examples of essential facilities. A telecommunication operator that controls an essential facility often has both the incentive and the means to limit access to the local loop, which causes the competition to suffer and the efficiency to decrease. In many countries, regulators have required incumbents to facilitate competition by providing local loops to competitors.

There has been much debate over what exactly constitutes the broadband market and different interests have different ideas. A common way to define a market is by the cross-price elasticities between goods. If a change in price in one of the goods significantly alters the quantity demanded of another good, both goods may be said to be in the same market. When viewed in this way, the market definition of broadband likely includes all high-speed Internet access, even though technologies, data transmission speeds, and providers may vary. However, it is worth noting that a broad market definition based on the number of potential providers does not imply that the market is truly competitive.

So, while different types of broadband (e.g. DSL, cable model, WLAN, etc) may be considered to be in the same market, governments often have regulations that do not apply evenly, or in a technologically-neutral manner. This is most evident with regulations imposed on incumbent telephone operators, who are often seen as dominant players. For example, some governments have mandated that incumbent telephone operators open up the local loop to competitors, in an effort to reduce the power of the incumbent and facilitate competition in the DSL market (unbundling the local loop). The view was that the cost of duplicating local loop investment could be considered to be a major barrier for companies seeking to provide services over a twisted pair telecommunications network. These moves have unsurprisingly met with great opposition from incumbent operators. While admitting they have control over the local loop, they insist the broadband market is much broader and that, in fact, they are not a dominant operator when other broadband options are taken into consideration. They point to cable and wireless providers as competitors in the full broadband market and argue that forcing them to sell access to competitors at regulated rates will reduce their incentive to invest.

The United States is one country where the incumbent operators have complained about the asymmetric nature of broadband regulation. Until 2003, the Federal Communications Commission (FCC) refrained from requiring open access to cable TV networks while requiring unbundled access to the local loop. However, the FCC recently reclassified broadband services provided over both the fixed local loop and cable TV networks as "information services", in effect removing these services from access regulation.

The broadband infrastructure gamble in the United States

The FCC has decided to rebundle the local loop for broadband over phone lines in an attempt to spur infrastructure rollout.

On 20 February 2003, the US Federal Communication Commission (FCC) ruled that incumbent local carriers no longer have to offer last-mile access to competitors over their networks. The ruling is an attempt to spur investment in next-generation networks such as fibre, with the reasoning that incumbent operators will be unwilling to make investments in next-generation networks if they are forced to sell access to competitors at wholesale rates.

The ruling is controversial, especially because it applies to the existing copper networks in addition to future network infrastructure. As a result, prices are expected to increase in the short term as the number of competitors in the market falls. This was highlighted by the FCC Chairman, who noted that up to 40 per cent of all DSL providers use line sharing inputs. He stated, "The decision to kill off this element and replace it with a transition of higher and higher wholesale prices will lead quite quickly to higher retail prices for broadband consumers".

Many successful broadband economies have achieved their high penetration levels precisely because of local-loop unbundling and strong competition. While the goal of encouraging investment in higher-speed networks is a positive one, many of the economies with unbundled local access are also leading the world in the development of high-speed fibre networks.

Source: FCC press release http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-231344A1.pdf

8.3 Maintaining competition

Regulation plays an important part in determining broadband supply, but competition policy alone will not ensure that there is true competition in the market. This is particularly relevant in developing countries where a single telecommunication supplier is often dominant. In South Africa, as one example, the monopoly of the incumbent operator, Telkom, officially ended in May 2002, but as of the start of 2003, there was still effectively no competition in the telephone market. A second national operator was only scheduled to be licensed by March 2003. In such cases, it would seem prudent for governments to consider alternative measures to introduce competition into the market.

In the broadband market, if there are no cable, fibre or wireless networks in place to compete with DSL, there may be a lack of inter-modal competition. In these cases, it would seem beneficial for the government to encourage the development of alternative broadband infrastructure. Governments could, for example, issue licences for alternative networks such as WLAN or fixed wireless and permit self-provision of these services. The development of wireless broadband technologies may gain further importance if laying cable or fibre networks is not feasible. Governments can aid this process through streamlining processes of allocating spectrum for wireless broadband as previously mentioned.

Looking to the future, as fibre to the home becomes a reality, it can be expected that a single supplier will control access to the fibre network. Furthermore, the high speed of fibre networks may preclude the availability of effective substitutes for fibre. In this event, problems with monopoly power will again be prevalent. However, in this case, the issue of asymmetric regulation (such as that between DSL and cable), cited as a drawback of unbundling the local loop, may not be as much of a problem if there is not a perfect substitute for fibre. Accordingly, regulators may eventually open access to these fibre networks as a way of effecting competition.

A further dilemma for policy-makers working to promote broadband is that even in areas where, on the surface, there appears to be inter-modal competition, individual consumers may only have one broadband option. DSL is limited by the distance from the central office to the premises. Cable is limited to residential areas with upgraded cable TV networks while wireless broadband is often limited to areas with line of sight connectivity. As such, while there may be many players in the market, they may not operate in the same geographical area. As a result, it is vital for policy-makers to clearly understand the structure of each market and to take appropriate steps to ensure their smooth functioning.

Even in areas where local loop unbundling has been implemented, the behaviour of incumbent operators can still often be viewed as stifling competition. One area where this is evident is in the fees they charge for access to the network. For example, line rental costs within Europe are similar among countries, but the initial one-off connection fees vary widely and can be high enough to reduce incentives for reselling ISPs. Another problem arises when wholesale pricing regimes of incumbents discriminate against smaller ISPs. Wholesale rates are often only attractive for extremely large purchases that would be available only to large service providers. In markets with small ISPs that tend to grow incrementally, these pricing regimes exclude effective competition. A possible solution to this problem is seen in the case of Korea, where the government worked to bring together multiple stakeholders to create Hanaro Telecom, an entity which is sufficiently large to rival the incumbent Korea Telecom

8.4 Conclusion

In summarizing this section on competition, it is worth considering the case of Korea where the broadband penetration is the highest in the world. There, competition exists through open access to the local loop as well as a high level of inter-modal competition. Furthermore, the competition environment is aided because Korea has a strong second player, Hanaro Telecom, which is able to take on the incumbent Korea Telecom. While it is difficult for countries to copy wholesale the policies of other countries which naturally have different socio-cultural conditions and markets, it is nevertheless worth noting that Korea has achieved success through having competition in multiple spheres.

9 Suggested list of issues for discussion

The following list presents a selection of potential discussion issues on Promoting Broadband: Issues on broadband that can be addressed from the perspective of participant’s own countries and backgrounds:

PROMOTING BROADBAND

1) What are the best ways for the private sector and governments to convince users that broadband is cost effective and necessary?

2) How can broadband technologies become meshed into culture, thus encouraging adoption and use?

3) What types of policies help create an environment in which broadband innovation thrives?

4) Are the killer applications for broadband destined to be for entertainment or communication such as voice? Are there other potential, viable applications such as distance learning, and business applications that could also drive broadband adoption?

5) How can broadband providers ensure consistent quality of service (QoS), necessary for video-on-demand, IP telephony, and other time-critical broadband applications?

FIXED WIRELESS BROADBAND / LOW COST BROADBAND / WiMAX

6) Which network technologies have been the most successful in expanding broadband access and are there others that show promise? (Digital subscriber lines (DSL), cable, fixed wireless, satellite, utility lines, wireless local area networks (WLAN), next-generation mobile networks)?

7) What are challenges in Wireless Broadband?

   a) From Economic perspective (i.e. economic model, pricing and billing plans between systems and operators)

   b) From Service perspective (i.e. service overlay network)

   c) From Technology perspective (i.e. standardization, interoperability, QoS, Security)

   d) From Regulatory perspective

OTHERS

8) How broadband can be effectively used for emergency communications i.e. disaster, terrorism, etc?

9) What role might ITU usefully play in promoting broadband? Outside of workshops and publications, are there other ways ITU can help promote broadband adoption around the world?

10) What should be the next step for the Regional Working Group to solve issues and to achieve promotion of broadband?