Broadband market in South Korea: What is behind its rapid development?

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ABSTRACT

Despite of the suffering from an economic crisis in 1997, broadband Internet access growth in South Korea had been remarkable. By December 2000, there were 19 million Internet users, 40% of the population, of which 3.96 million households were using broadband technology to access the Internet. This represents more than ten-fold increase from the previous year. This paper explores the phenomenal growth of broadband in South Korea. It analyses the key demand drivers and the key supply factors that made broadband such a huge success in South Korea. It also examines the possible reasons for the relatively slower broadband adoption rate in Hong Kong, Taiwan and Singapore.

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1.   INTRODUCTION

Before the National Association of Telecommunications Officers and Advisors 19th Annual Conference (September 17, 1999), the Chairman of US Federal Communication Commission made the following remarks: "The most important issue on our agenda today is broadband. This debate that we are having in our country about broadband – that we must have broadband – is an important debate. Broadband is going to change America in wonderful ways that no one in this room can predict, certainly not myself …Fundamentally, we want four things for consumers in the broadband world. We want fast deployment. We want ubiquitous deployment. We want competitive deployment. And we want open deployment."

Nevertheless, the called "four things" were actually better developed in South Korea, rather than in the US. Despite being hit by the financial crisis in 1997, broadband growth in South Korea has been remarkable. By December 2000, there were 3.96 million Korean households using broadband technology to access the Internet, a more than ten-fold increase from the previous year. In terms of percentage, broadband users make up 20% of Korea's Internet users as compared to 3% in the United States and about 1% worldwide (Shameen, 2000) or 26% of total Korean households (Korea Ministry of Information and Communication, 2001a) versus 9% of households in the United States (Broadband Intelligence Inc., 2001). For the 83 and fast growing number of Korean Internet Service Providers (ISPs) (Korea Network Information Center, 2001), broadband access will change their current competitive landscape and further advances in broadband technology will possibly bring about another revolution.

FIGURE 2-1
Korea Broadband Subscriber Growth
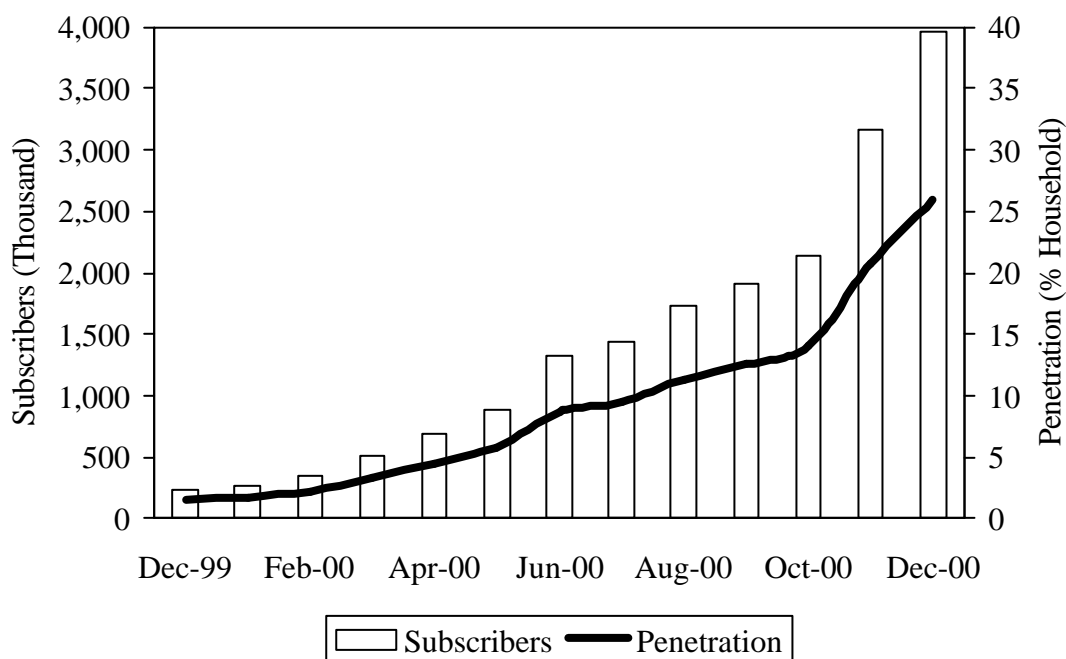
(Source: Korea Network Information Center, Hyundai Securities)

Based on a review of existing knowledge and in-depth field interviews with managers in the Korean broadband industry from both the government sector and the private sector, this paper explores the possible contributing factors behind the phenomenal growth of broadband in Korea. It analyses the key demand drivers and the key supply factors that made broadband such a huge success in Korea. It also examines the possible reasons for the relatively slow broadband adoption rate in Hong Kong, Taiwan and Singapore.

2.   OVERVIEW OF BROADBAND IN SOUTH KOREA

2.1   Broadband Technology

Broadband is Internet access at speeds much higher than 56 kilobits per second (Kbps) that narrowband typically provides via dial-up connection. According to the US Federal Communications Commission (FCC), it is defined as the ability to support a data rate of at least 200 kilobits per second (Gabel and Kwan, 2000). Broadband also has the advantage of being "always on". In this section, we will review different types of broadband technology used in South Korea, which are somehow different from the FCC definition.

2.1.1   Integrated Services Digital Network (ISDN)

ISDN is an international communications standard for sending voice, data and video over digital or normal telephone lines. It has been around for over a decade. It supports data transfer rates up to 128 Kbps (Webopaedia, 2001).

Several Asian telecommunication companies have invested heavily in ISDN and have been reluctant to abandon it for newer and faster technologies. An incumbent that is a monopoly or is overwhelmingly dominant will continue to promote ISDN because the market has no alternative. Conversely, in a liberalised market, competitive pressure forces reluctant operators to offer newer technologies.

In certain situations, telecommunication companies dramatically lower the price of ISDN while upgrading their networks for faster service. However, the market response to such measures has been lukewarm, as consumers are no longer satisfied with ISDN speeds. Despite of such negative reaction, ISDN is not completely dying out in Asia. It remains the technology of choice in many less developed markets, where operators face less competitive pressure (Pyramid Research, 2001).

2.1.2   Digital Subscriber Line (DSL)

Digital Subscriber Line is one type of broadband access that provides a dedicated digital circuit between a residence and a telephone company's central office, allowing high data transmission speed up to eight megabits per second (Mbps) over existing copper telephone lines. There are three categories: Asymmetric DSL (ADSL), Symmetric DSL (SDSL), and High-data-rate DSL (HDSL). Collectively, they are known as xDSL. Based on current Internet usage, ADSL is the most common form of xDSL. ADSL can provides approximately six times greater bandwidth capacity during download of data than uploads, making it more suitable and cost effective for consumer applications (Moy and Co, 2000).

ADSL is particularly suitable in Asia Pacific where the majority of people live in dense urban environments and is the leading broadband access type in Asia Pacific. In such types of environment, last-mile connections to homes or offices are typically within five kilometres (km). This is much shorter than in regions such as the United States or Europe. Given the good network coverage of most incumbent telecommunication companies, rollout of services can be very quick when demand exists. Korea Telecom (KT), for example, signed up 800,000 ADSL customers in less than a year since its launch in April 2000 (Chetham *et al.*, 2000).

2.1.3   Cable Modem

Cable modems are another avenue to access the Internet and they are designed to operate through cable television. A cable television system typically has 60 or more channels, most of which are used for cable television programming services. These channels can also be used to offer high-speed Internet access. Each channel offers 27 Mbps of downstream capacity and ten Mbps of upstream capacity, which is shared by a small geographic cluster of homes. Hundreds of cable modem users can surf simultaneously without any loss of performance. If speeds do start to degrade, the cable operator can allocate additional channels for service to boost capacity.

Cable modem services generally are far less developed than ADSL. In the case of Korea and Taiwan, it involves structuring complicated agreements between broadband access providers and the local cable antennae television (CATV) operators. Typically this means dealing with scores of local CATV operators, with the time-consuming matter of agreeing who pays for the cable upgrade and how revenue sharing is structured. However, the experience in Korea shows that this is workable. Operators such as Thrunet, Hanaro and DACOM have successfully put together delivery networks using a mixture of local CATV operations and a long-distance Internet Protocol (IP) backbone from fibre capacity leased from KT, DACOM or Powercomm, a subsidiary of Korea Electric Power Company (KEPCO).

2.1.4   Local Multiport Distribution Services (LMDS)

Local Multipoint Distribution Services is a fixed (non-mobile) wireless technology that operates in the 28 GHz band and offers line-of-sight coverage over distances of up to three to five kilometres and averages around 38 Mbps (downstream). LMDS is one solution for bringing high-bandwidth services to homes and offices within the last-mile of connectivity, an area where cable and optical fibre may not be convenient or economical.

In areas where neither fibre nor hybrid fibre-coaxial (HFC) networks exist, Hanaro offered LMDS service in Seoul in late July 2000. This was extended to five cities by October 2000. This service was targeted to serve the small and medium enterprises (SMEs) and residential customers at low-density multi-dwelling units.

Korea Multinet is another network operator using LMDS to offer high speed Internet access to its customers. This service is commercially deployed in Seoul, Pusan and Taeju but is limited to 500,000 subscribers in each city in the initial stage due to some technical constraints. DACOM has also launched broadband wireless local loop (B-WLL) service in Seoul during August 2000 (Yeo, 2000).

2.1.5   Satellite

There are currently three different types of satellites available for broadband: geo-stationary-earth-orbit (GEO), medium-earth-orbit (MEO) and low-earth-orbit (LEO). Satellite technology is appealing for sparsely populated places with little or no infrastructure, such as small islands or the countryside.

The rapid penetration of broadband Internet service has resulted in a huge growth in the demand for telecommunication transponders aboard Koreasat, Korea's broadcast and telecommunications satellite. KT and Samsung SDS are two ISPs that provide satellite Internet service in Korea. KT uses an up-link system called Proxy. Samsung SDS is planning to provide a new service with Hughes Networks Systems (HNS). In addition, Handok Communications announced its plan to enter into the satellite Internet service industry in alliance with KT in October 2000.

2.1.6   Other Technologies

In the face of constraints from both ADSL and cable modem services, ISPs in Asia are looking to other technologies to access customers. One of these technologies is Local Area Network (LAN). There is an increasing use of LAN, especially Ethernet, for delivering broadband to multiple homes and offices in a building. Another technology is Home Phoneline Networking Alliance (Home PNA). This is basically Ethernet technology adapted for use in the home or building. Initially aimed at the home networking environment, it allows Ethernet to run over normal phone cables rather than the thicker Ethernet cable. In Korea, this has been adopted as a low-cost, in-building access system. KT has about 330,000 customers using this service and DACOM and several smaller building-specific service providers are also offering it. Home PNA's key benefit is that it is flexible and easy to deploy and as a result users enjoy the cheapest broadband services in Korea.

2.2   Government Policy and Regulatory Overview

In its response to the financial crisis in 1997, the Korean government initiated and also accelerated several reforms to deregulate the telecommunications industry. Its purpose is to attract foreign investment and expertise to restructure the industry and to increase competitiveness among the local carriers. It realigned its information technology (IT) policy to be more aggressive while maintaining consistency in implementation. Another reason for the strong interest from the government in developing the country's information technology sector is to diversify Korea's economy beyond traditional bases such as automobile, textiles, steel, semiconductor, and shipbuilding.

2.2.1   Telecommunication Regulation Reforms

The government through the Ministry of Information and Communication (MIC) has been pushing with reforms and deregulation to spur infrastructure development and services growth. It has turned back on its strict ownership rules on all facilities-based and state telecommunication companies to raise foreign ownership from 33% to a maximum of 49%, except KT that stays at 33%. From 2001, foreign investors can also fully own value-added service providers.

There has also been a moderate level of liberalisation in the international facilities market. Three licensed international gateway operators: KT, DACOM and Onse Telecom are permitted to acquire indefeasible rights to use on international cables. International connectivity rates fell by 20% in first quarter 2000 due to a reduction in the connection charges that Korean facilities-based companies paid to their foreign counterparts (Teo, 2000).

2.2.2   Korea Information Infrastructure (KII)

Phase 1 (1993-1998) laid the foundation to build an advanced computer network over the existing telecommunication network. In phase 2 (1998-2001), a high-speed optical fibre backbone will interconnect computer networks with public switched telephone networks (PSTN) to upgrade the transmission speed to several gigabits per second. In densely populated residential areas and large buildings, fibre-optics cables will enhance the local loops for broadband access while satellite will serve the rural and remote areas. In phase 3 (2001-2005), the backbone networks will integrate and comprehensively connect wired, wireless, CATV and satellite to provide transmission speeds at terabits per second level (DACOM, 2001).

The cost of upgrading telecommunication networks under Cyber Korea 21 is projected at US$8.67 billion of which US$6.67 billion is spent on the backbone network and local loops and the remaining US$2 billion is spent on completely digitalising local exchange networks. The required funding comes from overseas depository receipt issuance, stock sales and loans through the effort of the telecommunication companies (Korea Ministry of Information and Communication, 2001b). A total of US$28 billion will be invested by 2010 (Korea Ministry of Information and Communication, 2001c).

2.2.3   Cyber Korea 21

Cyber Korea 21 is a 5-year blueprint by the Korean government to create a framework of a knowledge-based society and to improve its competitiveness and quality of life vis-à-vis that of advanced nations by 2002 (Korea Ministry of Information and Communication, 2001b). The three major objectives are: to expand and improve the KII (also known as Korea Information Superhighway); to create an efficient and transparent electronic administrative and database system that will integrate all government agencies into a national one-stop service, and thirdly to promote new businesses in electronic commerce by encouraging more ventures in Internet intermediaries and to simplify the complicated procedure of business start-up.

### 2.3   Broadband Market Overview

2.3.1   Subscribers

As of December 2000, Korea had 19 million Internet users, an annual increase of 75% from 1999. Out of these 19 million Internet users, 3.96 million were broadband subscribers. This translates to approximately every one household in four that has residential broadband access. As of March 2000, 62.6% of Internet users were male, 70.7% were below the age of thirty, more than 65% of students use the Internet, and 52.2% and 16.2% are college graduates and high school graduates respectively (Korea Ministry of Information and Communication and National Computerization Agency, 2000). 18 million users are said to have used the Internet more than once a week. The heavy users were in their 20s and teens, and almost half of the

surveyed users reported that they used the Internet an average of five to fifteen hours per week, with 22% said to have used the Internet more than 15 hours per week (Kim *et al.,* 2001).

According to a survey jointly conducted by the Korea Advertiser's Association and E-Trend, the Internet was superior to other mediums (television, radio, books and magazines) in terms of information (79.1%), practicality (63.8%), convenience (75.1%) and passing time (81.4%). Hence, the Internet has grown to become a dominant part of Korean lifestyle (Yeo, 2000). This could be one reason why Koreans spent so much time on-line to the point that it would be cheaper to use broadband access instead of narrowband, since the broadband access plans are for unlimited usages.

As a matter of fact, Koreans hold the world record for the number of times online, the number of unique sites visited, the number of page views downloaded, and the amount of time spent on the Internet per session and per month. Koreans use the Internet for 18.1 hours a month on average, compared to Hong Kong residents whose usage average 12.1 hours per month, and Singaporeans whose usage is 9.9 hours per month (Williams, 2001). In addition, Koreans are also heavy users of audio and video content on the Internet (Kim *et al.,* 2001).

FIGURE 2.1
Time Spent On Web

Average hours per month
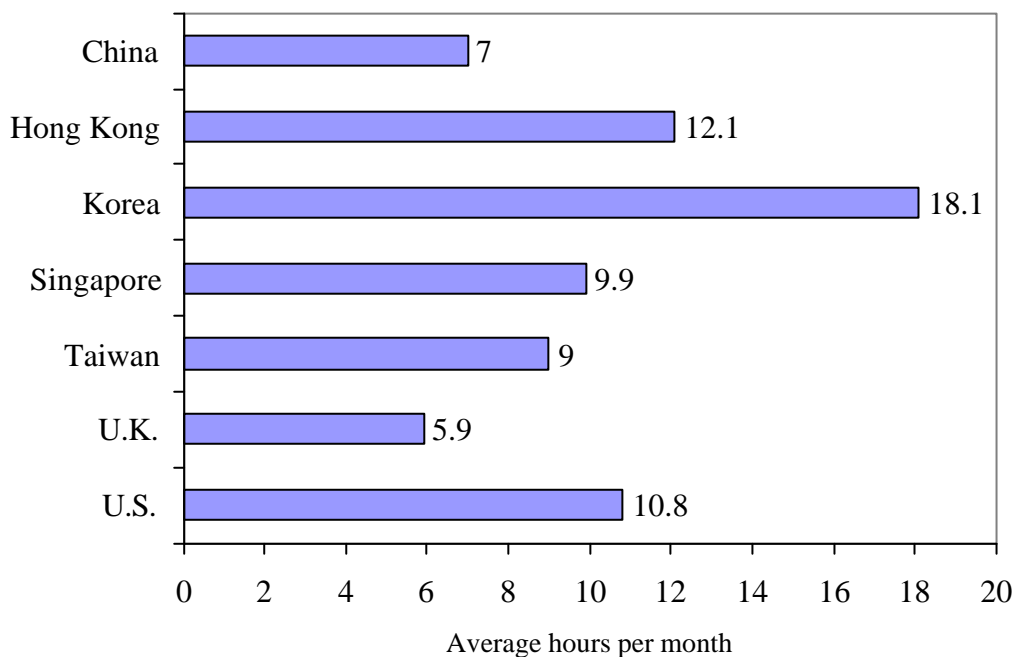
(Source: UBS Warburg, Netvalue)

2.3.2   Internet Facilities

PC cafes, which are equipped with broadband Internet and multimedia capabilities, totalled 21,460 at the end of 2000. However the growth rate has slowed down in large cities. In addition, over one thousand public PCs have been installed in Korea, mainly in Seoul. These PCs work like payphones and allow users to browse the Internet or to check emails (Yeo and Chew, 2001).

The MIC, Education Ministry, and KT have also paved the way for primary, middle, and high schools to get wired at no cost or reduced rates. All schools were connected to the Internet by the end of 2000 with Internet access at 256 Kbps provided free of charge (Yeo, 2000). This is a sharp contrast to the situation in the US and EU, where policy makers are still debating on how to finance an effective Internet connection (universal service, tax on interstate telecommunications carriers, or joint public/private initiatives, etc.; see Prieger 1998 and Kosmidis 2001).

2.3.3   Broadband Service Providers

At the beginning of 2000, there were approximately 30 access providers considering providing broadband service. By the end of June 2001, only three major broadband service operators emerged in the market with KT having the lion's share of 50%, Hanaro following next with 25% market share and finally Thrunet with 18% (Korea Ministry of Information and Communication, 2001d). All three are public listed companies with KT listed on the Korea Stock Exchange, and Hanaro and Thrunet listed on NASDAQ. All three major broadband operators have very similar pricing plans ranging from US$24 to US$35 per month with unlimited usage.

KT is the incumbent fixed line operator in Korea. With a near monopoly on fixed line last-mile connectivity in Korea, KT has the largest homes passed rate of 90%. Given its extensive last-mile coverage, KT has enormous advantages over its competitors. As it is not burdened with additional capital expenditure to build a last-mile network and need not share revenue with cable network owners, KT has the shortest payback period among broadband service providers (Suh and Lee, 2001). Despite entering the broadband market only in April 2000, after Thrunet and Hanaro, it is able to increase its market share substantially to become the dominant market leader. This is largely helped by its huge subscriber base, large fixed line network, nation-wide retail chain and an aggressive marketing campaign. Currently, KT offers a variety of broadband services with the most popular being ADSL technology and Home PNA.

Hanaro started out in the Korean market as a second-tier local telephony company. It commenced its ADSL service offerings in April 1999, mainly in major office buildings and apartments in four metropolitan cities including Seoul, Pusan, Incheon and Ulsan. Currently, its service coverage comprises some 88 regions covering 66 cities, including six metropolitan cities and 12 counties. Hanaro broadband services include ADSL, cable and LMDS technology. In areas where a HFC network is available, Hanaro will lease bandwidth from Powercomm's network. Otherwise, it builds its own HFC connections if there is sufficient scale (customer demand) to justify the investment. By the end of 2000, the network owned by Hanaro, and its affiliated system operators accounted for 48% of Hanaro's cable modem subscribers (as opposed to 29.2% in 1999), while the network capacity leased from Powercomm accounted for the remaining 52%, indicating that Hanaro is reducing its reliance on Powercomm. About 35% of Hanaro's ADSL subscribers are subscribing to Hanaro's bundled ADSL and local telephony service offerings (Yeo, 2000).

Thrunet became Korea's first broadband service provider when they introduced broadband service to users in July 1998. As Korea's largest cable broadband provider, Thrunet led the local broadband market until 1999 when Hanaro and KT entered the broadband market providing ADSL service. The better service quality and deep pockets of these ADSL operators

subsequently eroded Thrunet's market share to 19% at the end of year 2000 from 49% the previous year (Suh and Lee, 2001).

2.3.4   Broadband Platforms

ISDN was quite popular in the late 1999 and early 2000 due to its availability and reliability but it is slowly replaced by xDSL and CATV as the availability, reliability and quality of service of the latter two improved. The number of subscribers for xDSL began to overtook cable modem in February 2000. By December 2000, the market shares for ISDN, CATV and xDSL were 3.5%, 38.5% and 58.0% respectively.

FIGURE 2.2
Broadband Subscriber By Technology
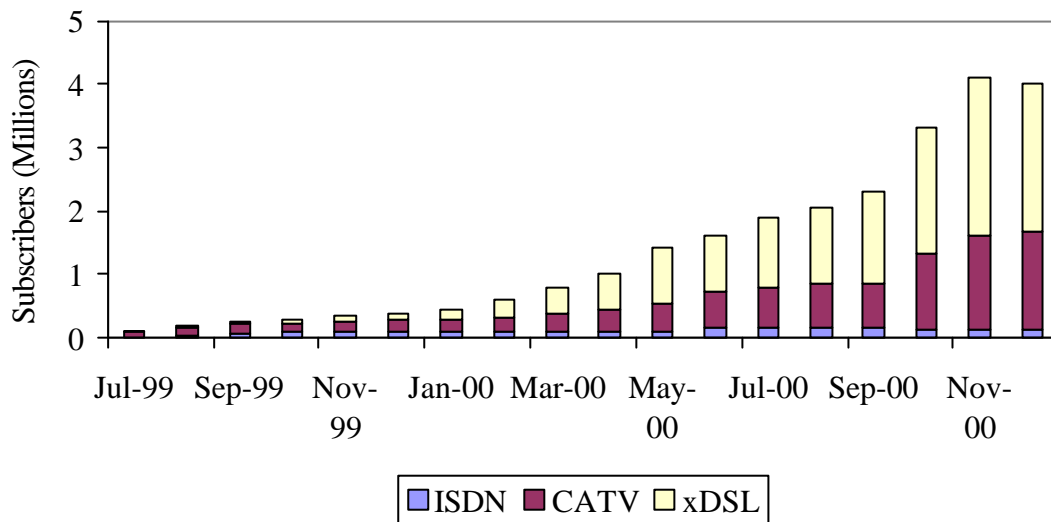
(Source: Korea Network Information Center)

3.   ANALYSIS OF KOREAN BROADBAND EXPLOSION

3.1   Key Demand Drivers of Broadband in South Korea

3.1.1   Relatively Cheap Pricing

In the fiercely competitive broadband market, operators have deployed aggressive marketing since its inception. At present, Korea's broadband rates are the lowest in the world. Korea broadband prices range from US$24 to US$35 per month with unlimited usage (Chetham *et al.*, 2000).

TABLE 3-1
Broadband Access Monthly Fee

Service	Advertised Speed (Upload/Download)	Monthly Fee (Won)	Monthly Fee (US$)
KT ADSL Premium	640K/8Mbps	40,000	35
KT ADSL Light	640K/1Mbps	30,000	26
Hanaro ADSL Pro	800K/8Mbps	39,000	34
Hanaro ADSL Lite	800K/1Mbps	29,000	25
Thrunet (cable)	10Mbps	38,000	34
Hanaro (cable)	768K/10Mbps	34,000	30
KT B&A	256K/1.5Mbps	28,000	24

(Source: UBS Warburg, US$1 = 1150 Korean Won)

The Korean experience has shown that absolute price alone may not be the only factor that drives demand but price relative to dial-up costs. With the relatively high price of the local call factored in, it very soon becomes more cost-effective for Koreans to switch to "always on" broadband services. That crossover point comes once when usage exceeds eight hours a month (Shameen, 2000). Since Koreans are among the heaviest Internet users in Asia, this suggests that Koreans are switching to broadband not just for faster Internet access but because it is cheaper.

3.1.2   True "Broadband" Access Speeds

In Korea, the typical broadband Internet access speed exceeds one Mbps. In cases of premium cable and ADSL service (e.g. Hanaro ADSL Pro and KT ADSL Premium), the access speed is eight Mbps or higher. With the widespread availability of high-speed connections, Korean Internet users are embracing multimedia-rich content quickly. The multimedia content here includes movies, songs, and videos in its entirety, not just trailers or snippets of the latest song or video.

Korea's major broadcasting companies (e.g. MBS, SBS, and state-run KBS) are not only airing their programs online but also offering video-on-demand, e-commerce, content development and Internet portal service. According to Korea Internet Broadcasting Association (KIBA), there was an audience of one million for 300 webcasting sites in February 2000 (Hwang J.J., 2001).

3.1.3   Catalyst Effect of PC Rooms

PC rooms were introduced in 1998 in Korea. Equipped with high-speed broadband access that is necessary to provide multimedia content, PC rooms have the characteristics of both video arcades and Internet cafes. These PC rooms have proven to be very popular in Korea, especially among Korean youths and have sprouted up in many places, giving users their first taste of broadband speed and multimedia content. This has created pent-up demand for broadband access, which has in turn accelerated the diffusion of household broadband access once domestic Internet operators launched their broadband services.

3.1.4   Cultural and Social Aspects

Koreans in general share a homogeneous culture, largely due to the mind-set of "keeping up with the Jones". This also explains why most Koreans exhibit similar consumer behaviour and adoption rates toward mobile phones and the Internet. Koreans in general also have a tendency of being hasty and constantly in a hurry. This "pali-pali" [1] culture has fuelled a social atmosphere that embraces computers and the Internet.

There is a strong emphasis on education in Korea and broadband has become a very essential tool in education. It is common for school assignments that require students to access the Internet to search for information. With Internet literacy perceived as a basic skill, it is not surprising to see the extent that Korea has embraced information technology and the Internet more passionately than most (Nastic, 2000).

3.1.5   Tech-Savvy Population

Korea has a well-trained and literate workforce. The illiteracy rate is less then 1%, and 25% of high school graduates go on to four-year colleges (Bremner and Moon, 2000). There is also a high-tech focus that has contributed significantly to the economy. This has in turn developed a technologically sophisticated market where the consumers are early adopters of technologies (Yeo, 2000). A society that is savvy with technology and has a high percentage of PC ownership has led to an environment where consumers are receptive to broadband access. Being avid Internet users, consumers understand and appreciate the benefits that broadband access can bring.

3.1.6   Popularity of Online Games, Chatting and Stock Trading

The explosive growth of online games, notably Starcraft by Blizzard of the United States and Lineage by NCSoft of Korea, has fuelled the phenomenal take-up of broadband services in the residential sector (Korea Herald, 1999).

A January 2001 report by Netvalue revealed that 65% of all Internet users in Korea visited online game websites as compared to approximate 10% rate recorded for the rest of Asia (Boasberg, 2001). Korea is also the leading market for streaming media, recording the highest use of audio and video Internet content in the world, with 69.2% of Internet users accessing this content. This usage is almost twice the amount seen in other markets (IT Singapore, 2001).

In addition, other Internet applications such as chatting and Internet stock trading have also contributed to the growth of broadband in Korea. The volume of online stock trading accounted for 69% of total stock transaction in June 2000 (Korea Ministry of Information and Communication and National Computerization Agency, 2000).

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[1] "Pali" is a Korean word which can roughly translated as "quick" or "hurry up", personal communications with S. Rhee and S.B. Chung.

FIGURE 3-1
Percentage Of Individuals Using Audio And Video Content

Average Hours per Internet user per month
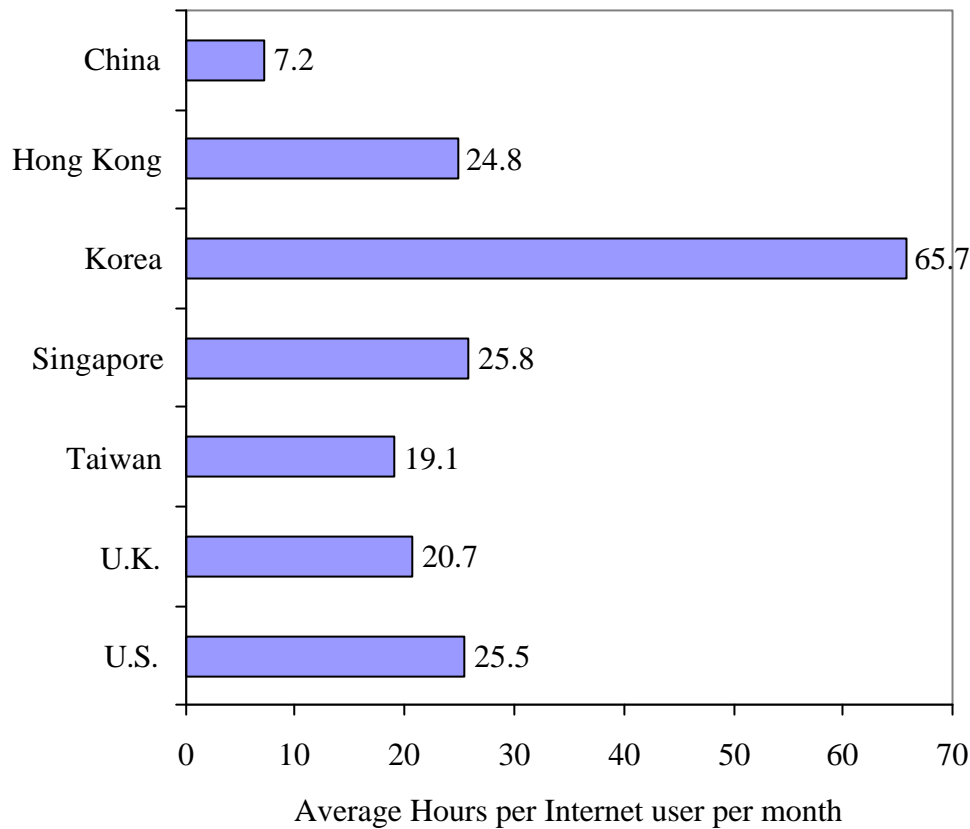
(Source: UBS Warburg; Netvalue)

3.2   Key Supply Factors Of Broadband In Korea

3.2.1   High Density Dwellings

The concentration of high-density dwellings in urban areas hastened the rollout of broadband services in Korea. From the 1999 census, about 46% of the Korea's 46.9 million population live in six major cities or provinces: Seoul, Pusan, Taeju, Incheon, Taejeon, and Kwangju; each with a population density of 17,045, 5,053, 2,842, 2,633, 2,711, and 2,535 persons per square kilometre respectively (Korea National Statistics Organization, 2001). The availability of such high-density residential areas has made it easier for operators to install fibre or cable networks and to deploy ADSL or cable networks promptly and cost-effectively. In KT's case, 90% of Korea's total households are within a four-kilometre radius of its branch offices, which makes ADSL broadband access possible.

3.2.2   Favourable Regulatory Environment

In Korea, all types of broadband access technology are permitted, and the regulation body permits effective competition. The introduction of strong competition has driven the incumbent telecommunication operators to rapidly deploy broadband access services, despite the threat to traditional service revenue streams and their legacy network investments. Every player

has been aggressive not just in rolling out the services but also over price, with profits being traded for market share.   Operators have also begun providing services through several technologies, each servicing a different segment of the market. In the case of KT and Hanaro, they have bundled their voice services with Internet access and broadband service.

3.2.3   Infrastructure In Place

Korea's broadband infrastructure can also be considered the result of a historical accident. Power utility KEPCO, through its subsidiary Powercomm, had developed a huge network of fibre-optic cables for its own use but was only utilising 10% of the capacity. When the cable television market was liberalised in 1996, there was a proliferation of small operators who used Powercomm's lines and added the last-mile to subscriber's homes. Broadband access providers were able to lease the lines cheaply and roll out their own services (Shameen, 2000).

3.2.4   Advanced National Backbone and Intra-city Fibre Network

A broadband subscriber access network that lacks capacity in its intra-city (metro-rings) and backbone networks would lead to network congestion, which will in turn result in users experiencing poor download speeds. In addition, service providers need to provide sufficient bandwidth on their backbone networks to cater for content that is based outside the country. However, Korea has reasonable international connectivity and exceptional domestic connectivity.

Its international connectivity has been enhanced by the deployment of the China-U.S. submarine cable. Currently, there is about three gigabits per second (Gbps) of U.S.-Korea Internet capacity installed, and this is expected to at least double every year as more cables are installed. In addition, Korean operators have access to regional links. For example, DACOM is currently the leader in Korea with 240 Mbps of regional capacity (Kim *et al.*, 2001).

In terms of domestic connectivity, Korea has six nationwide fibre networks (KT, DACOM, Thrunet, Powercomm, GNG and Dreamline/Korea Highway Corp) and currently five major ISPs with 2.5 Gbps IP Networks (KT, DACOM, Thrunet, Hanaro and Dreamline). The L21X exchange in Seoul now has more traffic than the MAE-East, the largest public exchange in the U.S.

3.2.5   Maximal Ownership of Network

An important factor in the successful deployment of a broadband network is the ownership of the network. It is advantageous for an operator to own as much of its network as possible. Otherwise, it cannot directly address the quality of the network at all levels and its ability to provide advertised broadband connection speeds on a consistent basis is weakened. This can potentially affect their quality of service and customer satisfaction. In the first half of 2000, Thrunet experienced strong subscriber growth that exceeded network capacity, resulting in a significant deterioration of service for Thrunet.   As Thrunet leases its bandwidth from Powercomm and does not own the network, it was unable to expand capacity to accommodate more users. Thrunet had to wait for network owner Powercomm to undertake additional cell splitting to increase capacity. Though the issue was rectified by the second half of 2000, the overall reputation of cable modem operators took a hit (Suh and Lee, 2001). The current top two broadband service providers, KT and Hanaro, both own all or a substantial part of their network and this ownership has contributed significantly to their successful broadband deployment.

3.2.6   Critical Subscriber Mass

A critical subscriber mass and a reasonable content fee structure is also important in the growth of broadband in Korea. This would create an environment where the operators and content providers can make reasonable returns on the provision of a high quality service with a range of attractive content. Presently, smaller and poorer markets are likely to find a lack of sufficient content to drive usage.

3.2.7   Government Policy

Government policy has been a crucial factor that helped define the broadband landscape in Korea. Its approach has provided the overall framework under which development takes place. In addition, the Korean Government has continually adopted a consistent IT policy direction based on competition, innovation and what it calls "informatisation". A high priority has been placed on appropriate infrastructure and the foundation for a knowledge-based economy and society. State-owned firms have been told to make 50% of their purchases online by 2001, and all government procurement will be on the Internet by 2002 (Nastic, 2000).

The government has also begun to certify and rate both commercial and residential building projects based on the level of high-speed Internet access. This initiative allows real estate owners to charge more if they provide broadband services, has resulted in a plethora of partnerships between residential construction firms, ISPs, and telecom services providers looking to build broadband-ready complexes (Welte, 2000).

These government initiatives have also cascaded down from the city to the provincial level. For example, Chungbuk province has made it mandatory for new apartment complexes to offer ADSL ports for Internet access (Rao, 2001). The government has also begun a US$35 billion nationwide high-speed Internet infrastructure that will be completed by 2005. At least 95% of Korean households will have Internet access by the time the backbone project is completed (Teo, 2000).

### 4.   Broadband In Korea versus Hong Kong, Taiwan and Singapore

In Asia, there are three other economies that are in similar stage of economic development as Korea. They are Hong Kong, Singapore and Taiwan. Collectively, they are known as the four "dragons" of Asia. Both Singapore and Hong Kong were the Asia broadband pioneers, with broadband services dating back in 1997. Yet, it is Korea that is surging ahead in the broadband growth. Despite similar economic success for the four dragons, only Korea seems to have the right formula for broadband success. No other "dragons" comes close to Korea in terms of broadband penetration (Pyramid Research, 2001). Some of the key drivers for Korea broadband growth do exist in the other "dragons". For example, all the four "dragons" have high urban densities and high literacy rates. Yet, tremendous success has only been observed in Korean broadband market.

There are several possibilities why broadband in these economies did not grow as much as Korea. Firstly, the regulatory environment in Korea is the most favourable among the four "dragons". Such a favourable environment has attracted players into the broadband market there

and has resulted in all major cities of Korea currently having access to two or more broadband service providers. In addition, in order to capture market share, the Korean broadband service operators are pricing their services at a small premium over narrow-band service. The price of broadband access in Korea is the lowest among the four "dragons". Korea broadband prices range from US$24 to US$35 per month with unlimited usage. The prices in Hong Kong, Singapore and Taiwan are typically between US$32 and US$50, a premium of about 80% to 100% over Korea prices (Chetham *et al.*, 2000).

The low incremental price to pay for broadband services makes it very attractive for the Korean consumers to switch from narrowband to broadband. Consumers in the other three economies are still paying premium price for broadband connection. Thus, these consumers have little incentive to embrace broadband unless their applications require high-speed connection (*Telecomasia*, 2001).

FIGURE 3-2
**Subscription Rate Between The Four Dragons**
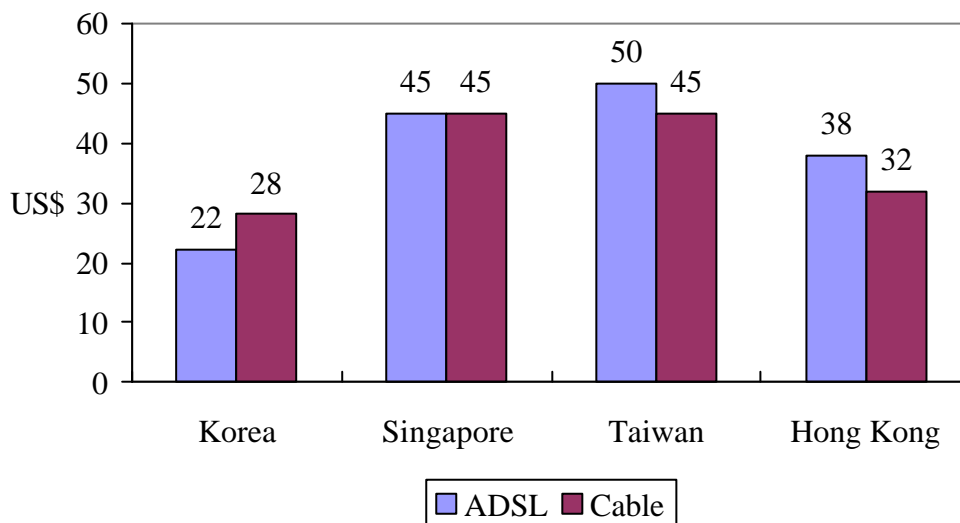
(Source: Hyundai Securities, Pyramid Research).

Another reason for the disparity in broadband success between Korea and the other three "dragons" is that the high penetration of broadband users in Korea makes it attractive for content and application providers to develop new content and applications specially tailored for broadband. With more choices of broadband content and applications, it fuels the demand for broadband connection, which in turn, generates additional demand for more content. The broadband subscribers go into hyper growth and the industry enters into a virtuous circle of growth. Since broadband penetrations in Hong Kong, Taiwan and Singapore are not high, there is no incentive for content and application providers to develop broadband content and applications for these economies. There needs to be a sufficient critical mass of users before content and applications providers find it profitably worthwhile to develop content and applications. Without broadband content and applications to drive demand, consumers in these economies are satisfied with narrowband connections. As of December 2000, Korea has about
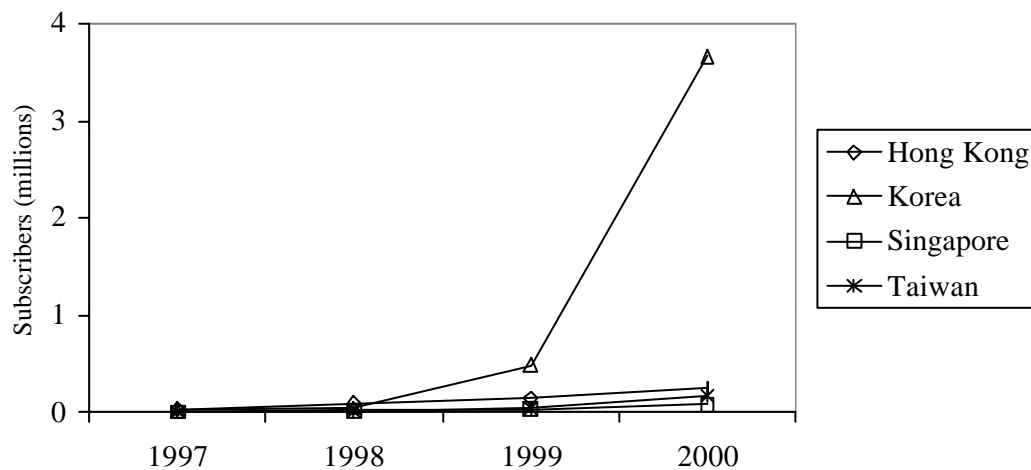
20% of Internet subscribers on broadband while the other "dragons" have less than 10% (Pyramid Research, 2001).

FIGURE 3-3
Broadband Penetration 1997-2000
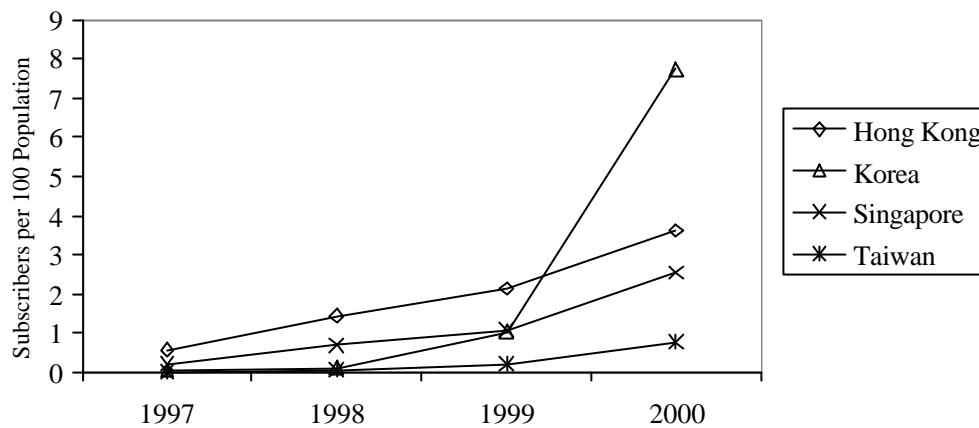
(Source: Pyramid Research)

FIGURE 3-4
Broadband Subscribers 1997-2000

(Source: Pyramid Research)

5. CONCLUSION

The broadband phenomenon in Korea is truly amazing. No other economy has experienced the same blazing pace of growth in broadband penetration as Korea, in such a short time span. The success of broadband in Korea has attracted the attention of many broadband operators all over the world. These players look towards Korea for a successful broadband deployment model, hoping to replicate Korea's success in their own regions.

As we have shown in this paper, Korea's success with broadband is not attributed to any single factor, but to the co-existence of several factors. Some of these factors are also present in other economies, but none of them has come close to having all the factors co-existing at the same time. It will be difficult for other economies to have the same level of success with broadband penetration without radically changing the regulatory and business environment to accommodate all the factors that we have seen in Korea.

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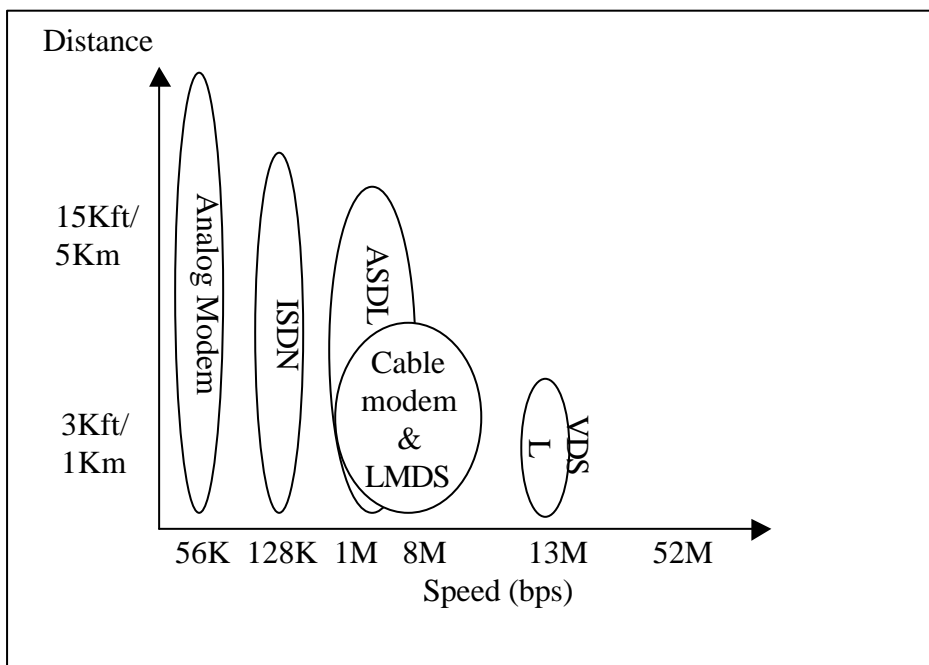Yankee Group, "Broadband Subscribers in Asia: 1999-2003 Review and Forecast", Vol. 8 No. 1, 29 February 2000.

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Appendix 1: Internet Access Speeds (Theoretical)
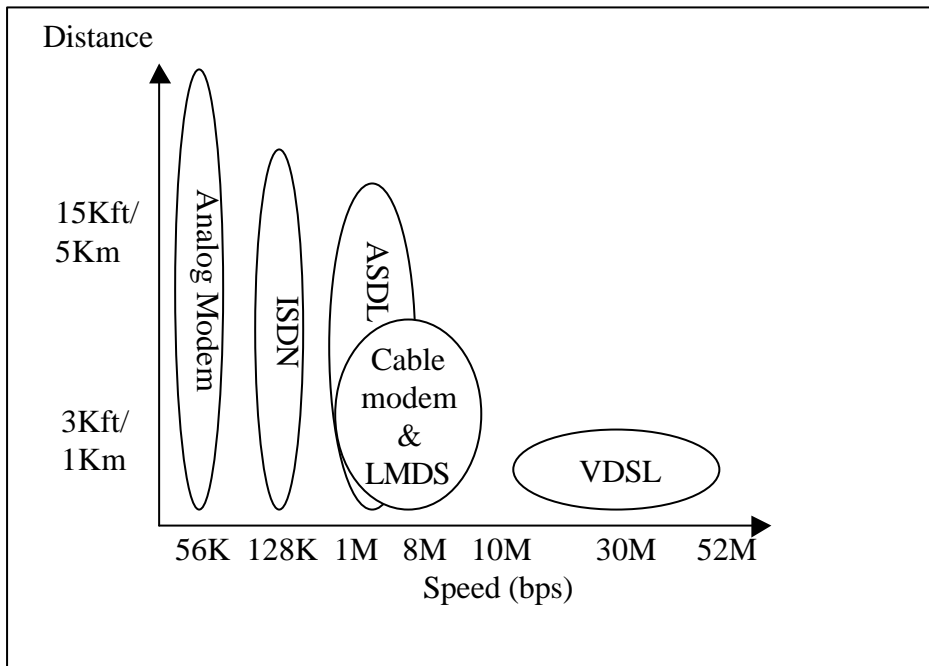
Appendix 2: Internet Access Speeds (Actual)

Appendix 3: Characteristics of Broadband Services

	Cable Modem	ADSL	VDSL	LMDS	Satellite
Speed Upstream Downstream	 128Kbps-10Mbps 1-10/30Mbps	 512Kbps-1.5Mbps 1-8Mbps	 1.5-2.3Mbps 13-52Mbps	 1-10Mbps	 400Kbps 10-64Mbps
Access	Always on	Always on	Always on	Always on	Always on
Network	Shared	Dedicated	Dedicated	Dedicated	Hybrid
Distance limitation	4.8Km	5.4Km	1.5Km		
Pros	Well-suited for residential uses Uses existing cable network	Dedicated bandwidth Uses existing copper line Data security	Very fast Well-suited for multimedia Internet, HDTV program delivery	Easy deployment, no physical network Wireless network characteristics of mobility and flexibility	Easy deployment Two way
Cons	Shared, tree-structure network; very sensitive to no. of users online Difficult to guarantee security on a shared network Require network upgrade (HFC buildout) Difficult to deploy in APT and building area	Asymmetric, relatively low upstream speed Quality of service vulnerable to the distance from the central office	Limited commercial services Very sensitive to the distance from the central office Needs extensive fibre-optic build-out	Roof rights needed Channel environment leads to downgrade in service quality	Time delay