INDUSTRY REPORT 2007
Volume 4

Broadband Access:
Trends and Implications

About the Cover

The Kuda Kepang is a highly-spirited traditional dance performance from Malaysia's southern state of Johor. Usually performed by nine dancers sitting astride two-dimensional horses, the dance forges the image of great determination with stories of historical and victorious battles told in various vigorous yet graceful movements. The Kuda Kepang image is set against the background of the Istana Budaya, the icon of Malaysian traditional performances and regarded as among the 10 most sophisticated theatres in the world. Much like the dance, the SKMM identifies and weaves the spirit, synergy and story depicted by the Kuda Kepang and the grandiose of the Istana Budaya with our own commitment in bringing about the progressive development of the communications and multimedia industry.

CONTENTS

FOREWORD

On behalf of the Malaysian Communications and Multimedia Commission (SKMM), it is my pleasure to present to our readers the Report on Broadband Access: Trends and Implications.

The scope of this report includes discussion on the policy and investment trends in broadband access infrastructure, both wired and wireless, across selected countries that are leading in broadband development. The analysis and discussion highlights the broadband access and services returns in terms of subscriptions and revenue, including a comparative of today's pricing terms and broadband applications service categories. Industry forecasts on world broadband access subscriptions and revenue derived are also included.

Also discussed are the various broadband delivery platforms and services, including associated developments in this area such as technology trend and device types. The various factors affecting broadband applications service delivery development and the impact of broadband on convergence or vice versa are also indicated.

A look at the broadband status and development in Malaysia is made, relating government initiatives to push broadband, the issues faced and the need for collaboration with the private sector to ensure broadband opportunities can be reaped. Broadband going forward emphasise the challenges in broadband plans and implementation, including measurement in review or Key Performance Indicators (KPIs) as a critical success factor.

A soft copy of this report can be obtained from the SKMM website at:

http://mcmc.gov.my/what_we_do/Research/industry_studies.asp

I trust this document will provide useful information to readers and indeed can serve as a catalyst to constructive business ideas and perspectives that can propel the communications and multimedia industry development. We welcome feedback that will help us improve our industry reports in the future. Please send your comments to webmaster@cmc.gov.my

Thank you.

Datuk Dr. Halim Shafie
Chairman
Suruhanjaya Komunikasi dan Multimedia Malaysia

EXECUTIVE SUMMARY

Over the next decade, there is expected a quantum leap in communications services as broadband in lightning speed over fibre networks come into play. Governments across the world have recognised the urgency to plan and implement broadband access to reap the benefits it is anticipated to bring with higher bandwidth, increased business opportunities and better quality of life and national competitiveness.

The importance of broadband access and its depth in usage is reflected in the many policy and investment trends over the last half decade or so. Indeed, developed countries have started ahead, with Asian countries such as Japan and South Korea in the forefront of development with household penetration rates today at more than 50% and 90% respectively. These countries are working on their recent strategies to broadband the nation with fibre connections detailing benefits envisioned in its implementation. Investments have been made in both the public and private sectors, and the wired and wireless spaces, with a view to reach the mass market.

The common feature in all the broadband plans is public and private sector collaboration and the plans to reap the benefits together. The consumer is included in terms of customer oriented broadband access and applications services, and the need to create awareness amongst the users apart from creating the supply side investments. With Internet subscribers numbering well over one billion subscribers, these thought to be amongst the first to embrace broadband Internet, the attraction to provide broadband access in itself is already magnetic. What more, the attractiveness of broadband applications services in triple play, quadruple play and the promises of video to handsets and home digital media penetrations. Asia, with its low broadband penetration is deemed as high growth broadband prospects.

Broadband pricing is getting better (cheaper) as the implementation years progress and as broadband applications services get more entrenched or widespread bringing scale economies. Developed countries pose the cheapest broadband prices today. DSL remains the main broadband access type today, although mobile broadband and fibre speed connections are expected to increase significantly in the coming decade, starting with developed countries. China, observed to have a budding fibre roll out today, is expected to accelerate roll out in time.

As traditional voice is losing its prime in revenue generation, incumbents are seeking alternative incremental revenue streams in provision of broadband delivery platforms and its various applications services. This is invariably a good move as well, since the thrust to an all IP based communications services delivery in next generation networks is already underway. Digitisation, broadband and IP are all factors moving in the same direction of a converging communications services environment where multiple services are expected to "play" over one delivery platform or device. Broadband promises bandwidths not previously available. Broadband provided opportunities abound in the many e-services on top of "on demand" and "interactivity" options it can provide along with the diversity of combinations and capacities to satisfy the most demanding of users, both at corporate and residential modes. Mobile broadband in enhanced 3G services of HSDPA and mobile WiMAX offers the mobility in many broadband services existing today. This arena is slowly, but surely improving in areas of delivery, device and services as we speak. The tradeoff of mobility and data rate offerings is a challenging balancing act, nevertheless.

It took the Internet four years to reach 10 million customers in mass market. Broadband boasts, if not surpass, the same take up speed. No wonder incumbents are waking up smartly to the realities of what broadband can provide or take away if they do not act fast enough. Developed countries are already galloping ahead in broadband roll out and services delivery. All in all, the factors influencing broadband applications service delivery are myriad, ranging from copyright issues and its management as providers gear up to provide IPTV through a digital subscriber line or broadcast video through the mobile phone. In a bid to increase limited capacity in cellular broadcast mode and lower cost of delivery, vendors

are literally racing to trial femtocells that offer these promises. User behaviour is changing as new communications delivery services arise. For example, user generated content (UGC) is a phenomenon of less than half a decade old and it has literally taken the world by storm. Digital home – an existing user desire, is becoming a reality today as bandwidth offered by broadband services unlock the key to its greater volume take up and pricing levels.

As broadband becomes available and its services speeds increase in many developed countries at exponential rate, such developments have not been left "on idle" in developing countries as well. For example, Malaysia has taken challenging strides to accelerate broadband take up since 2003. With penetration rates now in 2007 hitting just over 3% and household penetration rates at just over 11%, there is much that needs to be done. The Malaysian government has in the last decade through its five-year national plans sought to improve and increase the pervasiveness of information communications technology (ICT) as one of the leverages to national competitiveness. Communications services are recognised as an enabler to accelerate the nation to sustain economic growth and improve the well-being of its citizens.

To date, the target is to achieve a Malaysian broadband household penetration rate of 50% by 2010. This is being effected through a number of government plans, laid out and being implemented in collaboration with the private sector. The National Broadband Plan includes a Klang Valley Broadband Push (KVB90), which has target to achieve 90% household penetration in the densely populated and economically affluent stretch of Peninsula Malaysia by 2010. In September 2007, the Malaysian government unveiled plans to embark on an initiative to roll out high-speed broadband services across the country. The target is to cover 2.27 million premises, with investments to cost about RM15.2 billion (USD4.46 billion) over 10 years which includes the cost of 'last-mile' fibre, core network and improvements to international connectivity. In summary, the best of plans need to be executed well. On top of this, there is a need to incorporate measurement in review or key performance indicators, which is a critical success factor in the plan-execute-review process. A feedback system in the review stage after the planning and implementation stages is extremely important to ensure steering of initiatives for desired effects.

ACRONYMS

3G	Third Generation		**GDP**	Gross Domestic Product
AIMS	Applied Information Management Services		**GPRS**	General Packet Radio Service
ARPU	Average Revenue Per User		**HSDPA**	High-Speed Downlink Packet Access
ASP	Application Service Provider		**HSPA**	High-Speed Packet Access
ATM	Asynchronous Transfer Mode		**IP**	Internet Protocol
BPL	Broadband over Power Lines		**IP VPN**	IP-enabled Virtual Private Networks
CAGR	Compound Annual Growth Rate		**IPTV**	Internet Protocol Television
CDMA	Code Division Multiple Access		**ISDN**	Integrated Services Digital Network
DOCSIS	Data-Over-Cable Service Interface Specification		**ISP**	Internet Service Providers
DSL	Digital Subscriber Line		**LAN**	Local Area Network
DSLAMS	Digital Subscriber Line Access Multiplexers		**LBS**	Location-Based Services
DTH	Direct to Home		**MBMS**	Multimedia Broadcast Multicast Service
DVB-RCS	Digital Video Broadcasting – Return Channel via Satellite		**PBX**	Private Branch eXchange
EDGE	Evolutionarily Distinct and Globally Endangered		**PPP**	Purchasing Power Parity
ETTH	Ethernet To The Home Broadband (ETTH)		**ROI**	Return On Investment
ETTO	Ethernet To The Office Broadband (ETTO)		**SMS**	Short Message Service
EV-DO or EVDO	Evolution Data Optimized or Evolution-Data only		**T-DMB**	Terrestrial Digital Multimedia Broadcasting
FTTH	Fiber To The Home Broadband (FTTH)		**VoIP**	Voice Over Internet Protocol
FTTO	Fiber To The Office Broadband (FTTO)		**WiMAX**	World Interoperability for Microwave Access

BROADBAND ACCESS – TRENDS AND IMPLICATIONS

Introduction

Fixed-line telecommunications is over 125 years old. Today, the plain old telephone line system (POTS) is transforming from voice over copper wire to light pulses over fibre as part of a nationwide telephone network in broadband access. This change is occurring in stages worldwide due to a number of factors that include readiness on supplier and consumer sides, implications from legacy networks, and the economics of building network and infrastructure.

No doubt, revenues are declining from traditional local and long-distance voice service due to substitute services of mobile and services over the Internet or IP based networks. A more liberalised environment has encouraged intense competition, squeezing fixed line operator margins, and with new entrants and service varieties, providing more choice to consumers and at comparatively lower prices than before. The next decade or so is expected to see another leap forward in the telecommunications services as broadband access[1] be it fixed, fixed wireless or mobile and the services over this connection gets more entrenched in many countries. This includes user experiences of higher speeds for many existing and new applications to come, thereby providing little likelihood of going back to snail-speeds.

Importance of Broadband Access

Policy and Investment Trends

More connections cost money and connections at higher speeds cost more money. The initial fixed line investments were mainly from the government as the telephone system was for military or private use many decades ago. The trend of fixed line phone development sees companies formed or corporatised from previously government operated bodies and because there was no competing service then, were obvious monopoly companies. Competition emerged only decades later in the mobile phone phenomena. Funding for this service interestingly was mostly from operators who saw the enticing margins. Furthermore, mobile leaped ahead in consumer take-up as well, buoyed by decreasing prices over time and technology advancement as dynamics of economies of scale kicked-in. This is indeed the case in Malaysia.

The provision of broadband access appears to be a phenomenon requiring the approaches taken to institute the investments in fixed line and mobile together. That is, a need for a government and private sector push in collaboration. This approach is seen in the lead countries in broadband developments, with highest penetration rates today such as Japan and South Korea. In both these countries, the government envisioned the national aspirations, for example, "towards ubiquity" in Japan and "in the forefront of technology" in Korea. Together with the private sector, the realities of their vision are encased in Japan with a current broadband household penetration rate of 56% and in South Korea 94%, reaping benefits for operators, consumers and nation at large.

Meanwhile, broadband operator revenues in the UK have posted compound annual growth rates (CAGR) of 23.5% (2005-2007) and in the US between 14-19% (2004-2006). UK boasts 44% in household penetration rate, while US has 51%.

---

[1] Broadband is considered in this report as an "access" rather than "transmission" (core network) technology

Selected Countries – Broadband Investment Initiatives by Public and Private Sector
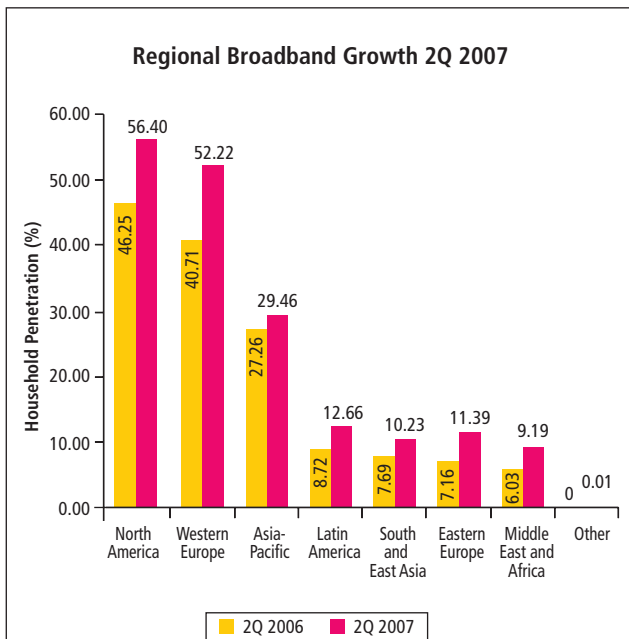
	Initiatives	Targets	Year	Investment
Japan	**Ubiquitous Japan (u-Japan)** Develop wireless infrastructure for information exchange anytime, anywhere by anything & anyone.	• To continue e-Japan strategy and make Japan the world's most advanced IT nation.	2004-2010	
	E-Japan Strategy II – Focus on broadband content & applications.	• To make Japan's IT infrastructure practical to the citizen.	Jul 2003	
	E-Japan Strategy – Government focus on promotion of broadband infrastructure.	• To make Japan the world's leading IT nation by 2005.	Jan 2001	
	NTT DoCoMo (US$25.4 billion to install 40,000 dedicated FOMA base stations nationwide).	• Super 3G mobile phone network by 2010, boasting speeds of 100Mbps – 360 times faster than FOMA services at 384Kbps; to realise high quality content & view high definition video.	2007	US$1.7 billion
South Korea	**Korea Information Infrastructure (KII)** 1. KII-Government 2. KII-Testbed 3. KII-Private	• To build a nationwide backbone for broadband. • Supported R&D to bring broadband technologies to market. • To facilitate market competition through private sector investment.	1995-2010	US$25.3 billion
	Broadband Convergence Network (BcN)	• To have 50 times faster connection speeds & national coverage by 2010; Convergence of TV broadcasts, voice telephony & Internet; transmission speeds of 50-100Mbps.	2003-2010	Government (US$1.7 million); private sector US$56.7 million)
	U-Korea	• To achieve society where all people can benefit from a safer ubiquitous society (4U: Universal, Usable, Unisonous, Upgraded).	2006-2010	
UK	**UK National Broadband Strategy**	• To have the most extensive & competitive broadband market in the G7 by 2005.	2004	Government-over £1 billion 2003-2006
US	**Rural Development Various State Coordinated Programs for Broadband**	• To increase economic opportunity & quality of life in rural America • Includes designated lead state agency for broadband deployment; enhanced e-government initiatives.	2005 2000s	
Australia	**National Broadband Strategy Implementation Group (NBSIG)**	• Test detailed program design for Coordinated Communications Infrastructure Fund (CCIF) & Community Based Demand Aggregation Broker Programme	Mar 2004	US$2.2 million
	Coordinated Communications Infrastructure Fund (CCIF)	• It is a high-speed wireless broadband project. • Towards development of Higher Bandwidth Incentive Scheme. • Develop broadband infrastructure in regional, rural & remote areas; improved government health & education services.	Apr 2004	US$18.0 million

Initiatives		Targets	Year	Investment
Australia (cont'd)	Demand Aggregation Broker Programme	• Establish a network of brokers at national, state, territory & community levels to assist in building an understanding of potential of broadband; identify local demand & supply.		US$18.0 million
	Higher Bandwidth Incentive Scheme (HiBIS)	• Provide registered ISPs with incentive payments to supply higher bandwidth services in regional, rural and remote areas at prices comparable to those available in metropolitan areas. • 17 HiBIS Providers (seven are satellite providers offering two-way or one-way services nationally; 10 are wireless or cable providers offering local services; Telstra is the only ADSL provider).	Apr 2004	US$82.1 million
	Telecommunications Action Plan for Remote Indigenous Communities (TAPRIC)	• Support strategies, e.g., improved take-up of Internet & broadband services for community service delivery & development; more awareness of telecoms opportunities & rights.	Jul 2002	US$6.3 million
	Metropolitan Broadband Blackspots Programme	• Target metropolitan areas where affordable broadband access is not available due to lack of suitable network infrastructure.	2005–2006	US$36.6 million
	Australian Broadband Guarantee	• Ensure subsidised Internet access for Australians unable to gain a reasonable level of broadband service at their home or office. • First phase will run until June 2008.	2007	US$1.61 billion
	Clever Networks	• Improve broadband delivery in health, education, government & emergency services for communities in rural & regional Australia.		US$91.28 million
Taiwan	Broadband Duct Construction M-Taiwan Programme	• Project to set up a seamless broadband Internet environment. • Build an environment for broadband applications and to provide users with unrestricted digital services.	2003 2003-2009	US$8.8 billion US$2.0 billion
	Broadband Development Project	• Promote Fiber to the Home (FTTH) and Wireless Local Area Networks in order to provide a higher access rate on the Internet.	2004	
	Taipei Cybercity Plan • Phase I (CyberCity Initiative) • Phase II (Follow-Up on CyberCity Plan)	Includes cyber education; automate public services; computerise government functions; establish info infrastructure. 1. Bridging Digital Divide – promotes accessibility, web access for disadvantaged. 2. e-Living – promoting an intelligent transportation system (ITS), a Citizen life net; and disaster prevention information net. 3. IT Education – e-learning, IT apps education, wireless campus. 4. e-Business – promote value-added applications – information, e-enterprise; development of Chinese-language content industry. 5. e-Government – set up a municipal affairs citizen service center, IT common platform, integrated e-document processing system.	1999-2002 2003-2006	

Kick Start to Broadband Access ➜

Broadband Infrastructure Build-up

- Collaborative Approach
- Initiatives Government and Industry
- Broadband Awareness and Public Awareness
- Interoperability and Compatibility
- Industry Collaboration
- Shared Network
- ↓ Multiple Infrastructure
- ↓ Cost (Rollout)
- Quality of Service
- Broadband Penetration Rate
- Standards
- Measurement/ Standards
- Network Security

Services from Broadband Access

Broadband Value Added Services:
Business
Security
Applications
IP VPN
VoIP
Remote Backup
Video conferencing
Others to come

Consumers
Security
IP Telephony
Gaming Online
Home Networks
Music downloads
IPTV
Others to come

Broadband Access Services:
Fixed Connections:
xDSL
Fixed Wireless Connections:
WiFi, WiMAX

Mobile Broadband Services:
Connections (software downloads; handset)
Applications: IP telephony, SMS, VoIP, video

Other Platforms:
Connections (software downloads; handset)
Applications: IP telephony, SMS, VoIP, video

Value from Broadband Access

- Country Economic Value
- Operators' ROI
- Service Quality & Reliability
- Affordability
- Education
- Teleworking
- Digital Home
- Content Delivery Variation
- New Business Models
- National Competitiveness
- Enhance Quality of Life
- Rich Digital Media
- Telecommuting
- e-Business
- e-Health
- e-Government
- e-Banking
- Digital Media
- Smart Utility
- e-Commerce

Regional Broadband Growth 2Q 2007

Household Penetration (%)

Region	2Q 2006	2Q 2007
North America	46.25	56.40
Western Europe	40.71	52.22
Asia-Pacific	27.26	29.46
Latin America	8.72	12.66
South and East Asia	7.69	10.23
Eastern Europe	7.16	11.39
Middle East and Africa	6.03	9.19
Other	0	0.01

Source: Point Topic

Household Penetration (Selected Countries)

Household Penetration (%)

Country	Penetration
South Korea*	94
Taiwan*	63
Canada**	62
Australia*	61
Japan*	56
United States**	51
United Kingdom**	44
Malaysia	13

*Informa Telecoms & Media, 2Q 2007 ** OECD 2006
Source: OECD, Informa Telecoms & Media, SKMM

Top Countries with the Highest Number of World Internet Broadband[2] Subscribers in 2007

Rank	Country or Region	Broadband Subscribers[3] (million)	Broadband Penetration		Population Density (inhab/km², 2006)	Population (million, 2007 Est.)	Source and Date of Usage Data
			By Population (%)[4]	By Household (%)			
1	United States	64.6	21.4	51**	302	32.6	FCC/CTIA – Dec/06
2	China	48.5	3.7	16*	1,317	140.9	MII – Sept/06
3	Japan	25.7	20.0	56.4*	129	340.1	OEDC – Dec/06
4	Germany	16.1	19.5	33.5	83	236.0	ECTA – Mar/07
5	Korea, South	14.0	27.4	94.0	51	497.5	OECD – Dec/06
6	United Kingdom	13.9	23.1	43.9	60	250.9	ECTA – Mar/07
7	France	13.6	22.3	n.a	61	111.6	Teleco – Mar/07
8	Italy	9.4	15.8	16.2	60	197.7	ECTA – Mar/07
9	Canada	7.6	23.7	62**	32	3.6	OECD – Dec/06
10	Spain	7.5	16.7	29.3	45	80.9	CMT – July/07
11	Brazil	64	3.4	n.a	187	22.2	Teleco – June/07
12	Netherlands	5.3	32.8	66.2	16	486.7	ECTA – Mar/07
13	Taiwan	4.5	19.6	63*	23	714.1	ITU – Sept/07
14	Australia	3.9	18.8	60.9*	21	2.7	OECD – Sept/06
15	Mexico	3.7	3.5	4.1	106	55.9	OECD – Sept/06
16	Turkey	3.6	4.8	n.a	76	91.4	ECTA – Mar/07
17	Russia	2.9	2.0	6.2*	143	8.4	ITU – Sept/07
18	Poland	2.6	6.9	21.6	38	126.6	OECD – Dec/06
19	India	2.5	0.2	1.09*	1,130	368.4	TRAI – June/07
20	Sweden	2.4	27.2	51.0	9	21.9	ECTA – Mar/07
	Top 20 Countries	**259**	**6.7 %**			**3,890**	**IWS – Sept20/07**
	Rest of the World	34	1.3 %			2,684	IWS – Sept20/07
	Total World Subscribers	**294**	**4.5 %**			**6,575**	**IWS – Sept20/07**

n.a: not avaiable
* Informa Telecoms & Media, 2007 2Q ** OECD
Source: www.internetworldstats.com, www.photius.com, Informa Telecoms & Media, OECD

BROADBAND RETURNS

Broadband Returns – Revenue

Country/Selected Service Provider	Broadband Revenue			Revenue CAGR* (%)
UK	**2005**	**2006**	**2007**	
– BT (million)	£502	£730	£946	23.5%
US	**2004**	**2005**	**2006**	
– AT&T ('000)	5,104	6,921	8,538	18.7%
– Comcast (million)*	2,938	3,757	4,986	19.3%
– Charter (million)	712	875	1,051	13.9%

*Compound Annual Growth Rate which measures the annual growth of a market over a period of several years[5].
*Includes cable system
Source: Companies' Annual Reports

Broadband Services Revenue Forecasts

Source	Current	Expected
Infonetics Research, May 2007	Service provider revenue from mobile video services was US$200 million in 2006 (up 317% from 2005). Drivers of this growth are the increasingly powerful and efficient handsets	In 2007, revenue is expected to triple. Worldwide mobile video subscribers are expected to soar to over 46 million by 2010. Bandwidth expansion to continue via existing 3G networks through HDSPA and MBMS, rollout of dedicated broadcast networks, and deployment of new mobile video services delivery platforms.
Juniper Research, Aug 2007	–	Wireless broadband operators will take up US$400 billion in revenues yearly by 2012.
Strategic Analytics, Aug 2007	–	Broadband service revenues will surpass US$150 billion in 2011, with Europe, Asia Pacific and North America leading the way (CAGR 2007–2011 = 13%); Broadband ARPUs will remain stable on a worldwide level.

---

[2] Broadband corresponds to fast speed Internet, and includes several technologies (ADSL, Cable, Dedicated Lines, etc)
[3] Data are based on number of subscribers reported by the ISP in each country
[4] Broadband Penetration Rate is the national total of connections (or subscribers) divided by the population and multiplied by 100. Demographic (population) numbers are based on the data contained in world-gazetteer.com
[5] CAGR is the constant percentage rate at which a market grows, year-on-year, to reach its current value (y) from the value in a base year (x). CAGR better indicates growth than average growth rate. Formula is $((y/n)^{(1/n)})-1$ where ^ denotes "to the power of", y is the value of the market in the final period covered, x is the value in the first year and n is the number of years in the period x to y
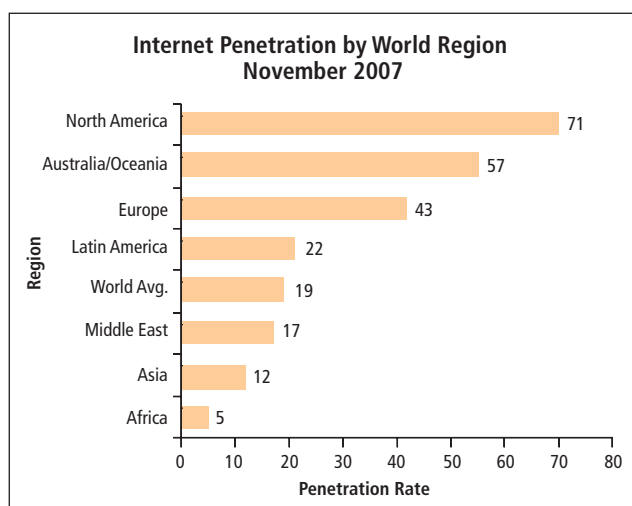
Broadband Returns – Access: Connection Subscription

It is noteworthy that the US has about 65 million broadband subscribers. This comprises close to a quarter of the 294 million world broadband subscribers today. Reports indicate broadband service accounts for about 72% of all home Internet subscriptions in US (2006: 60%). In the US, broadband adoption is seen as strongly tied to household income, that is about half of the households with annual incomes below US$30,000 subscribe to the home Internet service compared to 92% of households with annual incomes above US$75,000. In the developing Asian countries price sensitivity is invariably higher, and therefore broadband deployment to take over a longer period of time, unless broadband costs decline dramatically.
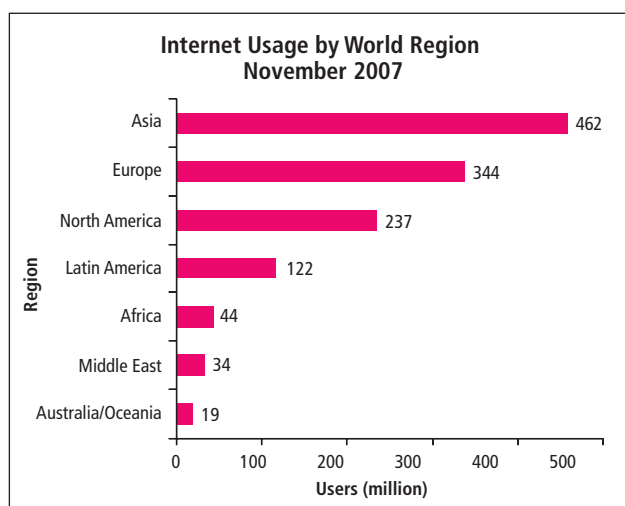
Country	Broadband subscribers per 100 inhabitants, by technology, June 2007				GDP– real growth rate (%, 2006 est.)	GDP per capita (USD PPP, 2006 est.)
	DSL	Cable	Fiber/LAN	Other		
United States	9.3	11.5	0.6	0.7	2.9	43,800
Canada	11.9	12.9	0.0	0.1	2.8	35,700
Australia	18.3	3.4	0.0	0.9	2.7	33,300
Japan	10.8	2.9	7.6	0.0	2.2	33,100
Sweden	17.9	5.6	4.6	0.4	4.5	32,200
Netherlands	20.4	12.7	0.4	0.0	3	32,100
Germany	20.2	1.0	0.0	0.1	2.8	31,900
United Kingdom	18.4	5.3	0.0	0.0	2.8	31,800
France	21.4	1.1	0.0	0.0	2.2	31,200
Italy	15.4	0.0	0.4	0.0	1.9	30,200
Taiwan	17.7	1.73			4.7	29,600
Spain	13.3	3.6	0.0	0.1	3.9	27,400
Korea, South	10.1	10.6	9.2	0.0	5.0	24,500
Poland	5.5	2.4	0.0	0.1	6.1	14,400
Malaysia	**3.18**	**–**	**0.88**	**0.007**	**5.9**	**12,800**
Mexico	3.5	1.0	0.0	0.1	4.8	10,700
Turkey	5.1	0.0	0.0	5.2	6.1	9,100
China	4.1	1.2	0.12*	–	11.1	7,800
India	0.18	0.02			9.4	3,800

*FTTx connections
Source: www.oecd.org, www.cia.gov, Informa Telecom and Media, Malaysian Industry

Internet Penetration by World Region November 2007

Region	Penetration Rate
North America	71
Australia/Oceania	57
Europe	43
Latin America	22
World Avg.	19
Middle East	17
Asia	12
Africa	5

Source: Internet World Stats

Internet Usage by World Region November 2007

Region	Users (million)
Asia	462
Europe	344
North America	237
Latin America	122
Africa	44
Middle East	34
Australia/Oceania	19

Source: Internet World Stats, 2007

North America has highest Internet penetration rates at 71%, and this constitutes about 237 million users (19% of world Internet users comprising 1.262 billion). With Asia having 462 million or 12% share of the world Internet users, and its relatively low penetration rates in respect of proportion of broadband access, this region is expected to hold tremendous growth potential for broadband access as network equipment and build-up costs moderate and the economies of the developing Asian countries improve over time.

There are many analyst forecasts for broadband uptake to double in numbers in the next three to four years to well over 500 million broadband connections, with prolific take up expected from Asia. This is not surprising in respect of China and India which are on the verge of takeoff on broadband delivery. China has 48.5 million broadband subscribers, the second highest after US in the world today. However, household penetration is at 16%. Note that China also has embryonic number of fibre lines as well. India has 2.5 million subscribers with household penetration of about 1%.

Broadband Subscribers Forecasts

Source	Current	Expected
MPA – Asia Pacific Pay TV & Broadband Markets 2007	Asia Pac 2007 = 108 million subscribers; Broadband penetration rate 13%.	Asia Pacific 2015 = 287 million subscribers Broadband penetration rate 31%.
Infonetics Research, June 2007	Worldwide DSL subscribers 2007 = 206 million. (23% increase over 2006)	Double digit annual growth is expected through 2010.
Juniper Research, Aug 2007	HSPA subscribers 2007 = 5 million (Next to HSPA, EVDO service is the next most prolific technology)	HSPA subscribers 2012 = 1 billion (One out of every three mobile subscribers worldwide will be using mobile broadband)
Strategic Analytics, Aug 2007	–	Worldwide broadband subscriptions will exceed 536 million by 2011, with DSL representing about 50%; FTTx and WiMAX are amongst the fastest growing access technologies in 2007-2012. FTTx subscriptions at 64 million by 2011 due to fibre rollouts in US by Verizon and AT&T, and in Europe by French operator, Free.
In-Stat, May 2007	Over the past 12 months, about 65 million new broadband subscribers signed up for high speed Internet access. Current subscriber base at 285 million worldwide.	By 2011, total worldwide broadband subscribers will number 567 million. This is double the number of subscribers in 2007.

BROADBAND PRICE AND THE CONSUMER

Broadband access or connection prices are coming down and at times it may be lower than what customers are willing to pay. However, it is obvious that the "willing to pay" on the part of the consumers come with its list of conditions that include quality of service, customer service, "better than Best Efforts" basis and the like.

Operators that can meet the "medium to higher" demand consumer needs in broadband access delivery often has higher probability of being rewarded with customer take up and less churn in the form of a "win-win" contract between operator and customer. Bundling or combined packages are now offered to ensure customer loyalty, but the basics of customer desire, which include value for money and service quality, are age old.

Broadband Prices: What Customers Are Prepared To Pay	
Service	Price Range (US$) per month
Telephony	$30-$40 (traditional), $10-$20 (VoIP)
Broadband	$30-$50
Mobile	$20-$40
Pay TV	$20-$30
Source: BuddeComm, 2006	

Average Broadband Cost for 100 Kbps	
Selected Country	Approximate cost ($)
Japan	0.07
South Korea	0.08
Netherlands	0.14
Taiwan	0.18
Sweden	0.23
Italy	0.30
France	0.39
USA	0.49
Germany	0.52
UK	0.63
Hong Kong	0.83
Canada	1.01
Brazil	1.08
Belgium	1.21
China	1.43
Switzerland	1.58
Australia	3.45
Spain	4.84
Mexico	6.25
Turkey	10.52

Source: BuddeComm based on ITU, 2006
Note: Some countries are able to offer cheaper broadband services due to government subsidies

On an indicative basis, in terms of cost per 100 Kbps of broadband, the lowest price bands are Japan and South Korea at 7 and 8 US cents. This is not unexpected given the fact that these country policy and investments trends have conscientiously steered broadband access delivery towards this end.

Other countries in the lower band price like Netherlands have high cable penetration in the country, which is one of the existing delivery platforms for broadband access delivery to ride on. Cost of 100 Kbps for UK and US are a little more at 49 and 63 US cents respectively.

It is interesting to note that most of the countries that have price of less than US$1.00 per Kbps are in the "developed country" category. Nevertheless, the countries providing the broadband service below US$2.00 are all worth further study.

BROADBAND DELIVERY PLATFORMS AND SERVICES

Traditional Voice Losing Prime

The phenomenon on declining voice revenue is an occurrence worldwide. As voice service ARPU declines and voice traffic finds alternative platforms in combined or "bundled" packages through broadband access via cable, or simply loss revenue to mobile, the incumbent operators' business models of yesteryears are under increasing pressure for change.

Informa Telecoms and Media report in 2006 indicated that after 2010, the incumbent telecom operators will no longer earn most of their revenues from traditional Public Switched Telephone Network (PSTN) in developed countries. Between end 2005 and 2011, worldwide PSTN revenues is expected to decrease 16.7%, which is said to translate to US$100 billion in lost traditional voice revenues. Total telecoms revenues today is reported to account for US$2.3 trillion.

This trend has increasingly push operators and network owners to seek out new ways for voice offerings such as incumbent operators offering VoIP services. They are also accelerating built up of broadband networks or all IP based next generation networks to offer in addition to voice, services such as video, games or content over broadband to create new revenue streams. There are issues to these alternatives in terms of their own VoIP services eating into existing cash generating PSTN voice revenue, and strategic planning and funding issues to consider when upgrading or changing networks. Nevertheless, incumbents are biting the bullet and planning and implementing already, for example BT with its renowned 21CN all IP based network and is reaping benefits from positioning itself as a telecoms IT consultancy as well.

Comparing the Old and The New in Telecoms Network

Description	Traditional Voice (PSTN)	New Technology (IP)
Designed for	Voice only	Packetised data, voice and video
Bandwidth Assignment	64Kbps (dedicated)	Full-line bandwidth over a period of time
Delivery	Guaranteed	Not guaranteed
Delay	5-40 milliseconds (distance-dependent)	Not predictable (usually more than PSTN)
Cost for the Services	Per-minute charges: long distance Monthly flat rate: local access	Monthly flat rate for access
Voice Quality	Toll quality	Depends on customer equipment
Connection Type	Telephone, PBX, switches with frame relay and ATM backbone	Modem, T1/E1, Gateway, Switches, ISDN, bridges, Routers, Backbone
Quality of Services	Real-time delivery	Not real-time delivery
Network Management	Homogenous; interoperability at network & user level	Various style with interoperability established at network layer only
Network Characteristics (Hardware)	Switching systems for assigned bandwidth	Routers & bridges for layer 3 and 2 switching
Network Characteristics (Software)	Homogenous	Various interoperable software systems
Access Points	Telephone, PBX, PABX, ISDN, switches, high-speed trunks	Modem, ISDN, T1/E1 Gateway, high-speed DSL/cable modems

Source: TechWeb News

BROADBAND TECHNOLOGY TREND: xDSL TO FIBRE

The "copper access technologies" is the multiple variants of digital subscriber line (xDSL) technologies. Supply and demand dynamics have led to what we have today in the xDSL family. They carry data at least, in one direction, at greater than 2 Mbps and are considered "broadband" access technologies.

Even greater demand for high bandwidth services like high definition TV and multiple service platforms through a very high speed broadband access, e.g., seamless quadruple play in home digital media, video telephony, and lightning-speed interactive web-based services are driving the need for the ultimate broadband delivery of Fibre to the Home (FTTH). Developed countries like the US, UK, Japan, South Korea and Hong Kong has seen fibre buildup in the last few years, albeit at relatively moderate pace due to costs involved. Nevertheless, online video content take up is increasing rapidly, for example, in the US, 11.9 million broadband households is expected to pay for online video content in 2007 (2006: 3.2 million broadband households; 2005: 1.5 million)[6]. This is due to availability of higher quality content and a significant base of products like iPod that allow for more seamless content-to-device linkages. High definition television viewing is demanding higher bandwidth requirements.

Developing countries and the rest of Asia use fibre, if at all, at the backbone network. The major broadband access in the world today is DSL. Industry analysts estimate this market to be worth US$3 billion in 2006, with DSL services ARPU at US$34 in early 2006 (US$41 for cable modem).

Major Broadband Access Types (by subscribers) – March 2006			
Access Type	Asia Subscribers (million)	World Subscribers (million)	Broadband Access Type Market Share for Asia (%)
DSL	58.352	152.738	38.2
Cable modem	28.763	76.194	37.7
Total	**87.115**	**228.932**	**38.1**

Source: Paul Budde Communication, Point Topic, DSL Forum;

---

[6] Parks Associates' Consumer Research: Broadband Video – A Market Update, 2007

Development of xDSL and Indicative Bandwidth Applications Demand						
Version	Standards	Year	Maximum Downstream/ Upstream Data Rates (Mbps)	Maximum Frequency (MHz)	Maximum Distance (km)	Indicative Bandwidth Applications Demand*
ADSL	ANSI T1.413 Issue 2	1998	6.1/0.64	1.1	6	Basic surfing, e-mail, VoIP, teleconference
	G.992.1 (G.DMT)	1999	6.1/0.64	1.1	6	
	G.992.2 (G.Lite)	1999	1.5/0.5	0.5	6	Online games, MP3 streaming
ADSL2	G.992.3 (G.DMT.bis)	2002	12/1.0	1.1	6	Video conferencing, multiplayer games, video streaming
	G.992.4 (G.Lite.bis)	2002	12/1.0	0.5	6	
	G.992.3/4 Annex L RE-ADSL2	2004	12/1.0	0.5	7	
ADSL2+	G.992.5	2003	24/1.0	2.2	6	Video on demand, Multi-channel TV; 5-seconds CD download, interactive gaming, virtual reality, towards 3D holographic, telepresence
VDSL	G.993.1	2003	70/30	12	1.2	
VDSL2*	G.993.2	2005	100/100	30	6	

*FTTN – Fibre to the Node
Source: BuddeComm based on ITU standards and industry sources; *Adapted from Point Topic

Advanced xDSL service providers can offer services such as high speed Internet access, voice over Internet protocol (VoIP), video on demand (VoD), and high definition television (HDTV) to their standard service. Very high bit rate digital subscriber line (VDSL), asymmetric digital subscriber line (ADSL2+) and VDSL2 that enable very high-speed Internet access of up to symmetrical 100 Mbps, can support the wide deployment of triple play services such as VoIP, video, data, HDTV, and interactive gaming. Therefore, a so-called "business model" leap is provided from ADSL to fibre to the node (FTTN) broadband delivery.

VDSL and VDSL2[7] bring a huge increase in bandwidth from ADSL. Yet these technologies are not end-to-end fibre networks. They are essentially a "fibre-extension" enabling fibre like bandwidth to premises not directly connected to the fibre-optic segment of a telecoms company's network. A VDSL network has a twisted copper pair with fibre coming to the curb or basement. Today, a realistic proposition of VDSL is slowly emerging, albeit, hampered by high costs, standards development and slow development to interoperability[8]. There is a need to weigh the opportunity costs of upgrades to VDSL or go straight to "end-to-end" fibre deployment which offers unlimited speeds in the gigabits per second.

While in-depth insight into end-users needs is critical to succeed in this fast growing marketplace for broadband access technologies and services, a deeper understanding of the competitive landscape both from the supply and demand sides is required for enduring successful business models and return on investments.

Meantime, ADSL2

While VDSL rollout may not be on wide scale until mid-2008 at least in Europe, broadband access route is currently supported by ADSL2 as base technology for triple play. Two new standards, ITU-T Rec. G.992.3 (Second Generation full rate ADSL) and ITU-T Rec. G.992.4 (Second Generation splitterless ADSL) for ADSL technology collectively called "ADSL2" was completed by International Telecommunication Union (ITU) in July 2002.
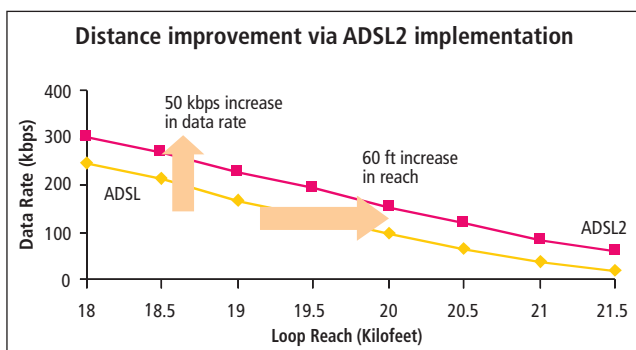
ADSL2 achieves downstream and upstream data rates of about 12 Mbps and one Mbps respectively, depending on loop length and other function. By improving modulation efficiency, reducing framing overhead, achieving higher coding gain, improving the initialization state machine, and providing enhanced signal processing algorithms, ADSL2 is an option. ADSL2 provides better modulation efficiency by mandating four-dimensional, 16-state trellis-coded and 1-bit quadrature amplitude modulation

[7] Global Broadband – xDSL Infrastructure.doc 29/07/2007 8.31 AM, Paul Budde Communication Pty Ltd, 2007
[8] Yankee Group, 2007

(QAM) constellation, which provide higher data rates on long lines where the signal-to-noise ratio (SNR) is low. With ADSL2, a significant amount of electricity can be saved if the modems engage in standby or sleep mode. It brings in two power management modes that help reduce overall power consumption while maintaining ADSL's "always-on" functionality.

Distance improvement via ADSL2 implementation

50 kbps increase in data rate

60 ft increase in reach

ADSL

ADSL2

Source: Quick Eagle Networks, the White Paper, Sept 2005

Benefits of ADSL2
Support for channelised Voice over DSL (CVoDSL)
Improved interoperability
Reduced start-up time for the modem to 3 second
Support all digital modes, adding 256 kbps of upstream data rate
Support packet-based services such as Ethernet over ADSL2

Source: Quick Eagle Networks, the White Paper, Sept 2005

BROADBAND AND DEVICE TYPES

Broadband services capability is based on the capacity of the technology support. The greater the capacity of the technology for example in the range of bandwidth delivered, the more devices can be used effectively at the same time by different members of a household.

The rapid pace of development means that many of these broadband technologies will soon have newer versions that will increase their capacity. Wireless technologies such as satellite, High-Speed Packet Access (HSPA) and WiMAX will more than double their capacity over the next few years. Fixed technologies such as BPL, DSL, FTTH will also increase in capacity.

Devices Supported by Types of Broadband							
Platform	**Desktop PC**	**Fixed phone**	**Modern phone (VoIP)**	**Mobile phone**	**SDTV**	**HDTV**	**Laptop**
Satellite	X	X					
WiMAX	X	X					
HSPA (3G Mobile)				X			X
Cable Modem (DOCSIS 2)	X	X					
Cable Modem (DOCSIS 3)	XX	X	X				
Broadband over Power Line	X	X					
ADSL	X	X					
ADSL2+	X	X	X		X		X
FTTN (ADSL2+)	X	X	X		X		X
FTTC (VDSL2)	X	X	X			XX	X
FTTH (GPON)	X	X	X			XX	X
FTTH (Ethernet)	XX	X	X			XX	XX

Source: Ericsson, Ovum-RHK 2006

Broadband Development and Forecasts		
Source	**Current**	**Expected**
Infonetics Research, Jun 2007	In 2006, ATM DSLAMS & IP DSLAMS each represent 50% of worldwide DSLAM revenue.	By end 2007, these proportions will shift significantly, with IP DSLAMS share up to 72%.
TIA Telecoms Market Review & Forecast, 2007	Wireless hotspots worldwide 2004 = 70,000 (2006 = 132,000).	Wireless hotspots worldwide 2010 = 218,000.
Parks Associates, Jun 2007	–	Mobile WiMAX will connect 8% (88 million users) of world's 1.1 billion mobile broadband subscribers by 2012; 52% from Asia.
In-Stat, May 2007	DSL and cable modem are the top access technologies, providing 92% of worldwide broadband connections.	By 2011, worldwide DSL subscribers will account for 58% of all worldwide broadband connections; with over 55 million households using FTTH architecture for broadband access.

BUSINESS CONSIDERATIONS IN BROADBAND DEPLOYMENT

Investing in a broadband network to meet market demands requires many factors to consider. Among them are choosing the best speeds for the operators service levels, considering which type of network to choose that fits the company's business model. In this competitive market place, cutting costs, improving profits and increasing efficiencies are a few important points to improve the company's return on investment.

Planning for Broadband Network

Technology	Availability	SLAs	Typical Max Speeds	Pros	Cons
Dial-up	Near-ubiquitous	Almost never	56kbps	Inexpensive, widely available, mature technology.	Slow, ties up phone lines, susceptible to line noise problems.
Cable	Where infrastructure is wired	Almost never	500kbps-6Mbps	Low-cost broadband, high speeds available.	Designed for consumer oversubscription, often not business-grade.
DSL	Within range of enabled Cos	Yes, for business-grade	144kbps-6Mbps	Low-cost broadband, high speeds available.	Limited availability, beware 'business' repackaged consumer services.
Frame relay	Near-ubiquitous	Yes	56kbps-1.5Mbps	High reliability, widely available, mature technology.	Expensive, especially for more remote areas.
Satellite	Near-ubiquitous	Yes, for business-grade	56kbps-3Mbps	Most widely available, mature technology, high reliability.	Higher install costs than cable or DSL, higher latency.

Note: SLAs – Service Level Agreements
Source: Spacenet

Choosing a broadband network and getting the return out of the investment require operators to study cost on the applications and long-term benefits for the company, which might involve reducing or eliminating existing costs. Studies show that greater broadband efficiencies are available by getting more timely point-of-sale (POS) data from always-on connections, cutting costs associated with training by multicasting video/data to stores, cutting credit/debit authorisation times and enabling real-time retail applications.

Factors on Successful Broadband Investment

- Get always-on connectivity for constantly updated POS polling, inventory updates and frequent dining program data.
- Use VSAT multicasting capabilities to enable guaranteed, simultaneous content delivery to a large number of sites.
- Improve credit processing with a broadband connection and reduce processing charges.
- Lower costs on employee training with interactive distance learning.
- Use your broadband network for customized in-store music and messaging.
- Reduce store losses due to fraud with surveillance video.

Source: Spacenet

Fibre Capex

Leading broadband operators are taking another leap forward in expanding major fibre network this year. Such operators include KT, Hanaro and LG Powercomm. According to industry reports, KT has promised to nearly quadruple capex on FTTH in 2007 and plans to spend about KRW400 billion (US$430 million) expanding its FTTH networks. It aims to add 1.4 million FTTH lines by year-end. In 2006, KT spent only about KRW120 billion (US$129 billion) on FTTH expansion, building about 120,000 lines.

Meanwhile, market newcomer LG Powercomm was reported to plan to have 90% of individual dwellings – distinct from apartment complexes – receiving 100 Mbps services by end of 2007, by replacing its HFC network, which delivers a maximum of 10Mbps, with FTTH. In the meantime, industry experts reported that Hanaro is also expected to spend probably half of its total capex in 2007 on rolling out new FTTH infrastructure but did not disclose how many FTTH lines the firm would install.

Unique Propositions in Broadband Investments

In July 2006, the satellite-television company, BSkyB came out with a broadband strategy into the UK high-speed Internet access market, taking the fight to competitors such as NTL, BT, Orange and Carphone Warehouse. BSkyB is targeting only Sky Digital subscribers.

The three broadband tiers (Max: Up to 16Mbps); (Min: Up to 8Mbps); and (Base: Up to 2Mbps) are based on bundling, in which customers have to pay for other products in order to access "free" broadband – satellite television in the case of BSkyB, mobile telephony with Orange and fixed-line telephony with Carphone Warehouse. The £500 million investment in broadband service, was built on the Easynet business that BSkyB bought last year for £211 million. BSkyB emphasised its "unique position" in the market with its focus on local loop unbundling (LLU) rather than reliance on leasing lines from BT.

| Broadband Capital Expenditure	
	Two-year Capex Outlook (2006/7 – 2007/8) (£ million)
Unbundling exchanges 1,200 total by December 2007 Average of £40,000 per exchange for installation of racks, power supply and backhaul	35
Network investment Additional capacity to satisfy growing customer bandwidth demand	55
Customer Service Integrated online fulfillment system, and New products and services	40
Subtotal	130
Variable capex £50 per customer for line card, DSLAM chassis and installation Unbundled telephony subscribers require additional cost of £25	120
Total	250

Source: BSkyB, UK

MOBILE BROADBAND

Mobile broadband is a step up from local wireless data applications like WiFi which gets rid of the wire, but not the confinement. Mobile broadband technology has open standards and all IP architecture combined with high capacity, wide coverage and quality of services. Mobile broadband systems offer scalability in both radio access technology and network architecture, thus providing a great deal of flexibility in network deployment options and service offerings.

Most users today experience broadband via a PC connected over a fixed line. However, users will be so dependant on their broadband Internet connection that they want it wherever they may be. Mobile broadband is expected to become a major broadband platform worldwide. In 2012 industry report, mobile broadband to represent almost half of the total mobile services revenues, making it one of the largest segments of the mobile industry.

In June 2007, there were already more than 200 commercial mobile broadband networks and forecasted to have more than one billion subscribers worldwide in 2011. Juniper Research says that 70% of cellular mobile broadband users will be using High Speed Downlink Packet Access (HSDPA) by 2012. There are currently five million HSDPA subscribers. The number is expected to increase to one billion in just five years. By 2012, nearly one out of every three mobile subscribers around the world will be using mobile broadband.
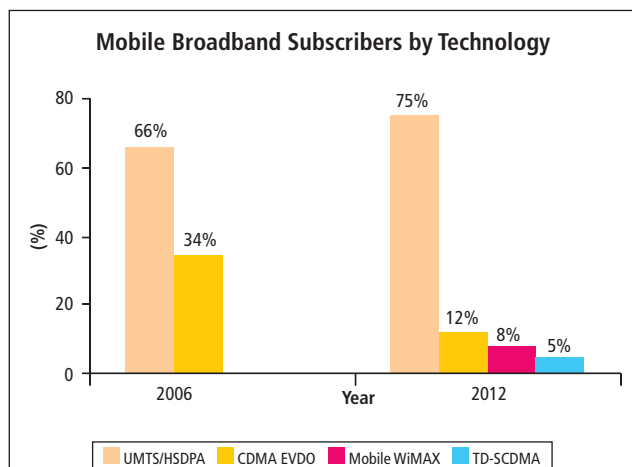
Source: Mobile Broadband Wireless: Path Towards 4G

In terms of mobile broadband by technology, UMTS/HSDPA is expected to lead mobile broadband technology, followed by CDMA EVDO and mobile WiMAX. However, CDMA EVDO users are expected to decrease to 12% of mobile broadband users in 2012. Mobile WiMAX is expected to contribute 8% of the world's 1.1 billion mobile broadband subscribers by 2012 accounting for nearly 88 million users worldwide. Park Associates forecast that most of the subscribers are going to be from Asian countries.

Developments in 3G Broadband Space

NTT DoCoMo of Japan is working on a new Super 3G system, which is expected to be superior to EVDO. A July 2007 report indicated that the company is testing this experimental system for mobile communications, which is hoped to enable 300 Mbps downstream. The service makes use of the Multiple-Input Multiple-Output antenna configuration which is mainly the 802.11n gear. NTT DoCoMo hopes to complete this technology development by 2009.

Specification Comparatives			
	3G (WCDMA)	3.5G (HSPA: HSDPA/HSUPA)	3.9G (Super 3G)
Spectrum	3G spectrum (2GHz band and additional spectrum for 3G)		
Spectrum bandwidth	5 MHz		1.4, 3.0, 5,10,15,20 MHz
Radio access scheme	DS-CDMA		OFDMA (downlink) SC-FDMA (uplink)
Peak data rate (uplink)	384 Kbps	5.7 Mbps	80 Mbps
Peak data rate (downlink)	384 Kbps	14 Mbps	300 Mbps

Source: dslreports.com

Developments in WiMAX

Mobile WiMAX is deemed first-to-market with the next generation of products using mobile radio technology based on Orthogonal Frequency Division Multiple Access (OFDMA)[9]. This is in contrast to two other eventual rival technologies, also based on OFDMA, which is 3G Long Term Evolution (LTE), following on radio technology from GSM/W-CDMA/HSPA – product release expected around 2010. The other is the CDMA 1X-EV-DO standard – Revision C, recently renamed Ultra Mobile Broadband (UMB), with commercial availability sometime 2009.

Significant boost to the WiMAX market in August 2006 is Sprint announcing allocation of US$800 million in 2007 and between US$1.5 and US$2 billion in 2008 on capital spending related to WiMAX in the US. Motorola, Nokia and Samsung would provide infrastructure and client equipment. WiMAX business model may include monthly service fee plus sales of associated content and applications.

In Asia, fixed versions of WiMAX and other fixed wireless broadband technologies have been providing broadband access for a number of years. Korea's WiBro service has been available since 2006. Developing countries benefit most from cost effective technologies as this translates into take up amidst customer price sensitive stance.

BROADBAND APPLICATIONS SERVICES

Broadband offers more business opportunities. For the fixed line operators it may be initially to reap alternative revenue streams as revenue from voice declines. For mobile operators, it offers a means to retain market share for voice by offering more value added applications on top of voice through data and video applications. The race is getting ever more intense in the communications services as broadband means increased bandwidth, more speed, more capacity to offer data services and lately video services, be it over the fixed line or over the radio waves.

The pace of development is fast, not only are the avenues opened for fixed line incumbents, mobile operators and new entrants, other incumbents from previously separate industries are eyeing or already working hard to capture a piece of this increasingly growing broadband pie. Amongst other services that came to the consumer, the Internet is the fastest growing – it took four years to reach 10 million customers in the mass market. Broadband growth, which is "high speed Internet", is as breathtaking, and the capabilities it offers in applications makes communications services going into another era of development altogether.

Take Up Time to Reach 10 million Customers in Mass Market

Service	Years	Remarks
Telephone	38	The Internet is a catalyst for growth of broadband market. The concept of such service existed for 20 years, i.e., online, videotext, teletext, electronic data exchange, but broadband took off only in mid-1990s. This was primarily due to PC market reaching critical mass. In 1996, the home computer market overtook the business PC market. Accelerated growth of broadband is expected due to lower entry prices (US$19.95); increased services, mainly offered via triple play models, including VoIP and IPTV; and increased competition from operators such as cable, mobile & new entrants – fixed wireless and WiMAX, operators offering broadband.
Cable TV	25	
Fax Machine	22	
Video Cassette Recorder	9	
Cellular Phone	9	
Personal Computer	7	
World Wide Web	4	
Broadband	4	

Source: Paul Budde Communication based on BA&H Analysis, Paul Budde Communication Pty Ltd

Broadband Services (2005)
• On Demand
Movies on demand
– pay per view
– near video on demand
– video on demand markets
Special events
Time shifted services
• Interactive
Video telephony
Video mail
Interactive games
Information services
– education & health
– news
– reference services
Interactive TV programs
Enhanced services
Basic services (telephony, messaging)
• E-Commerce/transaction
• E-Retailing/interactive advertising

Source: Paul Budde Communication Pty Ltd

The Internet movement reached the masses in terms of connections; the ease with which one person across the world could communicate in almost split second – the limitation of distance in communications gave way then. Data services have proliferated from this angle, improving from plain text e-mail to communications incorporating video – but still working within tolerated limitations on the uplink speed.

Broadband today can offer speeds of anything between 2-10 Mbps in developed countries. Exceptional countries are Japan, France, Korea and Sweden, which offers between 20-90 Mbps.

For others, just having an Internet connection is a novelty. This scenario is expected to change as the decade progresses and the next decade beckons. The Internet no doubt has accelerated the broadband market growth, but it may be the mobile broadband that spurs incumbents to quickly shake away the effects of slumber and wake up fast to the crisp air of mobile broadband taking users on with its additional function of mobility – the "anywhere" factor.

Top 20 Highest Average Advertised Broadband Download Speed by Country, October 2007

Mbit/s (000's)
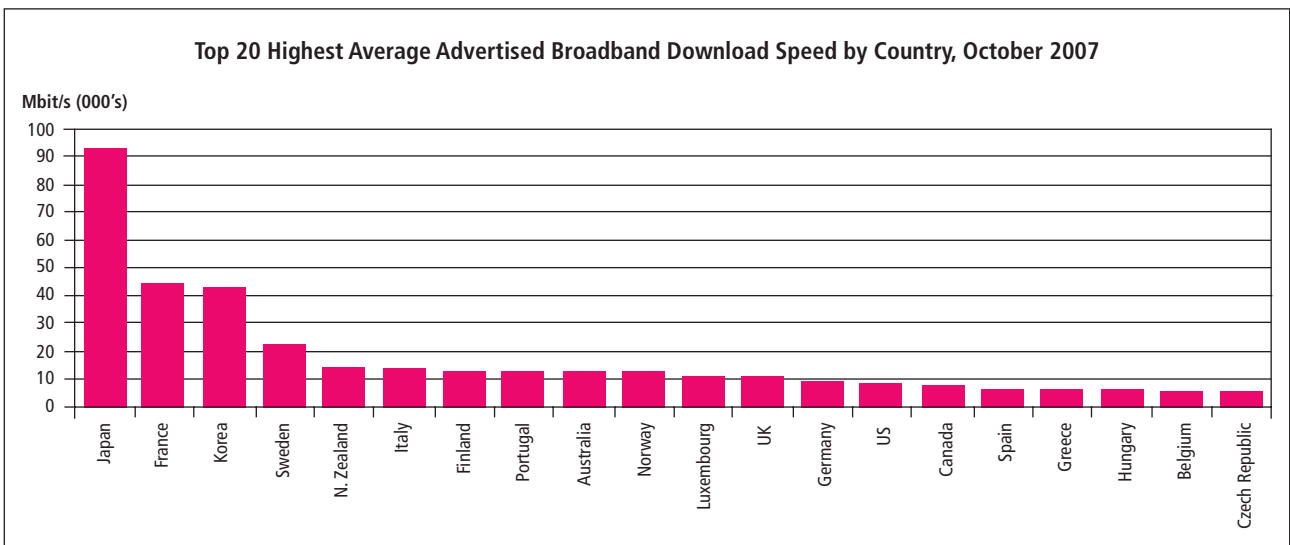
Source: OECD

It is understood that broadband applications aside from just providing broadband access derives more returns on investment. Nevertheless, this is easier said than done. The difficulty appears to lie on the part of the consumers who may not be aware or even ready to take up broadband services offered due to price constraints. Yet, it may be the operator who is grappling with designing appropriate business model and a long term scalable one at that in the case of broadband and the all IP based network promised by next generation networks offering speed and dexterity in delivery and cost. It may also be the vendors who are learning now to sell on a long term partnership basis.

Issues that could steer broadband services development are amongst others copyright management in the context of video offerings; new technology such as the femtocell development of the last 19 months or so, and the broadband over powerline that is still grappling with standards for a number of years; and changing consumer behaviour.

Factors Influencing Broadband Applications Services Development	
Copyright and its management	Current digital rights management (DRM) is reported to be at nascent stage development. DRM is the set of technologies that inscribes rules, conditions and price in context of a "digital ecosystem". Appropriate configurations for DRM are expected to take at least several years to stabilise and standardise to eventually allow for authentic user-led re-mixing to social content sharing.
Mobile Video Industry	It may take another two years before market for long form mobile/portable video content (video content more than 30 minutes) gains traction and demonstrate its long term potential. In-Stat's expectation is that this market has greatest potential if it can complement existing video industry.
Femtocells	Operators are still grappling with business plans in femtocell-take up (i.e., service offering for revenue generation). Yet, savings from backhaul & energy costs in its deployment are attractive in themselves for carriers to support this solution. ABI Research expects that by 2012, femtocells market to represent 36 million shipments with an installed base of nearly 70 million femtocells serving over 150 million users.
Broadband Over Powerline (BPL)	Over the last two years, commercial rollouts of BPL are reported to have picked up, and technical solutions to BPL radio communication interference have emerged. BPL standardisation – a work-in-progress is picking up, thereby enabling more BPL usage (Europe's OPERA consortium has standardized Access BPL). The HomePlug Powerline Alliance is working on an access standard of its own. Institute of Electrical and Electronic Engineers, Inc., is working on a globally-accepted BPL standard by 2008.
Demand for Value Added Services or broadband applications services	Demand for fibre as a broadband access platform is expected to be driven by increasing popularity of bandwidth hungry services such as IPTV and, in Japan, video conferencing. Generally, TV over broadband requires at least 3 Mbps bandwidth for seamless service delivery. High definition (HD) TV require up to 8 Mbps. Conventional ADSL access is unable to support such services. In Japan, South Korea and Taiwan, DSL growth slowed as a result of large scale migration of customers onto faster FTTx networks due to availability of such services. Meanwhile, cable modem and xDSL remain the main choice for broadband connections in Asia Pacific, with fixed broadband wireless an emerging option.
Changing User Needs	A Motorola study indicated 45% of European broadband users watch TV shows online. France is said to be the most enthusiastic. Users want to take control of their viewing (what, when and how), e.g., viewing times. Operators are happy to comply, e.g., BBC's iPlayer to show Doctor Who and EastEnders online; Joost (an on demand online video service backed by Skype founders) has launched Internet TV service with more than 150 channels – from cartoons to music videos & films. Users also want to make video calls via their TV (by 2012); and be able to pause, rewind or fast forward live broadcasts.
Digital Home	The takeoff of digital homes via integration of electronic gaming, MP3/high definition audio, UGC (Google YouTube, MySpace, Facebook), HDTV, IPTV demand on new generation game console & set-top boxes.
Combined services	Increasing ubiquity in quadruple & triple play delivering innovative services as operators differentiate offers to increase ARPU & secure user loyalty to influence speed & extent of broadband rollout.
Fixed Mobile Convergence	Technological innovative ways to differentiate services and offer customers what they need in the form of cheaper prices (even free of charge in combined services) through fixed wireless broadband access or mobile broadband access (HSDPA or WiMAX). At end 2006, there were less than 400,000 FMC subscriptions globally. Pyramid Research expects in 2007, the number of UMA and dual mode subscribers will quadruple, reaching 18 million in 2011.
Security	Exponential growth in security is expected to influence take-up of connection services, including cross sector applications over various delivery platforms as overall security issues are addressed, increasing confidence of users and mitigating risk of operators' capex commitments. More enterprises in Asia are beginning to establish an information or data centric security approach in contrast to a network based perimeter based approach to protection. The Asia Pacific Research Group predicts the information security market in Asia Pacific driven by China and India will grow to US$1.1 billion by 2012 (2006: US$420 million).

Source: Point Topic, Paul Budde Communication Pty Ltd, IDATE

In short, many issues are being worked out and many have already been worked out to bring broadband to the state it is today. As lead countries move to fibre in a tradeoff of ever increasing cost in instituting upgrade to legacy networks to fibre networks offering more benefits, the scenario of the importance of broadband is already set.

More broadband connections and applications mean more operator returns on investments, a bigger pie, a defence of market share and more. For the nation, it means an avenue for greater wealth through cost savings from what broadband can offer, e.g., teleworking saving consumer time on the road in today's congested traffic; wider spread of facilities such as e-Health, e-Education, e-Commerce, and other e-Services for both urban and rural communities.

CONVERGENCE

Convergence is expected as an ongoing affair of communications services of today and indeed of tomorrow. Convergence or combinations or services may be in many ways, but the result expected is that of an increase in new services and applications. For example, network convergence means that previously multiple, connection oriented and non-scalable physical networks are "converging" to a highly efficient, scalable infrastructure based on all-IP in next generation networks (NGN), with IP multimedia systems (IMS) and IPv6 capacities.

Evident signs of convergence include triple play services. These are evolving from simple low quality VoIP, stamp sized streamed video on FM quality audio over low speed Internet of less than one Mbps to full screen videophony, with XGA / VGA quality, TV quality video on demand (VOD) over regular speed Internet access of less than 10 Mbps. Triple play services of the next decade to 2011 are expected[10] as telephony/videophony of high definition quality; on demand HDTV over high speed Internet of over 10 Mbps. Such development are of real substance and appeal to users via IMS and service oriented architecture (SOA) implementation that allow providers a horizontally focused single billing layer, a single application layer, a single core network, a single BSS/OSS and a single brand.

The mobile device is considered a convergent platform, where multiple services can sit on the same handset, for example, converged voice services (CVS) offering the best of current mobile and fixed line services[11]. CVS product elements include a broadband Internet access, fixed line VoIP and mobile phone service that provides unlimited local and long distance calls, converged messaging services, calling features, web portal and are itself service enablers to other value-added applications such as presence, location based services (LBS), network based address book and single sign-on.

Telecom Convergence to Result in New Services and Applications	
Voice and Data	Voice and data convergence (VoIP, voice as an application)
Fixed and Mobile	Access technology convergence (fixed, wireless, mobile)
Telecom and Media	Convergence of telecom and broadcast media and content services
Telecom and IT	IP/IT network convergence (Next Generation Network Architecture)
Device	Device convergence (consumer electronics converging with traditional telecom)

Source: Paul Budde Communication Pty Ltd, 2006

Inevitably, convergence has significant impact on business models of the Internet and telecommunications value chain. Where broadband is concerned, the entry of non-traditional players into telecommunications is inevitable. Early on, the palmtop computer evolved to enable voice telephony. Recently, examples of non-traditional players entering the mobile arena are Apple and Google. For example, Apple Inc was a non-traditional handset and non-network operator upon introduction of its iPhone in June 2006. Internet search and online advertising specialist Google Inc was reported to have introduced its own prototype cellular mobile phone. Such "new" players appear to be positioning today to bypass mobile carriers' portal in today's world where 60-70% of revenues go to operators[12].

The convergence of mobile and IP will boost demand and increase the appeal of mobility to the masses. The result is the seamless integration of services commonly referred to as quadruple play comprising mobile and fixed line telephony, Internet access and TV or video services. Among the dynamism and benefits of convergence lies a host of issues such as availability of spectrum, strategic acuity in investments planning, expertise in telecoms and IT to embrace overlapping issues in these two previously divergent fields, and regulatory orientations.

---

[10] Arthur D Little; The Technology Trio Behind Next Generation Services In Capacity Yearbook 2007
[11] In-Stat, Converged Voice Services: The IMS Killer App, VoIP Asia 2007, 24-25 October 2007
[12] Swisscom, Switzerland, Mobile Revenue Streams – Integrating It All, Conference on Mobile Revenue Streams: Mining the Riches of Mobile Applications

MALAYSIA BROADBAND STATUS AND DEVELOPMENT

## Broadband Subscribers in Malaysia

The take-up of Internet in Malaysia and broadband growth in particular can be more desirable. The broadband Internet market took a turn up recently, albeit from low base. By end-2004, the market posted a penetration rate of 1%. In 2005, there was doubling of subscribers to just over 2%. In 2006, an 80% expansion lifted penetration rate to just over 3% – representing a household penetration of around 11%. The Malaysian broadband market to date is based on DSL technology. Wireless hotspots number 1,463 in Malaysia as at second quarter 2007.

Currently, only 11.7% or 643,500 of Malaysia's 5.5 million homes have broadband. These are on best efforts basis at best. The rollout of broadband services is excruciatingly slow. Nevertheless, the latest target is for household broadband penetration rate at 50% by 2010.

Broadband prices are now relatively low compared to when broadband first started in Malaysia. The price per 100Kbps posted a 30% reduction from RM29 (prior to 1 November 2003) to RM20 (from 1 November 2003). The 2004 Budget, in order to ensure wider access to the Internet at low cost and to promote e-commerce through wider and cheaper access to broadband Internet, local operators were directed to reduce Internet access charges via a 50% discount for industrial and corporate package, beginning with 30% for phase 1 and a further 20% for phase 2. For other users, a 30% reduction was given for consumer broadband Internet charges.
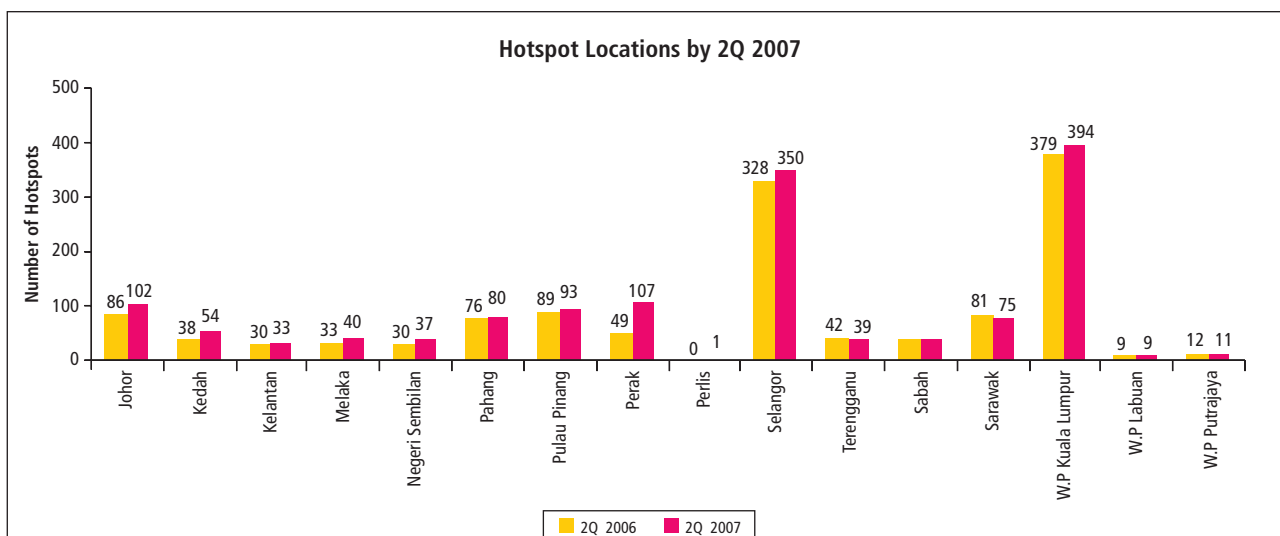
Source: Industry, SKMM
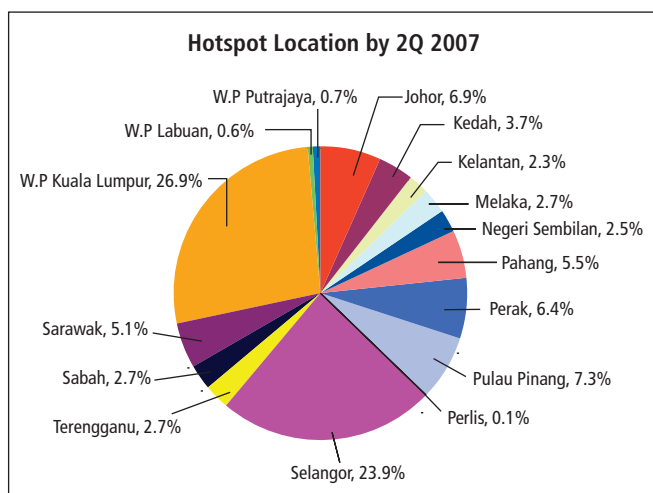
Source: Industry, SKMM
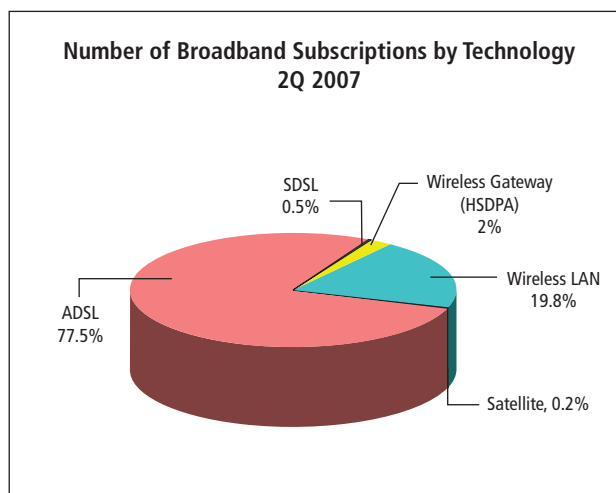
Source: Industry, SKMM

Broadband in Malaysia 2007– Services, Operators, Speed, Technology, Monthly Charges

Broadband Services	Operators	Speed	Technology	Monthly Charges
Traditional/Fixed Broadband	TM (Streamyx)	Residential: 384Kbps to 1Mbps	ADSL, SDSL, GLite DSL	• RM20–RM88 (without modem) • RM25–RM148 (with modem)
		Business: 1 to 2 Mbps	ADSL, SDSL	RM148 (with modem)–RM1,188
	Maxis (Maxis Broadband)	256Kbps to 1Mbps	ADSL	RM50–RM150 (modem included)
	PenangFon	2Mbps to 100Mbps/1Gbps	ETTH, FTTH, ETTO,FTTO	Home: RM60 Business: RM150–RM900
Mobile Broadband	Maxis (Maxis Broadband)	384Kbps to 3.6Mbps	GPRS/EDGE/3G/HSDPA	RM68–RM98 (modem included)
	Celcom (Celcom Broadband)	384Kbps to 3.6Mbps	GPRS/3G/HDSPA	RM8/day; RM68/month; RM0.10/10Kbps
Wireless/Nomadic Broadband	TM (Hotspot)	Up to 11Mbps	Wi-Fi	Postpaid: RM15–RM25 Prepaid: RM5–RM28
	Airzed Wimax	Up to 1Mbps	WiMax	Home: RM188–RM288 Business: RM228–RM468
	DiGi Mobile Broadband	Up to 224Kbps	EDGE	Home and Business: RM66–RM149
	Nasion 1 Wireless Broadband	n.a	n.a	Home: RM80–88 Business: RM800–RM00
	Maxis Wireless Broadband	n.a	n.a	Home: RM79–RM199 Business: RM199
	AtlasOne	n.a	n.a	Home: RM90 Business: RM390
	MyKris	n.a	n.a	Home: RM48–RM88 Business: n.a
	ZapZone	512Kbps	Wi-Fi	Home and Business:RM8–RM40
	GoLightSpeed	Home: 256Kbps to 512Kbps Business: 512Kbps to 1Mbps	n.a	Home: RM40–RM85 Business: RM150–RM250
	IM Wirefree Broadband	Up to 1Mbps	Wi-Fi	Home and Business: RM75 PC Card: RM1000
Satellite	Smart Ku-Band	512Kbps to 1.5Mbps	DOCSIS 1.1	Home: RM150–RM888 Business: RM350–RM888
	Smart C-Band	Up to 2.0Mbps	DVB-RCS	Business: Starting at RM998

n.a: not available
Source: Company websites

Development of Broadband in Malaysia

In September 2007, the Malaysian government unveiled plans to embark on an initiative to roll out high-speed broadband services across the country. The target is to cover 2.2 million premises, with investments to cost about RM15.2 billion[13] (US$4.46 billion) over 10 years. This includes the cost of 'last-mile' fibre, core network and improvements to international connectivity. The government plans to invest one-third of this amount, including the cost for the `last-mile' fibre, core network and international connectivity.

The government has picked Telekom Malaysia Bhd (TM) as partner under the public-private partnership (PPP) for the high-speed broadband (HSBB) project. TM, building on its existing infrastructure, will be able to deploy HSBB at a lower cost and faster speed, and with more than 90% of broadband market share, it offers the best chance of service take-up. The PPP agreement is to be signed soon and the rollout is expected to commence six months after the agreement is signed. Details are currently being discussed between the Government and TM.

---

[13]www.businessweek.com; Bernama, KTAK

In a separate development, the government is embarking on Klang Valley Broadband Push (KVBP) to achieve 90% household broadband penetration in the Klang Valley by 2010.

Three Pronged Strategy in Broadband Plan and Actions Taken	
1. Attractiveness – demand creation, availability	Increase PC penetration; connecting community programs; KVBP pilot projects; e-Government (eKL), e-Commerce, e-Education; free hotspots in public areas (k-Perak, Cyberjaya); Content stimulation initiatives.
2. Broadband for general population (up to 1 Mbps)	Award of WiMAX spectrum (2.3 GHz); Monitoring of WiMAX, 3G and HSDPA rollout; Tower sharing T1, T2, T3; Leveraging on current capacity for copper; Mandate broadband under USP program; Promote facilitative role of Local Authorities.
3. High speed broadband	License last mile solution provider (14 licensees); Fibre roll out under KVBP; TM roll out Metro-E; State initiatives (Melaka, Kedah, Penang).

Source: KVB90 – Creating Demand for Broadband by SKMM

Snapshot of KVBP Projects		
Projects – Phase 1*	**Timelines**	**Expected Outcomes**
WiFi in Libraries	Q2-07 to Q2-08	Target 5,000 users per day
Schools Pilot Project	Q3-07 to Q2-08	Facilitate usage of ICT tools in school
Web Portal	End 2007	Create demand for broadband services
Connected Municipalities	Q3-07 to Q4-08	Increase broadband coverage and penetration
Mobile Broadband Highway	Q4-07 to Q3-08	Create awareness and demand
Projects – Phase 2**		
U-Library	Q4-07 to Q4-08	Create critical mass
Hotspots in Universities (4)	Q2-08 to Q2-09	Target 100,000 users

*Short term (for implementation, with a total budget of RM25 million allocated)
**Long term projects and dependent on budget approval
Source: KVB90 – Creating Demand for Broadband by SKMM

The Malaysian government has been promoting the use of ICT for the last decade as an accelerator of economic development, growth maintenance, and a bridge to reduce the digital divide. In the need to raise national competitiveness towards the realisation of the nation towards developed status in 2020, a series of initiatives have been planned through the five-year National Plans and annual Budgets to ensure the engine of ICT including the development of communications services. The last Budget 2008 has explicit incentives for employer and employee broadband take up.

Government Initiated Programmes for Promoting ICT		
Programme	**Eight Malaysia Plan 2001–2005**	**Ninth Malaysia Plan 2006–2010**
Government Agency Computerisation	2,125.0	5,734.2
Bridging The Digital Divide	2,433.1	3,710.2
School	2,145.1	3,279.2
Communication Infrastructure Service Provision Program	254.0	150.0
Telecentres	18.1	101.0
ICT Training/Service	15.9	180.0
ICT Fund	1,125.6	1,493.0
ICT Multimedia Application	1,153.1	1,100.5
E-government	537.7	572.7
Smart School	363.9	169.8
Telehealth	91.8	60.0
Government Multipurpose Card	159.7	298.0
MSC Development	320.8	377.0
ICT Research and Development	727.5	474.0
T O T A L	7,885.1	12,888.9

Source: Economic Planning Unit, MyBroadband 2007 Conference & 2007 Conference & Exhibition

Thrust of National Strategy Framework (NSF) – Bridging Digital Divide (BDD)	
Five Thrust	**Strategies**
Increase access to and adoption of ICT by underserved groups	1. Target at least one telecentre per mukim. 2. Ensure equitable access to affordable PCs & online services. 3. Increase use of electronic services and applications including E-Government. 4. Utilise USP fund to complement government initiatives.
Create value in Bridging Digital Divide (BDD) programmes	1. Implement e-inclusion programmes. 2. Infuse ICT further in existing development programmes for underserved groups. 3. Utilise telecentre to increase socio-economic value of the community.
Develop local content through participatory approaches	1. Develop & increase relevant local content. 2. Provide financial support. 3. Promote generic local content for interactivity.
Cultivate multi-stakeholder collaboration and coordination	1. Integrate & coordinate policies, strategies & programmes for e-inclusion. 2. Incorporate civil society in policy formulation. 3. Increase capacity for creating e-inclusion.
Institutionalise evidence-informed policy and practice	1. Adopt improved methodologies for monitoring and evaluating e-inclusion programmes. 2. Target e-inclusion indicators that measure socio-economic benefits of technology. 3. Continuous monitoring.

Source: Economic Planning Unit, MyBroadband 2007 Conference & 2007 Conference & Exhibition

Overall Government Initiatives to Accelerate Broadband

Keyword	**Initiatives**

Entities	• In 2007, two new entities to drive the supply of highly skilled ICT workers:
	  – Knowledge Workers Development Institute
	  – Multimedia Super Corridor (MSC) Malaysia Digital Animation Centre
	• Based in Malaysia's "Silicon Valley", Cyberjaya

Penetration rate	• Increase to 50% by 2010, from 12% in 2007(grows at 3.7 per 100 inhabitants as at 1Q2007)
Infrastructure Expansion	• Broaden access to communication infrastructure in the rural and remote areas. • Increase investment, in terms of basic telephony, public payphones and Internet services to underserved areas, through Government allocation as well as the Universal Service Provision (USP) Fund.
Exemptions	Import duty and sales tax on broadband equipment and consumer-access devices.

Source: Malaysian government unveils IT initiatives, ZDNet.co.uk

Collaborative Arrangements Encouraged

As the market develops, the consumer will benefit from competitive price and differentiated communications services offerings. Benefits of economies of scale can be derived as products and services are standardised and delivered in concert by various operators involved, especially in a converging broadcast or video and telecoms environment. Market players should strive for sustainability that is derived from having a competitive edge. At the same time, they need to match their innovation strategy with the innovation ecosystem that will tune individual offerings into a viable solution desired by consumers.

In today's entertainment and communications industries, collaborative arrangements may be the only feasible way of bringing your product or service to commercial success. In an innovation ecosystem, an innovator is dependent on other partners for either providing complementary technologies or adopting and incorporating the technology into theirs. In such a situation, it would allow firms to create value that they could not create alone. This stance of collaborative arrangements be it through equity, partnership, joint venture, ecosystem, and others are encouraged to ensure expert delivery in the converging environment of telecoms today.

Comparatives of Broadband Strategies – Selected Benchmark Countries		
Country	**Started**	**Strategy/Developments**
South Korea	Feb 2004	Based on 839 strategy, technological development and infrastructure installation for the shift to broadband. In addition, Korea Telecom is fully into making FTTH available across the country by 2010.
Japan	Aug 2006	Next Generation Broadband Strategy 2010 is to realise nationwide installation of broadband by 2010 and target 90% of households to have access at any time to ultra high speed broadband such as FTTH service. The Plan emphasises the importance of coordination in approach among the government, regional public bodies and operators to achieve these goals.
UK	2006	Promoting 21st Century networks (21CN); broadband to be available equally in urban and rural areas. 21CN plans for optical fibre or metal cable networks based on the "BT GigaStream" Ethernet; fusion of fixed and wireless, including WiFi and WiMAX.
USA	n.a.	Shift towards broadband progressing with emphasis on competitiveness and flexibility of the communications market. The shift towards broadband done by various municipalities in wired, wireless and satellite platforms. BPL is promoted.
EU	Oct 2006	Broadband installation is moving forward based on "i2010 – European Information Society 2010".
North America	n.a.	Advances in the introduction of satellite broadband and in the development of WiMAX – through a combination of public and private sector initiatives.
Singapore	Jun 2006	iN2015 targets use of broadband by 90% of households and the strengthening of the ICT industry.
Australia	Dec 2006	A national "Broadband Blueprint" that is expected to expand broadband availability on a nationwide scale.
France	2006	The ministries of economy finance and industry set up the "Ultra High Speed Forum" in 2006. A plan with target of increasing no. of ultra high speed broadband subscribers to 4 million by 2012.
Sweden	2002-2007	Swedish telecoms regulator outlined a strategy to meet the target of "broadband for all by 2010". The suggestion is to use alternative broadband technologies to bridge the digital gap in some cases. Open fibre networks will play an important role in meeting the target. Sweden is among highest broadband penetration rates in Europe, the result of an effective government broadband policy and a population quick to adopt emerging technologies.
Malaysia	2005/2006	National Broadband Plan (including the Klang Valley Broadband Plan) and MyICMS 886 to accelerate broadband infrastructure development and take up.

Source: Ministry of Internal Affairs and Communications (MIC), Japan, Newsletter "Communications News Vol. 18 No. 13. Oct 2007; SKMM; Swedish regulator broadband strategy outline in Feb 2007; Paul Budde Communication on Sweden Broadband Market; Broadband stimulation in France, Ireland and Sweden by Cullen International 2002.

BROADBAND GOING FORWARD

Planning is Crucial

The planning that goes behind broadband demand and supply are tricky and difficult to implement on the ground. Nevertheless, most countries have embarked on plans to expand broadband availability and take up. There are many different ways that this is done, but most have strong government support and encouragement and indeed, in collaboration with the private sector. The implications of broadband availability and take up cannot be over emphasized in a world today where increased bandwidth means many benefits for the nation, service providers, consumers and all other stakeholders – creating a quantum leap forward into a ubiquitous communications services environment. The ubiquity of broadband is important both in terms of connections and the depth of usage to realise the potentialities much anticipated.

Measurement in Review as a Critical Success Factor

The plan-execute-review exercise is ever more important here. The Japanese government example of this is apt. That is, in the context of promoting next generation broadband technology and in response to user needs for ultra high speed services, Ministry of Internal Affairs and Communications (MIC) is speeding technologies that are "Japan Premium Technologies" such as optical fibre technology, optical wireless communication technology, technologies using the infrared spectrum or visible light spectrum in the frequency of over 3,000 GHz.

However, the realisation here is that there has been no investigation ahead of the actual use or the installation of a user environment for such broadband technologies. As such, there has been a study group formed to investigate into a framework for measures for the installation of a user environment from the technological aspect. In short, a feedback system in the review stage after the planning and implementation is extremely important to ensure steering of initiatives for the desired effects.

CONTACT US

Malaysian Communications and Multimedia Commission (SKMM)
Off Persiaran Multimedia
63000 Cyberjaya
Selangor Darul Ehsan
Telephone: (603) 8688 8000
Facsimile: (603) 8688 1000
E-mail: webmaster@cmc.gov.my
Website: www.mcmc.gov.my
Freephone number: 1-800-888-030

REGIONAL OFFICES

Northern Regional Office
Unit 3, Level 11
Menara UMNO
128, Jalan Macalister
10400 Penang
Tel: (604) 227 1657
Fax: (604) 227 1650

Eastern Regional Office
Level 2, Bangunan Tabung Haji
Jalan Bukit Ubi
25200 Kuantan
Pahang
Tel: (609) 512 1100 / 1119
Fax: (609) 515 7566

Southern Regional Office
Suite 7A, Level 7
Menara Ansar
Jalan Trus
80000 Johor Baru
Johor
Tel: (607) 226 6700
Fax: (607) 227 8700

Sabah Regional Office
6-10-10, Tingkat 10
No. 6, Menara MAA
Lorong Api-Api, Api-Api Centre
88000 Kota Kinabalu
Sabah
Tel: (6088) 270 550
Fax: (6088) 253 205

Sandakan Branch Office
Lot No.7, Block 30
Bandar Indah Phase 6, Batu 4
90000 Jalan Utara, Sandakan
Sabah
Tel: (6089) 227 350
Fax: (6089) 227 352

Sarawak Regional Office
Level 5 (North), Wisma STA
26, Jalan Datuk Abang Abdul
Rahim
93450 Kuching
Sarawak
Tel: (6082) 331 900
Fax: (6082) 331 901

Miri Branch Office
Lot 1395, 1st Floor, Block 10
Centre Point Phase II
98000 Miri
Sarawak
Tel: (6085) 417 400 / 600
Fax: (6085) 417 900

Central Regional Office
Level 17, Wisma SunwayMas
1, Jalan Tengku Ampuan Zabedah
C9/C Section 9
40100 Shah Alam
Selangor
Tel: (603) 5518 7701
Fax: (603) 5518 771

ENQUIRIES

For any details and enquiries please contact the Market Research team:

Yee Sye Chung (Head)
Mooi Mee Mee
Sharmila Manoharan
Azrita Abdul Kadir
Nadzrah Mazuriah
Siti Na'ilah Kamarudin
Nurul Izza Saaman

mrd@cmc.gov.my

Suruhanjaya Komunikasi dan Multimedia Malaysia
Malaysian Communications and Multimedia Commission

Off Persiaran Multimedia
63000 Cyberjaya, Selangor Darul Ehsan
Tel 603 8688 8000 **Fax** 603 8688 1000
Freephone number 1 800 888 030
Website www.mcmc.gov.my