

Attachment 5

2004

WHITE PAPER INTERNET KOREA

As the leading agency for national informatization, the National Computerization Agency provides policies and state of the art technology that will guide us to the successful construction of e-Korea.

White Paper Internet KOREA 2004

For more than ten the people of National Computerization Agency(NCA) have kept helping the public and private sector to make the best of new and exciting opportunities brought by information and communication technology all over the country.



National Computerization Agency
Ministry of Information and Communication

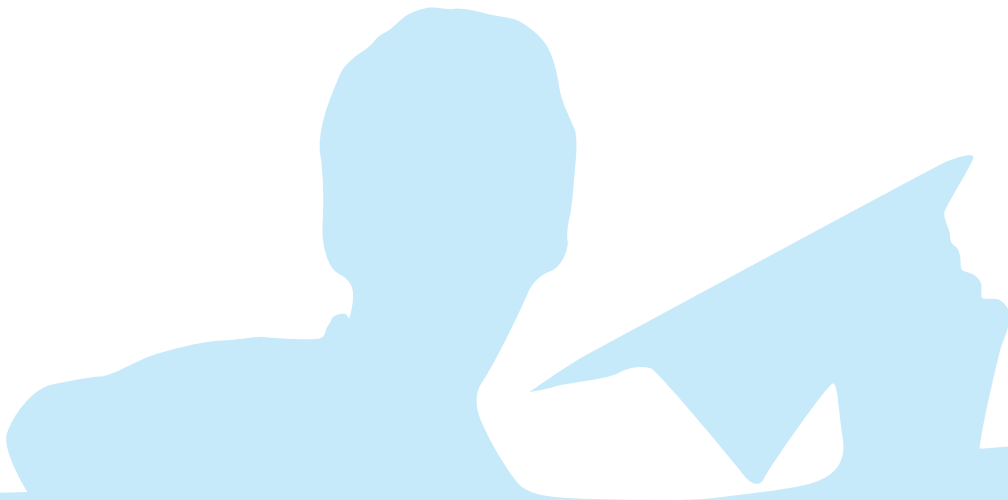
WHITE PAPER INTERNET KOREA

2004

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Message From the Minister

Korea has established a world-class information and communication infrastructure thanks to the joint efforts of the government and private sectors to build an IT powerhouse during the 1990s. Korea's leading infrastructure in the information and communication sector has enabled Korea to achieve unprecedented developments in all areas including political, economic, social and cultural spheres.

As of the end of 2003, 11.18 million households - more than 73% of the total number of households - subscribed to broadband Internet and 29.22 million people - 66% of the total population - had access to the Internet. According to the "ITU 2003 Internet Report," Korea ranks first in terms of broadband Internet penetration rate, has the third largest population of Internet users, and has the fourth highest PC penetration rate in the world. These statistics well illustrate Korea's firm standing as a leading Internet country.

The Internet has become an essential part of our everyday lives as more and more people rely on the Internet for their daily economic activities such as online shopping or Internet banking. Furthermore, an increasing number of parents are also depending on the Internet to provide education for their children.

For small-to mid-sized businesses, the Internet has become a useful tool in embracing information technology. The deployment of world-class Internet infrastructure in Korea has enabled SMEs, which lack capital and labor resources compared to their larger counterparts, to take advantage of the advance of IT technologies and readily introduce them to their own businesses.

On the other hand, the government has spurred its efforts to build an e-Government, thereby making more effective and interactive administrative process possible. The establishment of e-Government has allowed citizens to enjoy convenient public services online at the click of a mouse. The government has also created an environment to establish a Broadband convergence Network (BcN) since 2003 to prepare for a future ubiquitous society and is pushing ahead with plans to migrate to a new Internet protocol system, known as Internet Protocol version 6, or IPv6.

The 2004 Korea Internet White Paper will be useful in gaining a basic understanding of the present and future Internet environment of Korea. It provides a structured outlook on the future development of the Internet environment, trends in the Internet sector, and the current status of Internet usage by companies and citizens.

I congratulate the publication of the 2004 Korea Internet White Paper and extend by gratitude to everyone who participated in the publication of this white paper. Thank you.

July 2004
Daeje Chin, Ph.D.
Minister,

Ministry of Information and Communication



Preface

This year marks the 5th anniversary of the publication of the Korea Internet White Paper. After the Internet became commercially available in 1996, the Internet sector has faced its share of ups and downs; it has developed and diversified but also underwent the burst of the dotcom bubble. 2003 was a good year for the Internet sector as it saw great increases in profits despite the overall economic recession and gained the reputation as a genuine value-added industry. The number of Internet subscribers now reaches 30 million and full-scale movements to realize a ubiquitous environment integrating wired and wireless networks are being carried out.

The Internet sector experienced rapid growth in 2003 as can be seen through the growth of the online education market and the online game market that respectively amounted up to 100 billion won and 600 billion won. Information searching through large portals and new services such as blogs (web logs) have become popular while Internet financial services such as mobile banking and electronic money have started to become widely used. Such examples go to show that the Internet has become an essential part of our everyday lives. Additionally, the quality of wired and wireless telecommunication services went up and the development of handsets became more diverse. On the back of such developments, plans to establish a Broadband convergence Network (BcN) - the first step in realizing a ubiquitous environment in the future - and plans to provide and facilitate IPv6 - a next-generation Internet address system - were announced and various cooperative efforts to execute these plans are being carried out by the government, business and academia.

The 2004 Korea Internet White Paper provides diverse perspectives on domestic and international Internet issues and trends. I hope that the 2004 Korea Internet White Paper serves as useful material to people at home and abroad in providing insights on the current Internet issues and trends of Korea. I would like to thank everyone who contributed to the publication of the 2004 Korea Internet White Paper and would especially like to thank the compilation committee for their helpful advice and editing. Thank you.

July 2004
Suh, Sam Young
President
National Computerization Agency





Milestones in Korea's Internet Evolution

First Stage

Introduction Stage

Second Stage

Developing Stage

The Number of Internet Users
(Unit: 1,000 persons)

20,000

15,000

10,000

5,000

1,000

1980

1985

1990

1995

SDN launched in 1982

USENET connected in 1983

CSNET connected in 1984

PACNET established in 1985

KREN, KREONet launched in 1989

HANA Network launched in 1990

Korea Internet eXchange (KIX) started

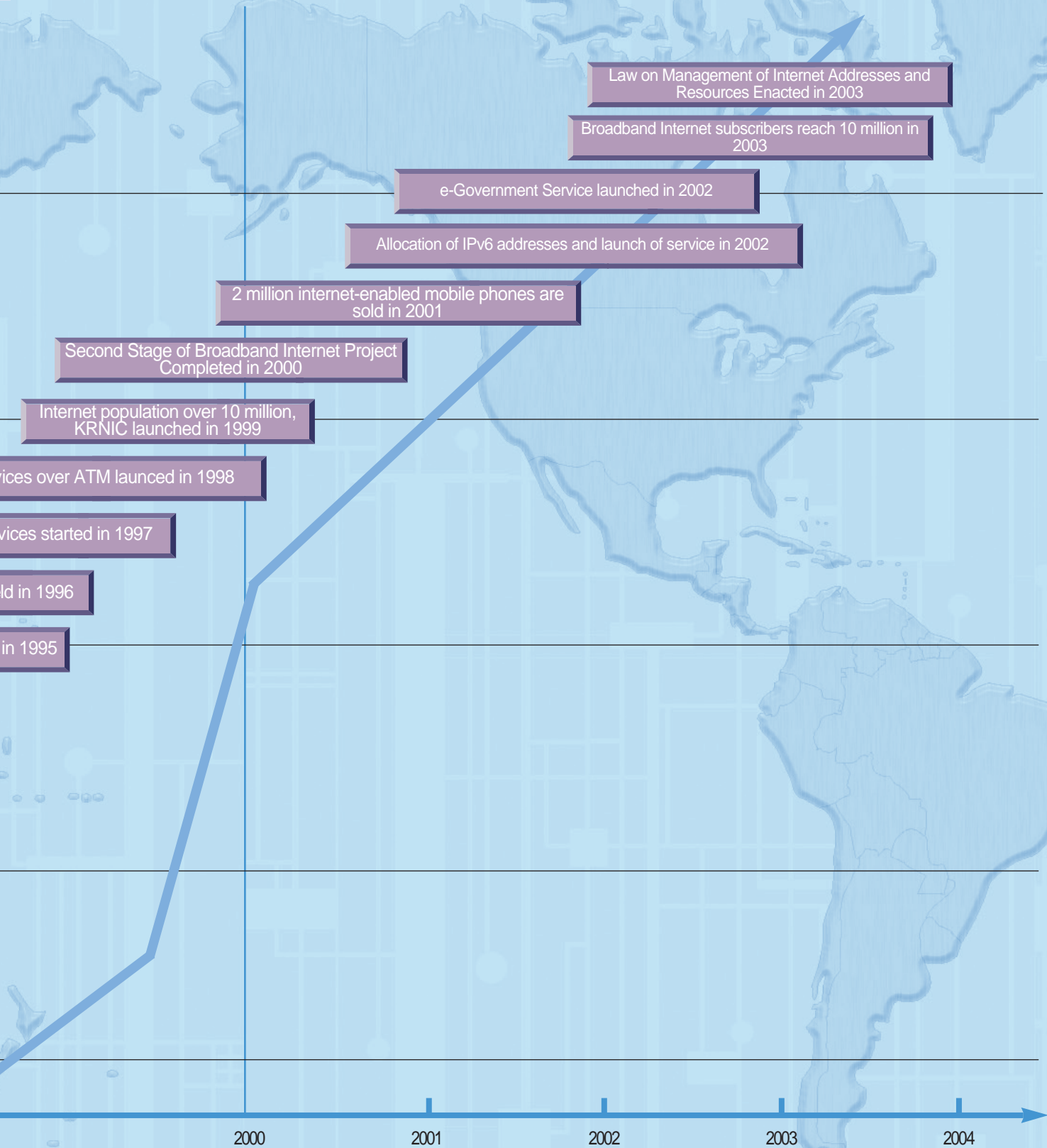
Internet World EXPO held

PUBNET Internet Service

Internet Service

Third Stage

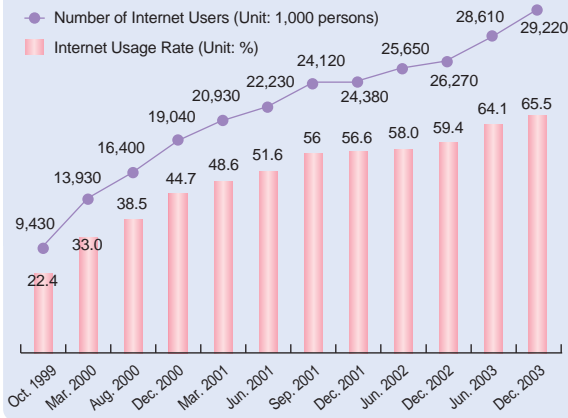
Expansion Stage





Internet at a glance

Number of Internet Users



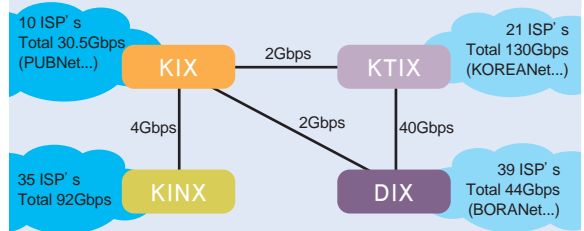
Source: KRNIC (December, 2003)

Number of Broadband Internet Subscribers (Unit: persons)

	xDSL	Cable Modem	Apartment LAN	Satellite Services
Number of Subscribers	6,435,955	3,828,166	909,542	4,836

Source: MIC (December, 2003)

IX Connectivity Diagram



Source: NCA (December, 2003)

e-Commerce Market (Unit: ten billions of won, %)

	2002		2003		Change from Previous Year	
	3Q of 2002	3Q of 2003	Distribution Ratio	Rate of Change		
Total Revenues from e-Commerce	44,926	55,833	100.0	10,907	24.3	
Business to Business (B2B)	40,551	50,028	89.6	9,478	23.4	
Business to Government (B2G)	2,990	4,195	7.5	1,204	40.3	
Business to Consumer (B2C)	1,283	1,517	2.7	234	18.2	
Other	102	92	0.2	-9	-9.3	

Source: NSO (February, 2004)

Trend of B2C Market (Unit: ten billions of won)



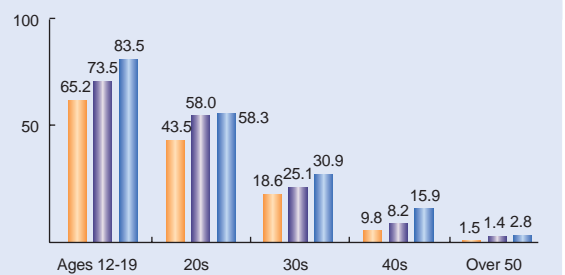
Source: NSO (February, 2004)

Frequently Used Mobile Contents (Unit: %)

Rank	Contents	Ratio
1	Bell Sounds	45.3
2	Games	12.5
3	Ringtones	9.2
4	Music	7.3
5	Characters	5.5
6	GIS	2.7
7	Sing Along	2.6
8	Traffic Information	2.3
9	Stock Information	1.4
10	Sports News	1.4

Source: Yonsei University HCI Lab (October, 2003)

Wireless Internet Users by Age (Unit: %)



Source: KRNIC (June, 2003)

Number of Wireless Internet Subscribers (Unit: persons)

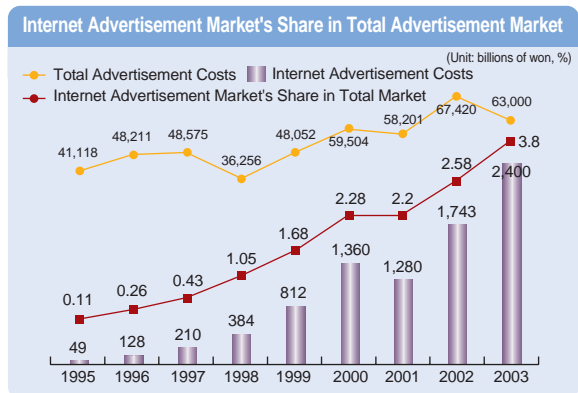
Type	SK Telecom	KTF	LG Telecom	Total	
By Delivery Method	WAP/ME Method	16,094,336	9,526,328	3,981,803	29,602,467
	ISMS Method	695,946	765,862	224,926	1,686,734
	Total	16,790,282	10,292,190	4,206,729	31,289,201
By Network	95A/B	2,715,902	2,939,543	1,363,857	7,019,302
	CDMA2000 1X *	14,074,380	7,352,647	2,842,872	24,269,899
	Total	16,790,282	10,292,190	4,206,729	31,289,201

* Note: CDMA 2000 1X subscribers include EV-DO subscribers (SK Telecom has 3,201,445 subscribers, and KTF has 696,199)

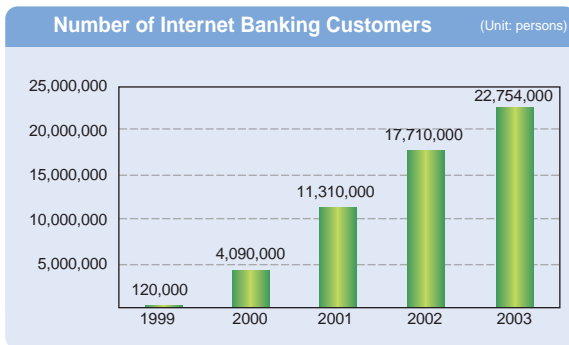
Source: MIC (November, 2003)

Best Selling Items among e-Retailers		
Rank	Items	Ratio
1	Home Appliances/ Electronics/ Telecommunications	18.3
2	Computer Equipment and Peripherals	12.9
3	Daily Necessities/ Automobile Supplies	11.6
4	Clothing/ Fashion-related Goods	10.3
5	Travel and Reservation Services	7.4
6	Cosmetics/ Perfume	6.6
7	Others	5.9
8	Books	4.9
9	Sports/ Leisure Goods	3.9
10	Total	85.9

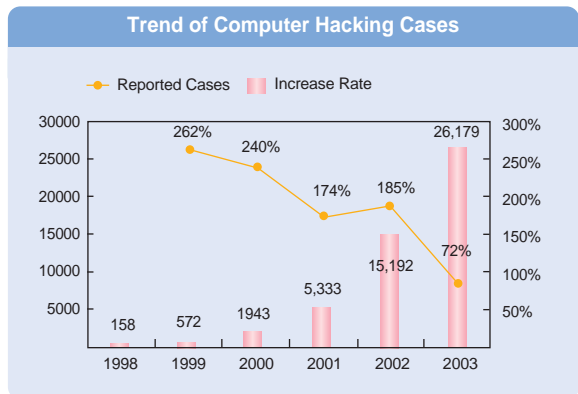
Source: NSO (December, 2003)



Note: Internet advertisement costs are the added sum of web and e-mail advertisement costs
Source: IMCK (December, 2003)



Source: BOK (December, 2003)



Source: KPR (December, 2003)

Amount of Spam Mail (Daily Figure)

(Unit: reported cases)

	2001	2002	2003	Total
Request for Correction	165	2,853	7,918	10,936
Reported to ISP	-	42,555	26,281	68,836
Reported to the Ministry of Information and Communication	43	2,162	1,688	3,893
Reported to Investigative Bodies	-	-	516	516
Total	208	47,570	36,403	84,181

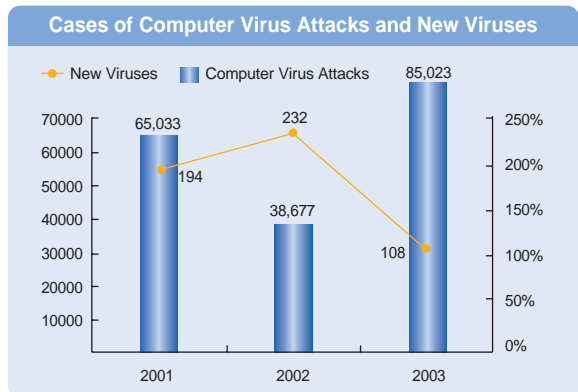
Source: KPR (December, 2003)

Cases of Spam Relay

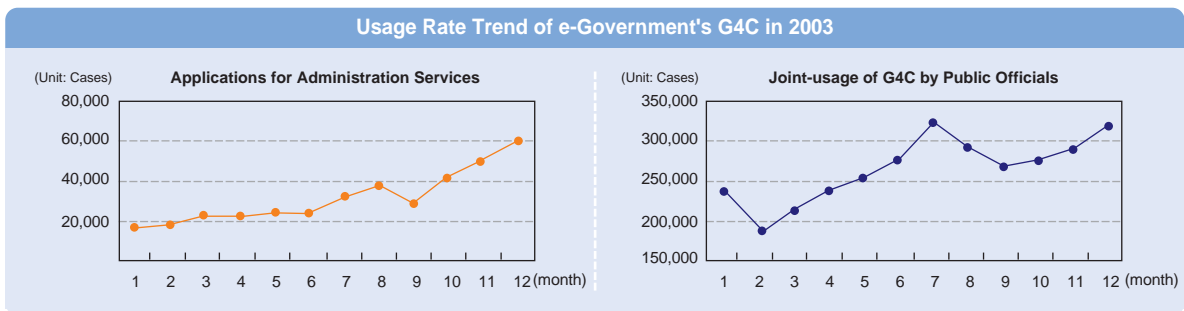
(Unit: reported cases)

	2001	2002	2003
Reported Cases	65	5,537	8,276

Note: Spam Relay is the act of sending spam mail by hiding one's actual mailing address in ways such as using someone else's mail server in order to pass a spam mail filtering system
Source: KPR (December, 2003)



Source: KPR (December, 2003)



Source: NCA (December, 2003)

▶ The Year in Review

01 Rapid growth of the Education Market in e-Learning - Internet broadcasting of EBS Scholastic Ability Test (SAT)

The online education market has recently been expanding at a rapid speed. The college entrance market for an online Scholastic Ability Test (SAT) has grown to 100 billion won in 2003

from 1 billion won in 2001. And in 2004, analysts expect this market to double its current value to reach 200 billion won. In addition, the markets for online education or online test preparation for obtaining certificates will also increase in value.

In particular, the 'EBS broadcasting and Internet service for the SAT' plans to have a 24-hour SAT preparation channel via satellite and rebroadcasts segments on the Internet (EDUNET) so that students can access all the shows from any place at any time they want.

※ 1\$ ≈ 1,200 won



02 Creation of a New Profit Model for Internet Portals - Information search, blog, keyword search advertisement

In 2003, despite the general economic slump, sales figures of leading portals have doubled

from the previous year. In 2003, portal companies exerted all their efforts into service areas by introducing personal media services such as blogs and portal search services. Currently, knowledge searches where people can ask and answer questions is a 'hot trend'. The growth of leading portals such as NHN and Daum communications, Neowiz and Auction owes much to them

being able to obtain various sources of profit and advertisements on search sites. Portal search services limited to listing website addresses was a 100 billion won-market in 2003, and prospects are that it will increase to 200 billion won in 2004.

※ 1\$ ≈ 1,200 won



Number of Internet Users Soon to Exceed 30 Million

The number of Internet users in Korea entered an age of 30 million Internet users as the figure stood at 29.22 million as of the end of 2003 according to the Ministry of Information and Communication (MIC). Internet users as a percentage of the population reached over 65%, and in 2003 those in the mid-aged group (mainly in their 40s) increased by over a million since 2002 making 51.6% of the people in their 40s are now using the Internet. Furthermore, among Internet users, about a quarter have used fee-based services and, buying goods online such as clothes and miscellaneous goods (52.2%) and books (34.5%) is gaining popularity. The Internet no longer just has the role as a community in cyber space but also has become a necessary tool in our daily lives for economic activities such as shopping, Internet banking, and education.



Netizen Culture at the Center of Public Culture

Uploading a photo of oneself on the Internet to be voted on by netizens has now become an established gateway towards stardom. The spontaneous gatherings known as 'Flashmob' are a cultural phenomenon where people hold various gatherings from candlelight vigils to concerts. The power of images has become stronger than before, and the popularity of digital cameras has created a new culture known as 'jjang' for best face, best body. The fact that 'uljjang' and 'flashmob' have become catchphrases in society, entertainment business and other areas means that the unique social networking culture that emerged on the Internet has now become mainstream culture. In 2003, the Internet not only emerged as a gateway to stardom but also developed into an effective medium.



05

New Financial Services including Mobile Finance

In 2003, new financial services and various payment methods such as e-money, mobile banking and smart card, were introduced. Although the financial sector's IT investment was dampened by the insolvency of credit card companies, cooperation between mobile companies and mobile carriers became more active in the case of mobile banking which led to a convergence between finance and telecommunications. In addition, the three mobile carriers, which used to operate their own mobile payment infrastructure (mobile merchant) for the last three years, agreed to make the infrastructure compatible for reasons of cost sharing and common technical standards. As a consequence, a wide range of mobile banking services such as checking the balance of an account, wire transfers and cash advances will be available, and credit card services using a mobile phone is expected to be widely used.



06

Korea at the Forefront of the Global Online Gaming Industry

In 2003, the market size of the online gaming industry was 600 billion won with a high annual growth rate of 30% on average. After Hangeame took over the Japanese online gaming market, Chinese Internet companies such as Sina.com and China.com have tried to buy shares of domestic game companies. Thus, Korean game companies have established a foothold in the global gaming market in 2003 and will start to make strong inroads in the U.S. and European markets in 2004.



※ 1\$ = 1,200 won

07

The Internet at the Center of Political Participation

- Allow for online election campaigns online and enforce 'Internet Real-Name Laws' to mandate the use of real names on Internet bulletin board



As the Internet started to have a greater influence on opinion making and politics, a legal framework was laid out for online election campaign processes for the first time in the world. The election law that was amended in February 2004 permitted the use of the Internet to encourage effective but lower cost campaigns while also imposing new regulations on Internet media. Thus, the 17th General Assembly Elections was the first election to be held centered on the Internet. Furthermore, Internet media companies developed a technology that could match the name and resident registration number of a person with his or her web postings on political discussion boards.

Establishment of Korea Internet Security Center (KRCERT)

After the '1.25 Worm Incident' that affected the nationwide Internet network, the Ministry of Information and Communication (MIC) has been preparing various ways to prevent similar incidents and, as a result, in December 2003, established the 'Korea Internet Security Center' (KRCERT) for the early detection and analysis of cyber attacks against the Internet. Through this center, the government is able to monitor major Internet traffic of ISPs at all times to detect and analyze any unusual activity. In addition, the center is also responsible for issuing an alert or warning to the public before and after any signs of computer intrusions or attacks.



Establishment of Broadband convergence Network (BcN) and Migration to IPv6

- First step towards a ubiquitous environment

With the plan to set up the BcN and promote IPv6, the government decided to upgrade the Internet infrastructure to make it a foundation for next generation industries. To this end, following the development of IPv6 applications and equipment, the government plans to start a pilot project in the area of fixed-line telecommunications such as broadband Internet in 2005 and expand into the wireless telecommunications sector in 2006. In addition, through the establishment of BcN, it plans to create an integrated service environment that converges wired and wireless telecommunications, broadcasting, and voice and data.



Korea Placed 10th in Informatization Level

Korea's informatization levels makes international informatization rankings as can be seen in its steady rise over the years. In 2003, Korea's average ranking was 10th, and in the rankings for ITU's 'Digital Access Index (DAI)' Korea came in fourth place. Korea was ranked near the top with respects to a nation's underlying infrastructure was evaluated. On the other hand, Korea received a low rank in the e-Business World Rankings, which took into consideration political, economic and societal environments. The implications of this are straightforward-Korea must enhance the effectiveness of Internet use.

< International Informatization index >

(Institute) Index Name	Purpose/ Characteristic	Korea's ranking (Number of Surveyed Countries)	Latest Announce ment Date	Ranking of Major Countries
(ITU) Digital Access Index(DAI)	Survey of IT infrastructure and usage focusing on Internet and telecommunication	4 (178)	Nov. 18, 2003	Sweden 1 st , US 11 th , Japan 15 th
(EIU) E-business World Ranking	Survey of e-business environment	16 (60)	Apr. 1, 2003	Sweden 1 st , US 4 th , Japan 24 th
(NCA) National Informatization Index	Survey of informatization by countries	12 (50)	Jul. 22, 2003	Sweden 1 st , US 2 nd , Japan 16 th

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1. ASP [Application Service Provider]

In the past, in order to apply information technology to our work and daily lives, we had to purchase application software stored on a CD-ROM or other storage device, and install them on our hardware. However, with the advent of ASPs, the information paradigm is gradually moving towards the provision of access services that eliminate the need to own both hardware and software applications. Using ASP services delivered through the network, we can use the service anytime, anywhere, as much as we want on a 'pay-as-you-go' basis.

Concept

An application service provider (ASP) is a company that offers individuals or enterprises access over the Internet to applications and services that would otherwise have to be purchased or located in their own personal or corporate computers. Sometimes referred to as software as a service (SaaS), ASP is a new

business concept that allows companies to access business applications ranging from emails to groupware, ERP, SCM and to CRM, directly from a website for a rental fee.

Background

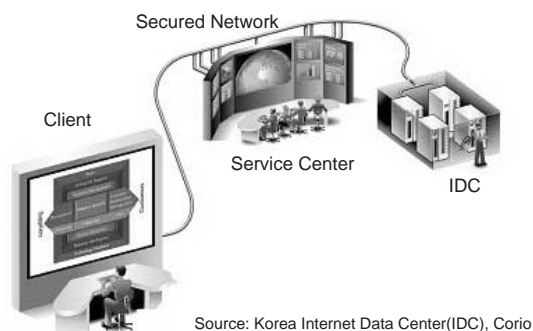
Since computers were introduced 40 years ago, companies have gone through three evolutionary stages of information technology: proprietary software development (1960~), package purchase (1970~), and outsourcing (1980~). Now, they are undergoing the 4th stage shifts from purchasing and installing to 'pay as you go'.

The emergence of ASPs, which brought in access-oriented information paradigm, is attributable to the growing demand to eliminate the need to maintain in-house IT applications forced to constantly keep up with evolutions in Internet infrastructures evolution including broadband network and IDCs. Companies have also recognized the need for new network-based IT services in order to respond quickly to the ever changing business environment, to overcome limits in time and space, to lower investment burden in IT and to address the problem of the lack of IT experts.

Composition of ASP

ASP is composed of several level each offering a necessary component of the service.

Figure 01 ASP Service Concept



■ **H/W and N/W**

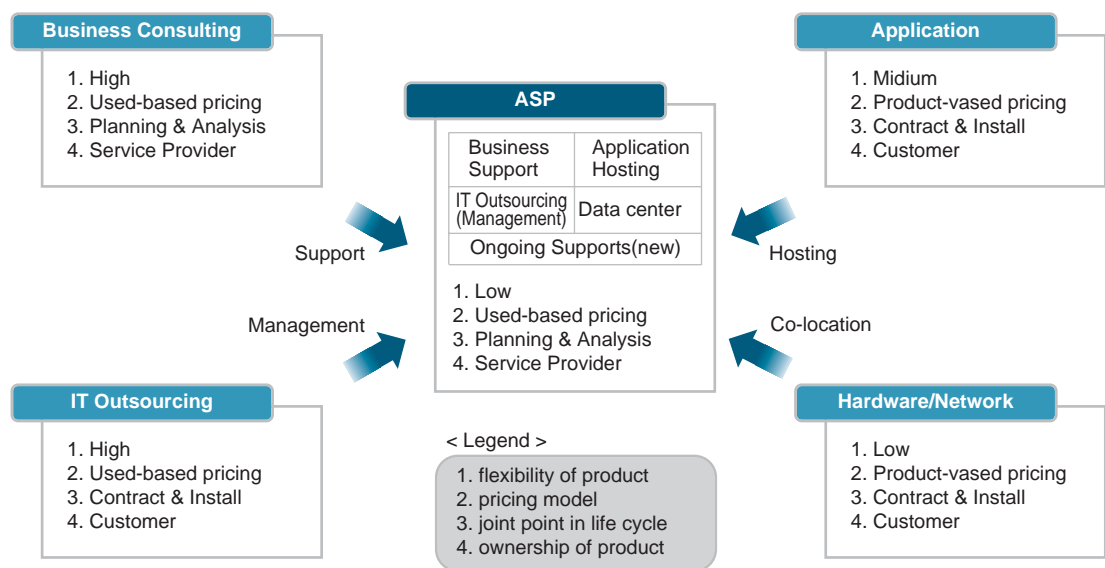
At the hardware layer sit hardware providers who supply servers and equipment. As for software, providers provide software products including management applications. From these two providers, ASP's can consequently offer clients applications such as servers, operating systems, firewalls, middleware, and technology platforms. Data centers offer hosting facilities and management functions, which includes server management, network management, power management and security management. The network layer provides a physical network access

service that can recognize applications. Companies involves in this include traditional telecommunications providers and ISPs (Internet Service Provider).

■ **Application**

The ASPs host applications from system developers and independent software vendors (ISVs) and offer both off-the-shelf applications and customized solutions while continuously maintaining them. Application users can categorize ASP, as follows.

Figure 02 Composition of ASP



Source: Internet Data Center(IDC)

Table 01 ASP Classification by Application Types

Classification	Content	Example
Personal ASP	Solution that can support many individual clients at low cost	Web mail, web office programs etc.
Collaboration ASP	Solution designed to support internal collaboration	Groupware, e-billing system etc.
Relation ASP	Solution that supports external relations such as customer management and exchange of information with partners	CRM, SCM etc.
Internal operations ASP	Solution that supports a company's basic operations and business management of a company such as finance, H/R, accounting and marketing	ERP, MIS etc.

Source: Korea Association of Information and Telecommunication(KAIT), Jul. 2003

Evolution of ASPs

The evolution of ASPs can be divided into the following three stages.

■ 1G ASP

In the early stage, ASPs offered software packages over the Internet. The application packages were either installed in a client's office as in-house solutions or hosted on the server to provide ASP services. When you installed the software in your office, you were charged a license fee and ongoing support and maintenance fees. Most ASP contracts were similar to the traditional maintenance outsourcing contract.

■ Web Native ASP

Following the first wave of ASPs, new applications made their debut as a service over the Internet, and they are classified as web native applications. These web applications were built to have a one-to-many delivery channel in their Internet service system and were developed fit to special network services rather than in-house solutions. Suppliers did not customize the service to each client's environment, and one consolidated bill was issued for both S/W license fee and the hosting fees.

■ Web Services ASP

Web services application refers to a unit application that can be delivered as a service by itself or in combination of other units of softwares or applications. Providers can host these web services and applications and deliver them to users via one-to-many service channels. In the future, many web-based applications are expected to migrate to a web service architecture.

Furthermore, unit applications that comprise application packages will be developed and provided in a web service format, allowing easier integration of application packages to enhance the IT system's efficiency.

As ASP services evolve into web-based services, ASPs are expected to overcome their rigidity and provide customized services, catering to the specific needs of each customer. At the same time, web-based ASP services will make it easier to integrate applications within and between companies, thereby increasing the efficiency of the IT system.

Obstacles to the Expansion of ASP Services

Initial software providers triggered the following problems in the process of repackaging large applications, which were subsequently

Table 02 Evolutionary Stages as a Service

Stages		Description	Period (Year)
1st Generation ASP		Focus on the delivery of software packages over the Internet	1998-2000
Web-based ASP		Advent of Internet-based software development companies	1999-2001
Web service ASP	1G web service	Ensure interoperability through alliance based on the standards like SOAP, UDDI and WSDL	2000-2003
	2G web service	Provide components-based web service	2003-2005
	3G web service	Provide business process-based web service	2005-2010

Source: Korea Internet Data Center(IDC), 2002

installed and run on the client's system as ASP services. First, systems were often delayed or local servers needed to be installed at the client site due to complex application, both of which led to failure in accommodating network access or multiple user access. Second, ASPs faced excessive requests from clients for customization as clients expected ASPs' services to be as personalized as in-house solutions. Further, pricing was still based on 'per-seat' basis due to lack of expertise in sophisticated pricing and service volume measurement. ASPs offer centralized network services that integrate

facilities and applications, which used to be owned by individual companies. Accordingly, ASP services have not yet gained confidence and reliability compared to in-house information systems.

Small Business Network Project

The small business network project targets 3.02 million small businesses with less than 50 employees, as well as solution developers who serve small businesses. A total of 71.4 billion won

Table 03 Service Delivery Per Consortium in 2003

Classification		Current Status
KT (36 participating companies)	Basic Service	VPN+bizmeke solution, KORNET+bizmeke solution, Megapass+bizmeke solution
	Value-added Service	Lite Alzzapack, Groupware, Business management, Business management POP, shopping mall builder, homepage builder, Credit card, information management, B2BI, SCM, ERP, platform rental service, marketplace, semuro national pension, health insurance, medical insurance, iPOS, mobile
	Specialized Service	Automobile management, beauty salon management, food materials management, interior, sports club management, real-estate management, church management, optician's shop management
Hanaro Telecom (67 participating companies)	Basic Service	Merchant, Soho
	Value-added Service	4 insurance, handy account book, comprehensive payroll management, groupware, CRM, CRM plus, card master, mail hosting, establishment of home page, home page building plus, CRM, e-Business card, domain registration service
	Specialized Service	Hair salon management, optician's shop management, car service center management, soho mall, kindergarten management, institutes management
Dacom (10 participating companies)	Basic Service	Fund management, MagicFax, CMS
	Value-added Service	Foreign currency information, legal information, legal counseling, shopping mall, home page, video conference, vidual web, call center, CRM, personnel/salary management, webhard, WebTAX21, web hosting, mail hosting, OnNet21, settlement service, trade EDI, eSCM21
	Specialized Service	Marketing/logistics management of distributors, accommodation management, RentPRO, wedding hall management, vending machine marketing management, apparel/furniture dealer management
Korea Information and Communication (2 participating companies)	Basic Service	Card sales manager
	Value-added Service	In preparation
	Specialized Service	In preparation
ELION Information Technology (2 participating companies)	Basic Service	Automobile-related contents & web-mail
	Value-added Service	Shopping mall
	Specialized Service	Car service center management

Source : Ministry of Information and Communication(MIC), Jul. 2003

will be invested from 2001 to 2004 to develop and distribute 50 business models and solutions as well as to support digital training for 180,000 small companies.

The small business network project is designed to develop business solutions that can serve the needs of small businesses in the early stage and provide integrated services in connection with broadband Internet services. At the same time, the project plans to provide small businesses with training on how to use the services to acquire enough subscribers so as to reach critical mass, allowing the network to be expanded autonomously.

Conclusion

ASP has entered a stable growth stage and is expected to evolve leveraging web services as key driver. As software has evolved into a utility service through ASP service, a great change is expected to occur in the overall information environment for individuals and enterprises. Especially, ASP is likely to contribute a great deal towards addressing intellectual property issues of software including piracy.

ASP should be used extensively to facilitate corporate competitiveness and realize an advanced information society, with the world's best IT infrastructure. Korea, therefore, plans to enhance global competitiveness of traditional small-and mid-sized companies and the ASP industry.



2. BcN [Broadband convergence Network]

The recent ICT environment is rapidly moving towards digital convergence, which brings together the industries of telecommu- nications,

broadcasting and the Internet. At the same time, the trends of intelligence, convergence and broadband are being reinforced in the services and

Table 04 Prospects for the Advance towards Ubiquitous Information Environment

Narrowband Network (2.4kbps~9.6Kbps)	Broadband Network (1.5~2Mbps)	Broadband convergence Network (50~100Mbps)
<ul style="list-style-type: none"> · Voice & text services · Focus on electronic information process & distribution · Low Integration among devices 	<ul style="list-style-type: none"> · Broadband Internet service · PC-based service · Some IT products are networked 	<ul style="list-style-type: none"> · Various integrated IT services · IT convergence in all areas · All products are interconnected
<ul style="list-style-type: none"> · Narrowband technology · Single media technology 	<ul style="list-style-type: none"> · Broadband Internet technology · Web-based service technology · Stand alone type IT technology 	<ul style="list-style-type: none"> · Broadband network technology · Digital convergence technology · Ubiquitous computing technology · Convergence technology with other industries
1990	2000	2010

Source: Ministry of Information and Communication(MIC), Dec.2002

devices of information and communication networks. In order to respond to such a drastic change in the ICT environment the Korea Government has set forth a plan to aid the creation of the Broadband convergence Network (BcN).

※ Ubiquitous Network : Ubiquitous refers to the quality of 'being available anytime anywhere', and ubiquitous network means a network environment in which networks exist everywhere, offering always-on connectivity.

Table 05 Prospects for the ICT Service Market (1995~2010)

Classification	1995	2003	1995~2003 Growth rate	2004	2010	2004~2010 Growth rate
Fixed-line (0.1B won)	66,789	204,951	15.9%	219,449	337,280	7.4%
(Voice)	(58,276)	(57,449)	(-0.01%)	(57,334)	(56,490)	(-0.25%)
(Data)	(8,513)	(147,502)	(47.1%)	(162,115)	(280,790)	(9.7%)
Wireless (0.1B won)	17,101	163,897	35.2%	170,953	198,857	2.6%
(Voice)	(17101)	(146,048)	(33.6%)	(144,533)	(109,339)	(-4.0%)
(Data)	(-)	(17,849)	(81.3%)*	(26,420)	(89,518)	(26.1%)
Broadcasting	27,555	79,793	15.2%	88,452	153,886	9.8%
Total	111,445	448,641	17.9%	478,854	690,023	6.3%

N.B. 1) Fixed-line voice : General call services including local, long-distance and international calls

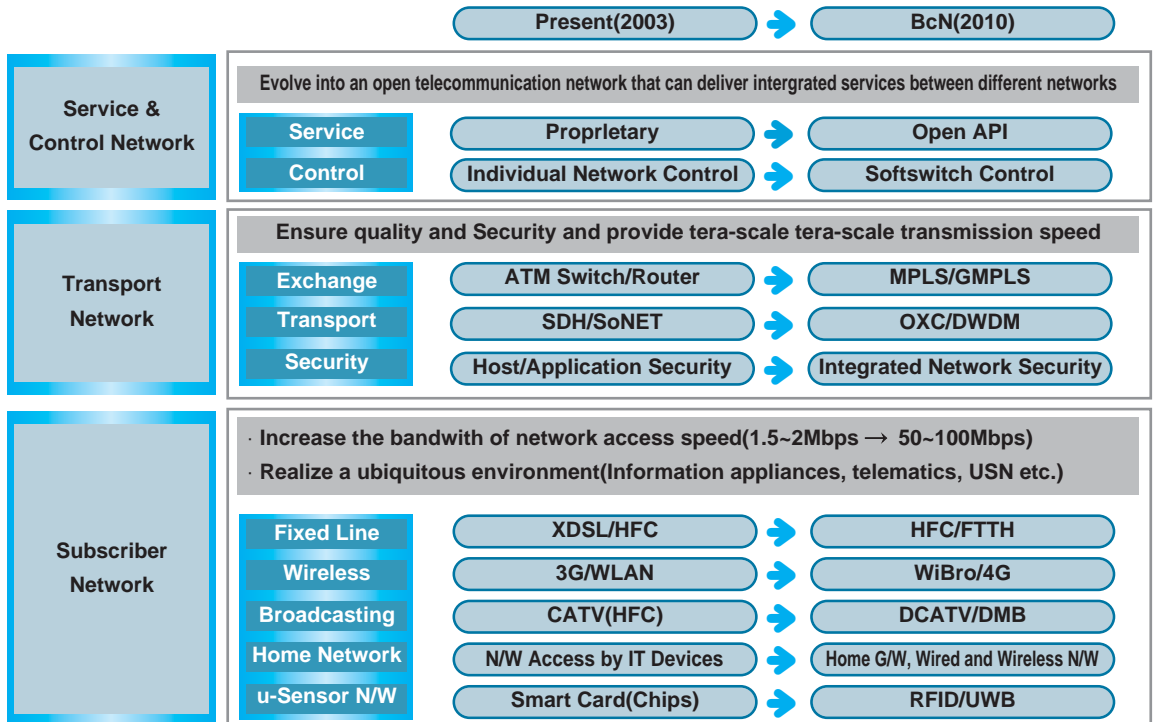
Fixed-line data : Except the areas of fixed-line voice, Internet telephony, premise communications and the entire value-added communications

Wireless data : Portable Internet, mobile phone Internet service, wireless data service

(*) : Year 2000~2002

Source : Korea Association of Information and Communication(KAIT) (1995~2001), Ministry of Information and Communication(MIC)(2002), Korea Information Strategy Development Institute(KISDI)(2003~)

Figure 03 Evolution of BcN



Source: Ministry of Information and Communication(MIC), Dec.2002

Growth Outlook for the ICT Service Market

The size of the ICT service market grew from 11 trillion won in 1995 to 45 trillion won in 2003, a remarkable 18% growth per year on average. As a result, a variety of application services such as VoIP and MMoIP are hitting the wired and wireless telecommunications market with the wide penetration of digital broadcasting and two-way broadcasting. The market is expected to maintain an average annual growth rate of 6%, expanding the volume of business to 69 trillion won in 2010.

Growth Outlook for BcN

The Control Network (CN) of BcN is expected to develop into an open network that delivers a variety of convergence services of voice and data, wired and wireless, and telecommunications and broadcasting. As for the Transport Network (TN),

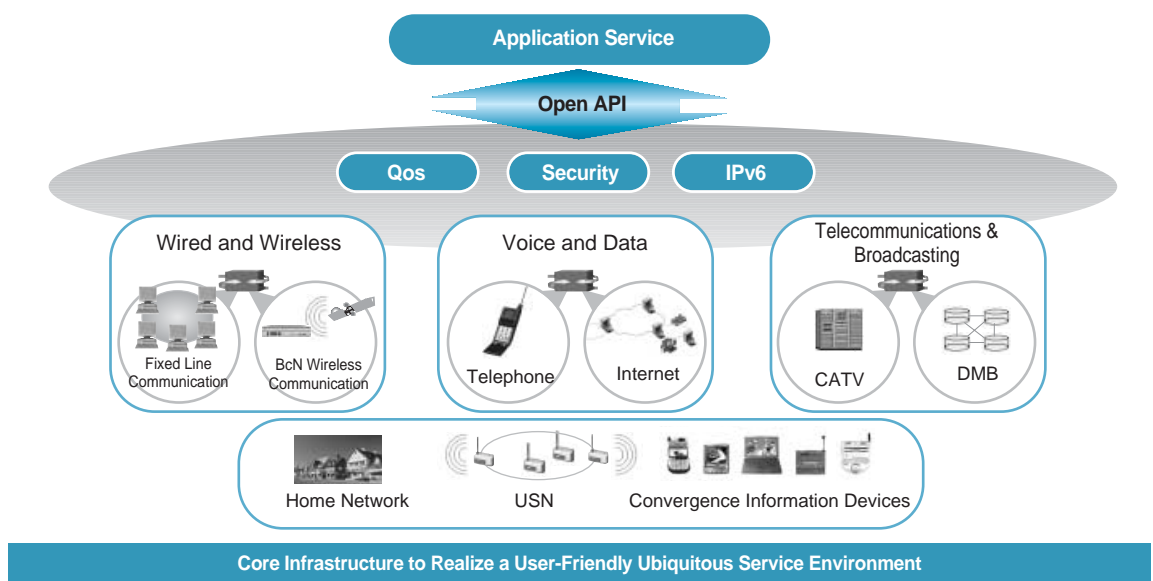
the tera-scale transmission speed will be available, and the Subscriber Network (SN) will turn into a broadband subscriber network that can send and receive a wide array of broadband multimedia information. The home network is predicted to evolve into a structure in which various home appliances are interconnected to provide a set of integrated services. And the development of ubiquitous access network will be mainly driven by the advance of integrated terminals, smart tags, UWB and sensor technology.

BcN will allow a wide range of applications and services to be easily developed based on open API. This convergence network ensures security and QoS while supporting IPv6. In addition, BcN offers a ubiquitous service environment where users can enjoy seamless service regardless of their handset or network operator.

■ Transport Network

Transport networks will be built to guarantee end-to-end QoS, which differs depending on the

Figure 04 Composition of BcN



Source: National Computerization Agency(NCA)

service quality requirement by users. The network also will efficiently carry out the functions of intrusion detection, intrusion response, and traffic control. As the Internet spreads of to include, information terminals, home appliances, and sensor networks, a new Internet address system, IPv6 (128bit, Some 3.4×10^{38} addresses) is necessary to enable this cusent estimates project that IPv6 will be functional by 2006. Against this backdrop, in order to introduce IPv6 in all the layers including a variety of information devices and digital home appliances, IPv6 is being applied to new businesses like portable Internet and digital home, and the migration from the existing IPv4 network to IPv6 network is taking place on a gradual basis. Open API services will be introduced through standardized interface among all network layers, so as to create an environment where services can be developed and used regardless of the types of telecommunications networks.

■ Subscriber Network

Currently, more than 100 million households subscribe to a broadband subscriber network, which uses technologies like DSL, HFC and LAN ; but, there are a limits to what the bandwidth can deliver contents, interactive services like P2P (Peer To Peer) and digital home services.

In order to accommodate a wide range of telecommunications then, broadcasting and convergence services such as HD-quality VOD, P2P, webcam chatting and games, 50~100Mbps bandwidth will be required in 2010. Accordingly, the existing subscriber network is expected to broader its bandwidth, and eventually lay optic cables from a carrier' s office directly to a subscriber' s residence, thereby achieving FTTH (Fiber-to-the-Home).

The Korean Government plans to roll out high-speed WLAN service with a goal of building the wireless network that ensures 50~100Mbps of bandwidth both at a standstill and on the move. At the same time, portable Internet service also will be introduced, offering 30~50Mbps transmission speed in low to medium speed moving environments. In addition, a service that ensures transfer speeds of up to 10Mbps while moving at high-speeds will come through IMT-2000, and New Mobile Access(4G mobile communications service) will be commercially available with the speed of 100Mbps around 2008~2010.

Upgrading the broadcasting network by interworking telecommunications and broadcasting networks will allow the provision of high-quality (HD-quality pictures and CD-quality sound) two-way intelligent services that can be used anytime, anywhere. Such a network upgrade will contribute to creating various business models including T-Gov and T-Commerce, and lead the existing broadcasting infrastructure such as terrestrial, cable, satellite, and DMB broadcasting into going digital while developing into the convergence network of telecommunications and broadcasting.

■ Home Network

In order to create a large consumer base along with the early expansion of the home network, the government is encouraged to develop and distribute the standard model and low-cost core equipment that befit residential environments like cyber apartments, general apartments and houses. Cyber apartments uses premise wiring, Ethernet, and power line communications (PLC) for their home networks. Mobile devices like mobile terminals and laptops are connected through wireless LAN, and as for A/V devices are connected using IEEE1394.

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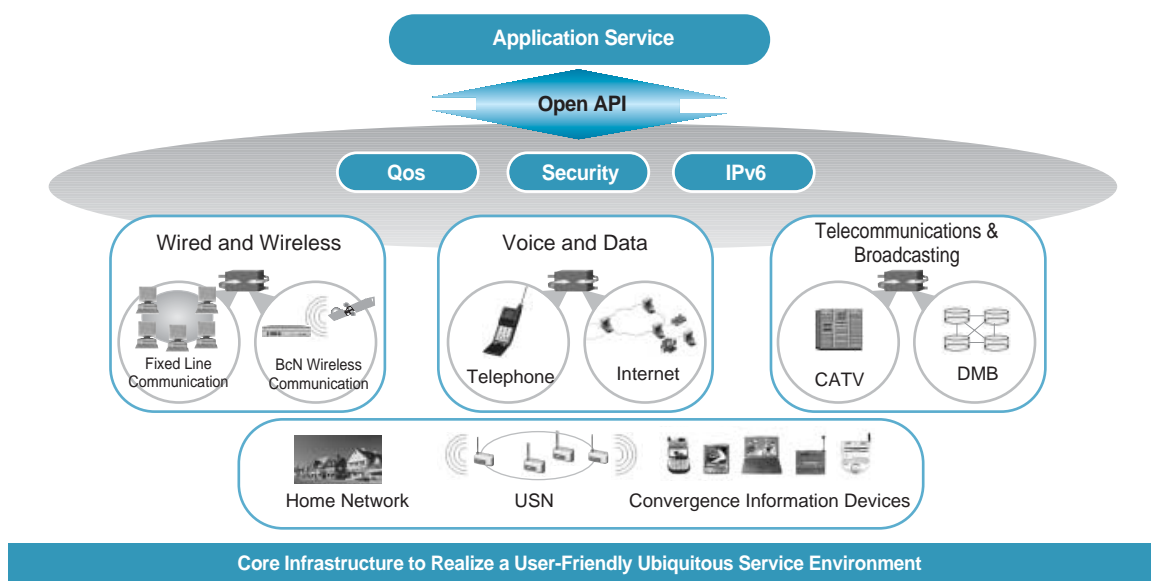
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■ u-Sensor Network

u-Sensor Network links users to the wired and wireless subscriber network by attaching RFID or sensor to the objects, thereby allowing them to collect information of anytime, anywhere.

※ WPAN (Wireless Personal Area Network) : Short-distance wireless network represented by a Bluetooth technology and provides connectivity among mobile devices within the vicinity of the user whether stationary or in motion.

※ RFID (Radio Frequency Identification) : Composed of tag, antenna, and reader. Can be applied to many applications, say, to identify individual objects and surroundings, and provide support for logistical management. International and domestic standards related to spectrum used and output power need to be set up.

■ Building of the Advanced BcN R&D Network

The advanced BcN R&D Network is a network that develops and verifies technologies and services by providing a test-bed for pilot projects. To build such a network, KOREN, which is deployed in six major cities across the nation, will be upgraded. And in order to allow Korean research institutes to conduct international joint studies, Korea should spur efforts to develop Korea into an R&D hub so that international research networks like APII Testbed and TEIN can be interconnected centered around Korea.

※ As of the end of May, 2004, the interconnection of Korea-U.S. (1Gbps), Korea-Japan (1Gbps), Korea-Singapore (12Mbps) and Korea-France (34Mbps) is under construction.

■ BcN Pilot Project

Core BcN pilot projects are developed with the focus on voice/data, wired/wireless, telecommunications /broadcasting, users business, QoS, security, telematics, home network and u-commerce that can create a new service market and create a large demand base in the new IT growth engine sectors.

Creating an Environment for the Building of BcN

In order to successfully build the BcN, the government plans to facilitate the development of services to realize u-Life across the nation including all the public and private sectors. And the government will work on the development of a digitalization model by setting out a plan to build a BcN model city, and explore the pilot projects related to e-Logistics, virtual office, e-Learning, home network and telematics. Further, the government will encourage the use of BcN services by building e-Government communications network and providing the foundations for advanced e-Government services such as m-Gov, t-Gov, and u-Gov.

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1. General Overview of the Internet Industry in 2003

Chapter 1 Introduction

2003 was a meaningful year for the Internet. For one, the domestic Internet industry that had sunk as the dot.com bubble burst discovered the potential to become a 'profit-generating business'. And secondly, the Internet has come to play a greater role in our daily lives. In the meantime, 2003 was also a year that searched for measures to resolve the counter-effects of the Internet.

1.1 Era of High Profit for the Portal Business

Major domestic portal sites such as NHN, Daum communications, Neowiz and Empas posted record earnings due to efforts to diversify their revenue sources and search engine advertising business. In particular, the sales figures of these four companies for the first half of 2003 exceeded the total sales figure for the whole of 2002 and profit rate reached close to 40%. Neowiz leads with a growth rate of 210% compared to the first half of 2002, recording sales of 41.5 billion won, followed by NHN, Empas and Daum which have grown by 158%, 107% and 103% with sales figures of 76.5 billion won, 11.3 billion won and 61.8 billion won respectively. Moreover, the total amount of sales of NHN, Daum and Neowiz in 2003 reached over 400 billion won.

The profit rate of the Internet business draws a sharp contrast with the profit rate of domestic manufacturing companies, which stands at a level of 2-5%. Such a comparison shows the high added value aspect of the Internet business in the sense

that it can be run with only labor and marketing costs. This wipes out the uncertainty of the Internet business and proves that it has risen to the ranks of the category of high value-added businesses.

1.2 Fierce Competition for the Top Place between 'the Big 3'

The competition between Daum, NHN, Neowiz, Knowledge power station, Yahoo! Korea (Yahoo), Nate etc. for the top three spots in the industry that is currently held by Daum, NHN and Yahoo, has become fiercer than ever before.

As the competition between web portals increases, the distinct business areas in the portal business have merged and today web portals provide a one-stop comprehensive service. In other words, if one web portal provides a service within a couple of months, most of the other portals start to offer similar services. Conventional search portals such as NHN and Empas are concentrating their investment on community services which is expected to be the next major service. As NHN's 'Hangame' achieved great success, Daum, Empas and Freechal also competed to start a game portal and Naver's knowledge search service has also mostly expanded to portal services.

1.3 M&A Frenzy

M&A has become one of the most important management strategies for survival and expansion in the portal industry. Just as Naver and Hangame merged into one company to become NHN, such a trend is gaining momentum since merging with another company that possesses a different technology and an established user base, is more profitable and easier than entering the new market as a new entrant.

1.4 Fusion of the Wireless Internet Content.

The main topic of conversation among industries dealing with mobile content is 'fusion.' While user demand for more diverse mobile content is growing, the overall wireless Internet content market is growing rapidly. The fusion of business items as well as advancement into new areas has become a common interest for mobile content businesses. This reflects the acknowledgement of mobile content businesses that they will not be able to survive or take a leading role in an era of network interworking between wired and wireless just by providing contents such as bell music and games. In particular, the business structure that guaranteed stable profits started to come under pressure as mobile content, fixed-line portals, mobile communications businesses and other players started to face fierce competition with the opening of wireless network.

1.5 Full-fledged Use of the Hangeul Domain

As Hangeul.kr domain registration service started in August 2003, the era of the Korean domain opened in Korea's Internet market. Considering the fact that Hangeul.kr domain is a Korean domain that is superior relatively on recognition but due to legal rights' issues regarding trademark law and successive introduction of new services, its actual effectiveness as a domain was realized in November 2003 when its popularity was encroached upon by hangeul.com and Hangeul.net. But despite such difficulties, registered users of the Hangeul domain rose at an immense rate and in November 2003 '.kr domain reached 600 thousand'.

1.6 Game Craze Across the Internet Industry

2003 was a year when the Internet industry focused all its efforts on games. In the case of NHN that is operating Hangame as well as the Internet portal site, Naver has profit margins of 40% on revenues and its Hangame division contributed a substantial portion of these profits. The Internet community site, Neowiz of Sayclub, may have made a loss in the first quarter of 2003 but with the incredible response from Netizens for Saygame, their game business, not only could they overcome the losses but sales in 2003 continued to rise. The number of all small-and mid-sized portals, contents industries, companies that pursued projects related to games, amounts up to around 30.

1.7 Korean Mobile Games Sweeping the Global Market

Domestic mobile games have advanced into the top ranks for games in top communications industries and mobile portal sites in other countries. The mobile game 'Action Tennis' of Magic house technology ranked fifth out of the total downloads within a week of starting its services on Jamba!, a well-known European portal site, and gained widespread popularity. The

mobile game 'Samgukji' which Manastone introduced in China, is a leading game among Chinamobile WAP games. The mobile game portal site 'Minigame Paradise' that was introduced in Japan by Com2us ranked number one among Java games. In this light, it seems that due to the rise in the value of Korean mobile game brands, the export prospects of mobile games is very bright, and it seems that mobile games will become the export item with the most potential in 2004.



2. The Internet, Penetrating into Our Daily Life

2.1 'Personal Media' Blog Craze

The blog craze which is a personal media, has over 2,000,000 new blogs being set up a day in about 30 portal blog services and special sites, and in November 2003 blog users reached over 10 million. The immense success of blogs are due to the attraction that you can be at the center of the site and create your own open community. At the end of 2002, the number of blogs hovered around 2 million but increased more than fivefold within a year. Given the total number of people who use the Internet, it means that one out of three Internet users have their own personal blog. Furthermore, with the introduction of the mobile blog (mobiolog) which enables users to post photos taken on their mobile phones directly to their blog by connecting their blogs and mobile phone, users are becoming 'prosumers' who produce content as well as consuming it.

2.2 Expansion of the Internet Culture

2003 was a year when the Internet's role as a gateway was significant as the influence of images grew. The word 'uljjang' which means 'a good-looking face' became popular word in social, political and cultural areas and events related to 'uljjang' were held all the time on web sites and each web portal competed to set up related services too.

2.3 Internet Users: Rapid spread to those in their 30s and 40s.

There has been a significant increase in Internet users among 30-40 years of age. In particular, the middle aged group in their 40s who can be referred to as the generation caught in the middle of the digital and analog age, are rapidly surfacing all over the Internet. According to the outcome of

the ‘survey on the current situation in informatization technology’ carried out by the government in November 2003, Internet users in

their 40s have increased by over 1 million and out of the total number of people in their 40s, 51.6% are shown to be using the Internet.



3. Exploring Policy Alternatives

3.1 A New Turning Point in the Internet Address Policy

The Internet Address Resources Act that was passed in the national assembly in November 2003 was announced in January 2004 and will be put into effect on July 30, causing the Internet address policy to reach another milestone.

The bill will provide a new opportunity to introduce and use a management system in the Internet address protocol that had been bogged by squatters and excessive competition that had been happening so far. In particular, it is significant in that the government allowed the limited number of Internet addresses to be used by all, thus making the best use of its strength as ‘a country with well-deployed infrastructure’ and established a legal basis to take the leading role in the Internet address system.

3.2 Strengthened Internet Security Policy

After the Internet break-down incident in January 25 2003, with wired and wireless Internet services grinding to a halt for about nine hours, the government formed a ‘Computer Emergency

Response Team (CERT)’ to prevent such incidents from reoccurring. The government established a comprehensive war room and Korea Internet Security Center (KRCERT) involving the experts from the government, ISPs and information security companies. In particular, spam mail and spread of computer viruses through e-mail and most frequently used services have become a major issue that needs to be controlled in cooperation between private and government agencies and there has also been an increase in the number of people installing anti-virus programs. Government policies that had concentrated on expanding the underlying Internet infrastructure are now making efforts to ensure the security of the infrastructure and prevent various cyber attacks.



1. Trend in Internet Usage

1.1 Fixed-line Internet

■ Number of Internet Users

In Dec.2003, the percentage of Internet users nationwide was 65.5% with the number of Internet users among those with registered residence in Korea reaching 2,922 million. The number of Internet users has increased every year by more than 10%, only beginning to slowing after 2001 when the market became relatively saturated.

■ Gender/Age Groups

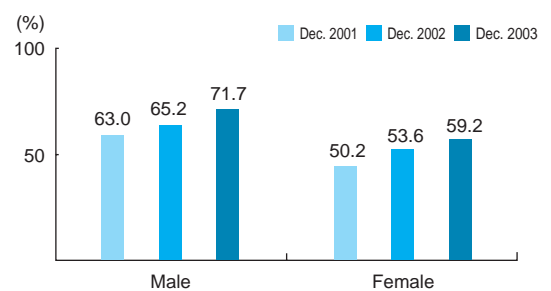
In Dec. 2003, approximately 72 out of a hundred Korean men and 59 out of a hundred Korean women used the Internet. As for age breakdowns, the percentage of Internet users aged 6~19 was the highest with 94.8%, followed by those in their 20' s with 94.5%, those in their 30' s with 80.7% and those in their 40' s with 51.6%. In

comparison to Dec. 2002 surveys, usage among those in their 40' s showed the most growth, increasing by 12.3% (1.08million). the growth of internet use by those in their 30' s followed close behind with 11.3%(0.98million) growth.

■ Households with Internet Connection

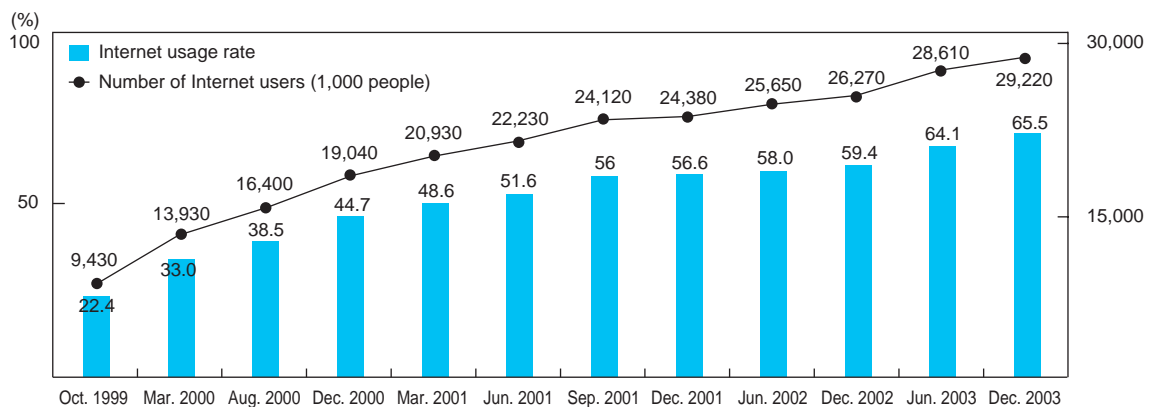
Among households, 68.8% had Internet connections, and 91.5% of the households with computers have suitable Internet use environments.

Figure 2-02 Internet Usage by Gender



Source: Korea Network Information Center(KRNIC), Dec. 2003

Figure 2-01 Changing Trend in the Number of Internet Users



Source: Korea Network Information Center(KRNIC), Dec. 2003

The total number of houses with computers is divided into 'Internet accessible households' and 'Internet access unattainable households'.

middle and small cities and in major cities, 83.1% of the households connect into the Internet via 'XDSL'.

■ Internet Connection Type

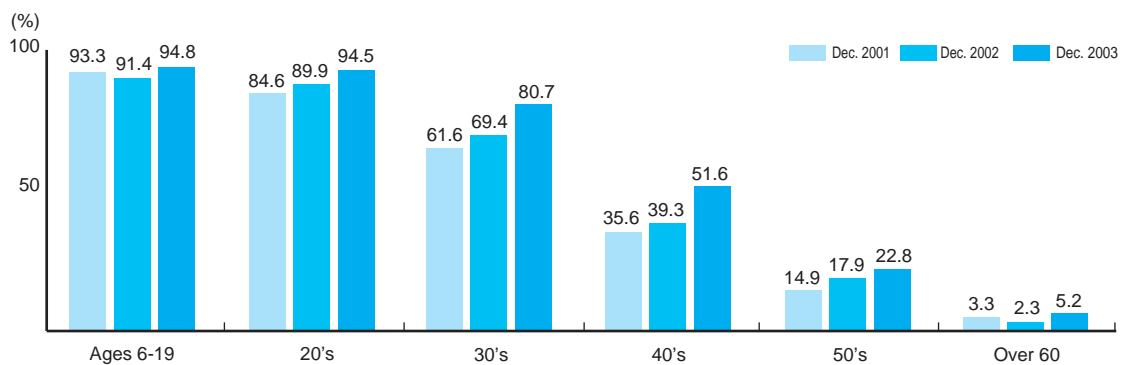
In Dec. 2003, the most popular type of Internet connection among families was the 'XDSL' type with 83.5%, the 'CATV' net (12.4%), 'Dial-up MODEM' (2.1%), 'ISDN' (1.0%) etc. In case of district regions, 88.2% of households with access to the Internet use the 'SDSL' type, 83.3% in

■ Internet Fee

The monthly average Internet usage fee among Internet accessible households is approximately 32,100 won, and among all households with Internet, the average monthly payment is 22,100 won.

By community, the monthly average costs in

Figure 2-03 Internet Usage by Age group



Source: Korea Network Information Center, Dec. 2003

Table 2-01 Ratio of Households with Internet Connection

(Unit: %)

	Households with a computer			Households without a computer
	Number	Internet connection	Non-Internet connection	
Total Households	75.2	68.8	6.4	24.8
Households with a computer	100.0	91.5	8.5	-

Source: Korea Network Information Center(KRNIC), Dec. 2003

Table 2-02 Types of Internet Connection among Households

(Unit: %)

	xDSL	CATV	Dial-up Modem	ISDN	Others	Don't know/no reply
Total	83.5	12.4	2.1	1.0	0.5	0.5
Major cities	83.1	13.6	2.1	0.8	0.2	0.2
Middle to small cities	83.3	12.0	1.6	1.1	1.0	0.9
Districts	88.2	5.1	4.6	0.7	0.0	1.3

Source: Korea Network Information Center(KRNIC), Dec. 2003

major cities is 24,800 won, significantly more than their counterparts in small and mid-sized cities and district regions.

■ Internet Usage Time

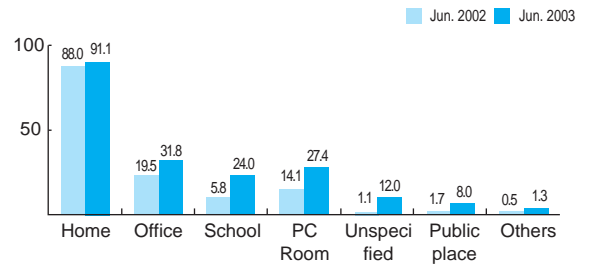
The average Internet usage time per week is 12.5hours with 46.9% of users using the Internet for more than 10 hours. The remaining 27.3% use the Internet for 4~10 hours or less, and 16.8% use the Internet for 2~4 hours or less.

■ Main Location for Internet Use

Surveys show that most Internet users (91.1%) connect to the Internet at home, followed by work (31.8%), PC rooms (27.4%), schools (24.0%) and the remainder at other places.

Figure 2-05 Main Location of Internet Access

(Unit: %)



Source: Korea Network Information Center(KRNIC), Dec. 2003

Table 2-03 Monthly Average Internet Usage Fee per Household

(Unit: %)

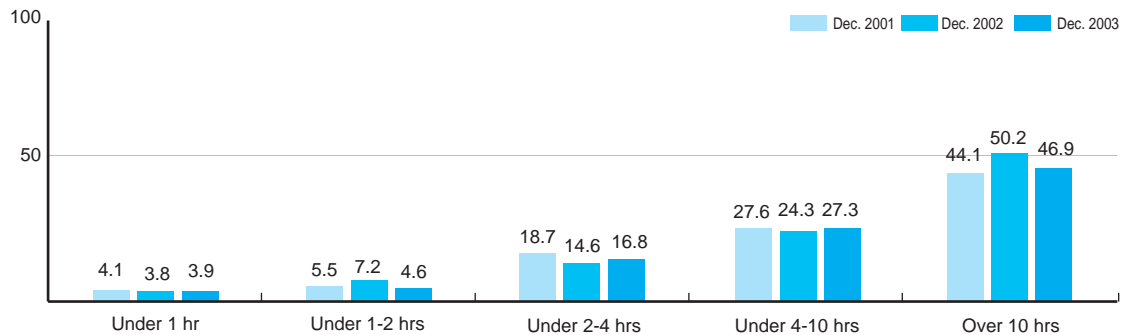
	Free of charge	Less than a 10,000won	10,000~20,000won or less	20,000~30,000won or less	30,000~50,000won or less	50,000won over	No reply	Total household average (1,000won)	Internet-enabled household average (1,000won)
Total	0.3	0.4	1.9	17.2	76.6	2.9	0.6	22.1	32.1
Major cities	0.0	0.4	2.4	14.8	78.0	3.7	0.5	24.8	32.8
Middle to small cities	0.7	0.3	1.1	21.4	73.7	2.1	0.7	21.0	30.9
Districts Regions	0.2	0.6	2.0	10.2	84.4	2.2	0.3	14.2	33.2

* 1\$ = 1,200won

Source: Korea Network Information Center, Dec. 2003

Figure 2-04 Average Internet Usage Time per Week

(Unit: %)



Source: Korea Network Information Center(KRNIC), Dec. 2003

■ The Current Status of PC Rooms

Near the end of 1998, the number of PC Rooms in Korea stood at approximately 3,000. Afterwards, the figure showed continuous growth, expanding to 22,549 by 2001, In 2002 however, this figure decreased to 21,213 as the Internet infrastructure at homes improved.

Also in May 2003, according to a survey of 600 game players in Seoul and Gyeonggi Province, the average time spent at PC Rooms per trip was 2 hours. 43.3% of respondents said to have spent 1~2 hours in the PC Room playing games at costs of approximately 43,000 won monthly. By age group, those above 30 spend 61,042 won monthly at PC Rooms, the most on average. Male users

spend approximately 55,000 won while female users spend approximately 17000 won.

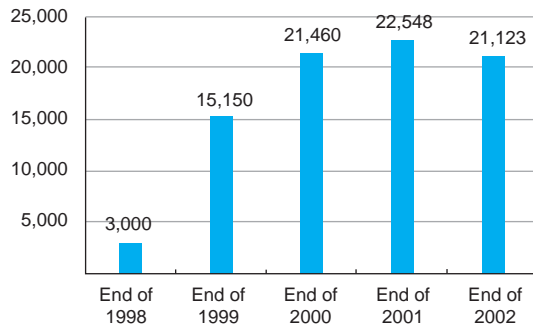
■ Current Status of Internet Shopping Malls and Fee-based Contents.

39.9% of Internet users above the age of 12 have within the previous 6 months conducted Internet shopping, either purchasing goods or pre-purchasing/reserving a ticket.

Most people use Internet shopping to purchase 'clothes/personal goods' (51.2%) followed by 'books' (34.5%), 'living/car supplies' (24.0%) and 'reservation/pre-purchased tickets' respectively.

Figure 2-06 Yearly Trend of PC Room

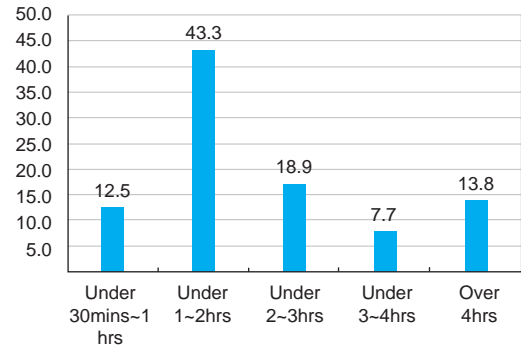
(Unit: No. of PC Room)



Source: Korea Entertainment System Industry Association, Jul. 2003

Figure 2-07 Average PC Room Usage Time per Trip

(Unit: %)



Source: Korea Entertainment System Industry Association, Jul. 2003

Table 2-04 PC Room Usage Fee

(Unit: 100won)

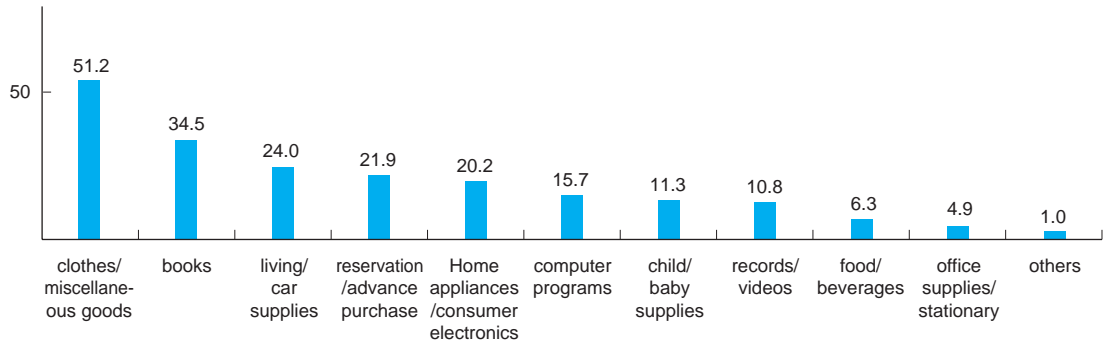
Category		Monthly average usage fee
Total		430.4
Age	10's	28.97
	20's	483.54
	Above 30's	610.42
Gender	Male	554.83
	female	175.32

※ 1\$ = 1,200won

Source: Korea Entertainment System Industry Association, Jul. 2003

Figure 2-08 Items Purchased at Internet Shopping Malls

(Unit: %)



※ more than one answer permitted

Source: Korea Network Information Center(KRNIC), Dec. 2003

1.2 Wireless Internet

In June 2003, 36.1% of wireless Internet users were mobile phone holders, and the number of wireless Internet users was 1.197 million (users above age 12). The ratio of male wireless Internet users was 34.1% and the same figure for females was 38.9%, a 4.8% higher usage figure than males.

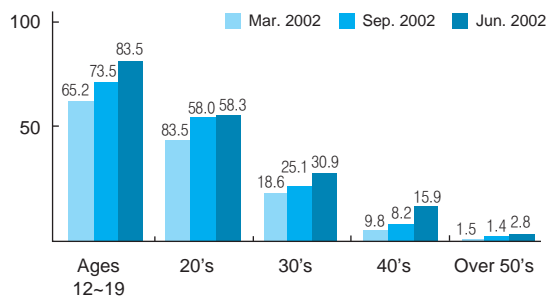
■ Ratio of Use by Age

By age group, Koreans between 12~19 used wireless Internet the most (83.5%) and as the age group gets higher the ratio of wireless Internet use drops significantly with only 2.8% of those above their 50's using wireless services..

In Sept 2002, the 12-19 age group experienced the largest usage increase levels..

Figure 2-09 The rate of Wireless Internet usage by Age Group

(Unit: %)



Source: Korea Network Information Center(KRNIC), Jun. 2003

■ Frequency of Use/Average Time Online

41.2% of wireless Internet users log on at least once every week and up to 10.4% said to have used wireless Internet 'nearly everyday.'

The average usage time per week for wireless Internet users is 1 hour 4 minutes (64.2 minutes). 51.4%, the highest figure in this grouping, said they used wireless Internet 10 minutes or less per week while 12.3% of respondent said they used the same services for 90 minutes or more.

Table 2-05 Usage Time of Wireless Internet

(Unit: %)

		Less than 10 mins	Less than 10~30 mins	Less than 30~60 mins	Less than 60~90 mins	More than 90 mins	Average time (mins/week)
Total		51.4	19.3	11.1	5.8	12.3	64.2
Gender	Male	48.4	18.8	12.0	6.9	13.9	79.0
	Female	55.0	19.9	10.1	4.6	10.5	46.8

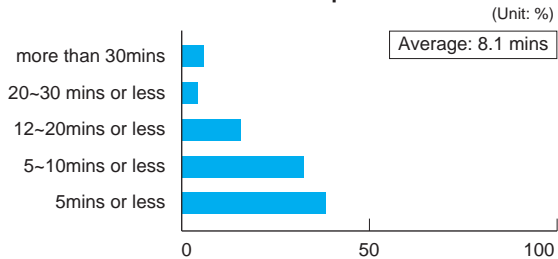
Source: Korea Network Information Center(KRNIC), Jun. 2003

Average connection times to wireless Internet, however, hovered around 8.1 minutes on average.

■ Contents of the Wireless Internet

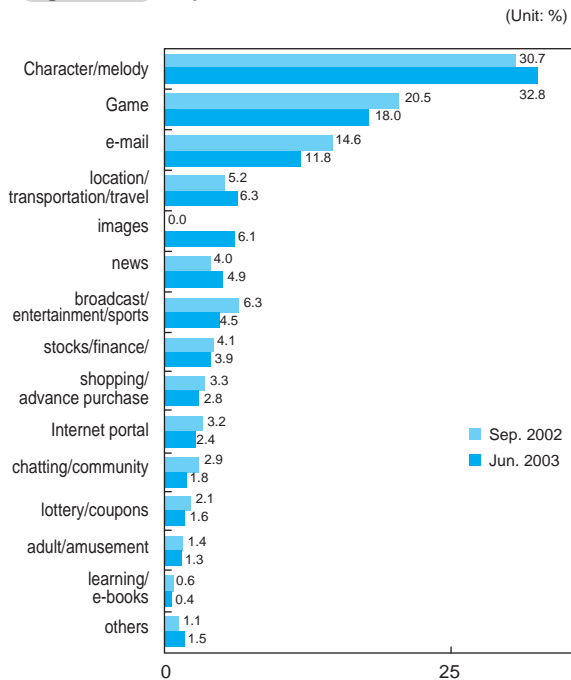
The most popular contents used by wireless Internet users are 'characters/melody/photo download' (32.8%), followed by 'Games' (18.0%) and 'e-mail' (11.8%).

Figure 2-10 Average Usage time of Wireless Internet per Connection



Source: Korea Network Information Center(KRNIC), Jun. 2003

Figure 2-11 Popular Wireless Internet Contents



Source : Korea Internet information center, Jun. 2003

2. Current Status of Internet Usage by Sectors

Chapter 2
Internet Usage

2.1 Industries

■ Network Construction and Current Status of Internet Connection

Among all the companies in Korea with more

than 5 employees, those with established networks (communication networks excluding modems) came to 52.7% as of June 2003, and companies capable of Internet connection came to 79.7%

Looking at each sector, finance and insurance companies had the highest percentage of network

Figure 2-12 Network Construction Rate

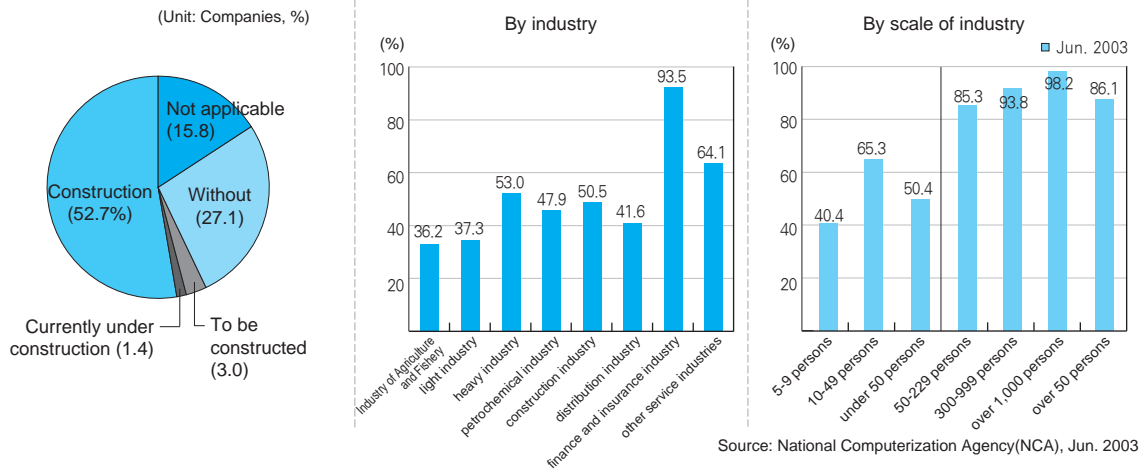
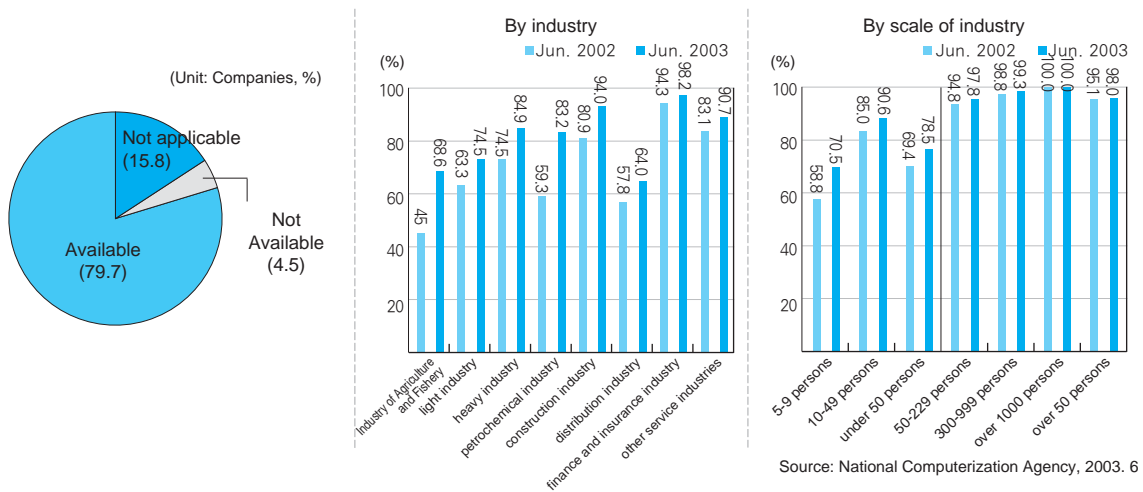


Figure 2-13 Internet Access Availability by Industries



construction and Internet connections while agriculture, forestry and marine product industries were lowest in both network construction and Internet connections. The larger the number of workers was the higher the percentage of network construction and ratio of Internet connections. And in comparison with 2002, there was a much larger increase in network construction among companies with less than 50 workers.

■ Main Internet Connection Type and Speed

In June 2003, 64.2%(241000) of the 375,000 industries able to have Internet connections used 'xDSL' to connect into the Internet, and 18.9% used 'leased lines'.

By industry, finance and insurance companies (52.3%) used leased lines as their main connection type. And by organization types, central and local governments (65.0%) used leased lines as their main connection type.

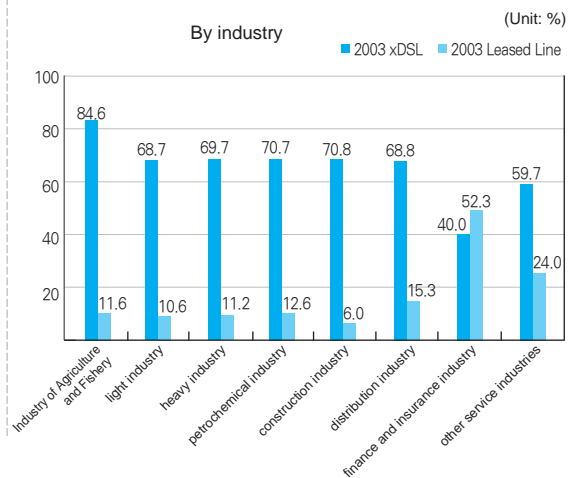
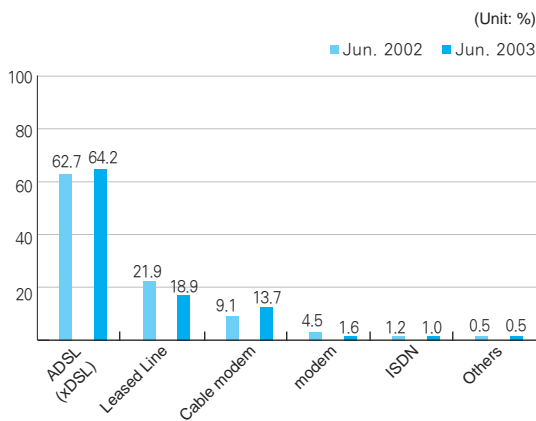
■ Proportion of e-Commerce Usage

According to our yearly survey on e-Commerce (subject to companies with more than 5 employees between Jul. 2002 and Jun. 2003), 23.5% of companies that have experienced electronic trading or roughly 111 thousand companies.

If we compare this to the same period in 2002, the proportion of those with experience in e-Commerce has increased by 13.7%, evidence of e-Commerce's increasing appeal. By industry, construction, finance and insurance industries and other service industries record slightly higher rates of e-Commerce use with light industries the lowest.

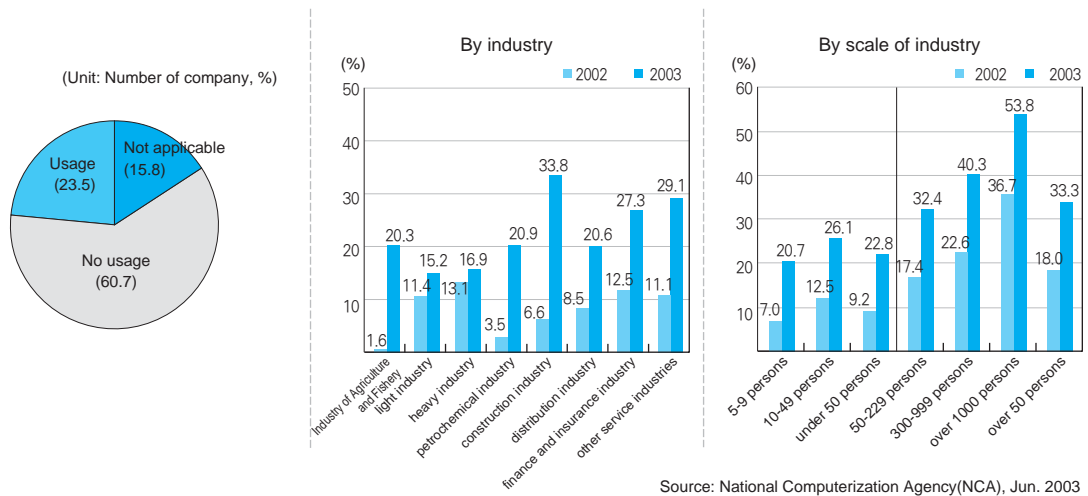
Gauging by the number of employees, for companies with less than 50 employees, the percentage who used e-Commerce is 22.0% while companies with more than 50 employees recorded a higher 33% use. In comparison to the same period in 2002, the proportion of e-Commerce usage by companies with less than 50 employees has increased by 13.6%.

Figure 2-14 Main Internet Connection Type by Industries



Source: National Computerization Agency, 2003. 6

Figure 2-15 e-Commerce Usage Rate



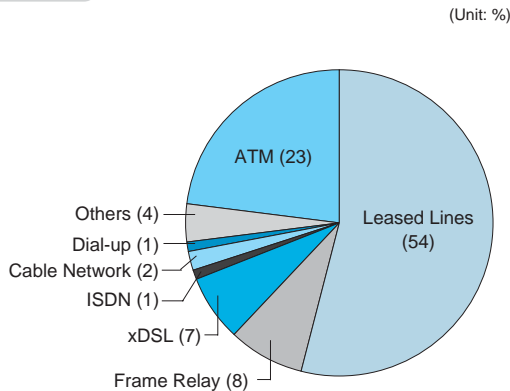
Source: National Computerization Agency(NCA), Jun. 2003

2.2 Public Organizations

■ Internet Connection Type

The method of Internet access mainly used by public organizations is via leased lines (54%), followed by ATM's (23%), Frame Relay (8%) and Xdsl (7%). 76% of these Internet lines can handle 256Kbps or more.

Figure 2-16 Connection Type of Internet Lines

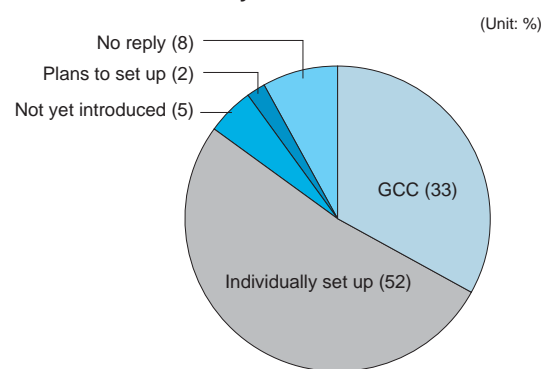


Source: National Computerization Agency(NCA), Dec. 2003

■ Online Civil Services

In the public sector, 90% of institutions have introduced online civil services while 10% have not. The types of online civil services are verification and validation 27%, petition and inquiry proposal 26%, declaration and transfer 16% while authorization and permission came to 9% and registration and license identification came to 9%.

Figure 2-17 Current status of Building Public internet system for Civil Services



Source: National Computerization Agency, Dec. 2003

52% of all institutions have set up an individual public Internet system to deal with claims, and 33% responded affirmatively to having set up a claim system through the Government Computerization Center(GCC), bringing the total to 85% of all institutions.

2.3 Educational Institutions

■ Preschool and Special Education

Since 1999, preschool Internet education has grown in popularity. And since 2000, around 700 early education institutions were operating their own homepage. The homepages offered information on education plans, events and other educational activities and communication with parents and mailing classroom activities to homes via bulletin boards and counseling sections

The Internet also is being used for special

education, targeting students with disabilities, special education teachers and parents. Out of the total 137 'special' schools, 132 are opening homepages providing services concerning related materials.

■ Elementary and Middle Schools

In Dec.2003, 1,2555,704 PCs were supplied to elementary and middle schools (an average of 2.6 PCs per student); and by 2005, these figures should reach to roughly 5 PCs per student.

As for Internet speed, 6,307 of all schools reached E1 grade (2Mbps) lines or more, and in 2003, 71% reached the same grade. As every elementary and middle schools is supplied with Internet lines and most schools have constructed their own homepage, the school and family are being closely connected, sharing teaching and learning materials through homepages.

Table 2-06 Year of Homepage Establishment at Pre-school Education Institutions

(Unit: Number of institution)

number of sub-menus	1996	1997	1998	1999	2000	2001	2002	2003
total	1	2	10	23	42	59	48	12
Kindergarten	1	1	6	10	28	26	19	4
Children's Home	-	1	4	13	14	33	29	8

Source: Ministry of Education & Human Resources Development, Nov. 2003

Table 2-07 Current Status of Education through Special School Homepages

Regional education office			Special schools		
Number of education office	Established number	Ratio of establishment	Number of schools	Operating staff	Ratio of operation
180	140	77.8%	137	132	96.4%

Source: Ministry of Education & Human Resources Development, Nov. 2003

Table 2-08 Current Status of Internet Speed at Schools

(Unit: Number of lines)

Category	256K	512K	2M	Over 3M	Other	Total
state schools	-	-	45	-	-	45
public and private schools	754	3,381	6,262	-	132	10,529
Total	754	3,381	6,307	-	132	10,574

Source: Ministry of Education & Human Resources Development-Korea Education and Research Information service, Nov. 2003

■ **General Universities**

Since 1996, after expanding electronic networks within campuses and establishing information

education classes at preparatory teachers training institutions in 1999, e-Classes based on on-line learning have been constructed at 151 out of 376 universities. In 2003, about 11,568 classes (53.3%)

Table 2-09 Current status of e-Classes

Category	No. of school	No. of General classes	No. of e-Classes	Percentage of e-Classes
4 year state university	24	4,312	2,165	50.2%
State commercial university	8	619	190	30.6%
Education university	11	476	222	46.6%
State college	5	98	59	60.2%
4 year private university	156	16,158	8,932	55.2%
total	204	21,663	11,568	53.3%

Source: Ministry of Education & Human Resources Development-Korea Education and Research Information service, Nov. 2003

Table 2-10 Cyber University Curriculum

(Unit: %)

		Types of major	
IT related courses	Engineering Department	IT Division, IT Planning course, Computer course, Information Technology division, Computer Information Technology course, Digital Multimedia division/course, Multimedia division /course, Computer Media course, Digital Information course, Internet course, Internet Contents course, Digital Contents division, Education Contents course, International Authorized Computer Programming course, Information Protection course, Computer course.	15.5
	Design Department	Digital Multimedia division (majoring Design), Computer Design division, Multimedia Design division, Digital Design division, Digital Animation department, Space Design	4.4
	Game related	Game Planning course grouping, Game Contents course grouping	1.6
Social Science related courses	Management related courses	Management course grouping/ division /course, Management Information course, e-Business course, e-Management division /course, Management Information course, Venture Management course, Property Management course, Tax Accounting course, Industry System Management course	20.8
	Tourism Management	Hotel Management course, Tourism Hotel and Restaurant Management course	2.5
	Social Welfare	School of Cyber NGO (majoring Social Welfare), Social Welfare course	9.2
	Law/Administration/Society	Law division /course, Law Administration division, International Studies division, Digital Administration course, Advertising and Public Relations division, Cyber NGO course, Military Affairs course	9.8
Language related courses	Language	Foreign Language faculty, Practical English course, Practical Language course	10.9
Humanities related courses	Education / Culture	Digital Education course, Lifelong Education course, Education for Handicapped course, Care of Children course, Literary Creation course, Theatrical Movie course, Media Literary Creation course	4.2
Not Classified		Social Science course, Information Culture Industry course, Humanity and Society courses, Nature Engineering courses, Arts courses (Hard to classify due to big registration unit)	21.1
Total			100.0

Source: Ministry of Education & Human Resources Development-Korea Education and Research Information service, Nov. 2003

out of the 21,663 university classes researched were operated via the Internet.

■ Cyber Universities

As of 2003, 17 cyber universities had been established to provide advanced education. The curriculum provided at cyber universities is mainly economics (23.3%) and data communication related (21.5%).

■ Life-long Education and Internet classes for Parents

Since 2000, the government has been promoting a 'life-long education system.' As a result, from 2002, an education center homepage(ncle.kedi.re.kr) providing information on life long education programs and life long learning contents began operations, and cities and provinces built community life-long education center homepages. Government education on the Internet for parents began in 2001, aiming to narrow the digital divide and provide information concerning children's learning, schools and life, which are the main interests of parents.

Table 2-11 Current Status of Internet Classes

(Unit: persons)

Category	Elementary School	Middle School	High School	Total
Number of students	29,155	14,752	11,596	55,503

Source: Ministry of Education & Human Resources Development-Korea Education and Research Information service, Nov. 2003



1. Internet Address Policy

The current IP address is the Internet Protocol version (IPv4), a 32-bit system that can accommodate approximately 4.3 billion addresses. However, due to the increase in Internet users and diversity in media, demand for IP address is rapidly increasing and thus at the current rate of demand, all IP addresses will be allocated within the next 5 to 10 years. Therefore, we are promoting a plan to gain a clear verification and analysis of the current status of IPv4 that have been allocated when an oversight committee for allocating Internet address resources was absent.

Furthermore, the introduction and general use of the 128 bit IPv6 address system is being promoted to improve the quality of the next generation Internet by improving mobility, security and QoS (Quality of Service). In particular, as the wireless Internet service and digital home services among the next generation Internet services are being introduced on a trial basis, while telematics and mobile Internet services are becoming more common, more fixed IP addresses are being used in the next generation Internet environment. This is why the introduction of the IPv6 address system is being recognized as a critical step to address future issues. Therefore, the government is establishing a plan to facilitate the introduction of IPv6 across the nation.

1.1 Internet Governance

If the previous Internet was a physical infrastructure, today's concept of the Internet has

expanded to include a social and cultural infrastructure. As a result, creating a governance system for all information-based society that will enable the effective operation of social and cultural infrastructures has become a very urgent issue. Internet governance now encompasses the technical aspects of the Internet such as protocol, to the political, social, economic and cultural aspects. To be more specific, Internet governance is a process through which related parties, including governments from each country, manage, regulate and control their decisions and implement Internet policies with consistent authority and means.

In December 2003, the first World Summit on the Information Society of the International Telecommunication Union stated that setting up an appropriate framework for Internet governance should be the main task for the development of the global information society and the authority of public policies related to the Internet are under each country's sovereignty. Furthermore, the conference demanded that the Secretary-General of the UN construct a framework for Internet governance and to submit a report by the second opening of the WSIS scheduled for November 2005. To this end, governments, industries, academic circles, civic organizations, and other groups are cooperating and carrying out research not only concerning Internet-based governance that is sometimes referred to as Internet governance (technical domain), but also in Internet support governance (social and economic domain), practical Internet governance (political and social

domain) and other sections. Research on Internet management models at the global and local level and new governance structures is being actively carried out.

1.2 Settling Disputes on Domain Names

For a faster settlement of domain disputes, supporting evidence such as the applications and letters of the parties involved in the disputes can be submitted online and the arbitrator can swiftly carry out the process through document screening.

An average period of 2 years is required to settle a case, whereas in cases of settling by arbitration cases, an average period of 50 days is required. The Korea Domain-Name Dispute Resolution Committee has 14 professional domain-name dispute arbitrators including experts from universities and research institutes, lawyers and patent attorneys. As of the end of 2003, 80 cases out of a total of 103 cases of dispute resolution complaints had been resolved (37 cases were removed, 34 cases cancelled, 9 cases dismissed), and 11 cases succeeded in reaching a settlement between the parties involved in the disputes.

1.3 New URI Environment

Recently, under the general concept of URI (Uniform Resource Identifier), there are ongoing debates concerning the various identification and approach system of the next generation Internet, and active discussions are also taking place over the following issues; 1) the International Domain Name System (iDNS), which allows non-English speakers to navigate the web by supporting their local language characters without using the plain English text (ASCII; 2) protocol ENUM (Telephone Number Mapping) that provides a variety of integrated services in a wireless Internet environment by converting the telephone number to URL; 3) and the mobile address system which is an approach that uses numbers. On the other hand, to ensure that digital content is efficiently delivered on the Internet, a standard identification system is being developed and a basis for a national URN is being created.



2. Policy for the Next Generation Internet

2.1 IPv6

■ Network Construction Policy

There are plans to construct a convergence test network of wired and wireless network (KOREAv6) and verification tools and techniques related to the IPv6. The backbone network will use the IPv6 network of KOREN and be linked with domestic and overseas IPv6 networks through the 6NGIX. There are also plans to construct an access network for subscribers such as the IPv6 exclusive network line, public wireless LAN network, xDSL network, CATV networks, mobile communication network and other access networks by incorporating key telecommunication carriers.

■ Providing and Promoting Services

In order to promote the development and provision of IPv6 application services, the facilitation of the next generation Internet service is being explored in the following ways. First, develop an IPv6-based P2P application and launch an IPv6-based home network trial service in liaison with home network businesses and FTTH pilot project. Second, develop an All IPv6-based VoIP service by gradually connecting WLAN (2.4GHz, 5GHz), mobile communication network, fixed-line or PSTN, and provide a high-quality IPv6-based Internet education service for elementary, middle schools, high schools and universities. Third, develop an IPv6-based telematics application service through a

composition of various factors such as ITS, Mobile IPv6, mobile communication network, sensor network, location-based or wireless LAN, and develop and embrace wired and wireless e-Government services based on IPv6.

2.2 Home Network

A home network is a future-oriented family environment where all information electronic home appliances are connected to wired and wireless home networks in which anyone can have access to various home network services from any place at any time. Home networks are being promoted by many industries including the communication, broadcast, and construction industry in various ways. The government is planning to transfer 10 million households, 61% of all households, into a digital living space where various services can be provided by constructing home network by 2007.

Construction industries are planning to cooperate with electronic home appliance companies and ISPs to deliver the early stage of home network services, based on the experience of building cyber apartments that realized home-automation and remote control service for home-information devices. In the case of some luxury apartments, home gateways and Internet information devices are built into the building's structure and the early stage services such as home-automation service are being offered. In addition, telecommunication carriers and

broadcasters are competitively pushing ahead with their business strategies to create new sources of profit in response to the convergence trend of broadcasting and communications. The networks of broadcasting companies are going digital, and telecommunication carriers are exploring new business domains by providing a two-way multimedia service based on the existing wired and wireless network and satellite infrastructure.

2.3 u-Sensor Network

Recently, electronic tags and sensing technology is drawing much attention as next generation technology. This technology is used to check information of objects by attaching electronic tags to them. Electronic tags and sensing technology are the core technology of the government's project to foster new growth in the IT industry, and under the evaluation that it has big technological ripple effects and a large application area, a 'u-life policy' was established and is being promoted. According to the implementation plan, by the year 2005, a passive and active electronic tag product is to be developed and will start to be spread in line with formation of a foundation and standardization.

By 2007, low-powered, micro communication tags that allow communication between electronic tags installed with sensing functions are to be developed so that sensor network services can be provided by 2008. The development of u-Sensor Network technology is expected to be gradual as its adoption in the market depends on the development of the electronic tag technology in aspects such as price, size and function of the chip. If the electronic tag can be cheap and minaturized but more intelligent, its application in every day life will be expanded in areas such as logistics,

distribution and environment, clothes and food management.

■ Technology Development Policy

The leader for constructing the u-Sensor Network and the gradual development of tag technologies will be pursued through cooperation of industry, academia, and research institutes with government-funded research institutes at the center. Passive and active electronic tags will be developed by 2005, sensing type tags by 2007, and core technologies of ubiquitous sensor network and system by 2010.

■ Frequency Policy

Frequency for electronic tags used for constructing the u-Sensor Network basically uses the ISM bandwidth, but some frequency bandwidths cannot be supplied for electronic tags as frequency allocation varies by countries. Therefore, as for the 860~960MHz bandwidth that was suggested to be used for a Global TAG, the allotment of 910~914MHz return bandwidth of CT-2 is being considered as an alternative. And obstacles will be overcome by easing the regulation on the power output limitation.

2.4 Revenues in telematics

Revenues in the Korean wireless Internet market exceeded 2 trillion won in 2003 and the 'communication network evolution' that is heading for a Broadband convergence Network in order to accommodate various wired and wireless communication networks is accelerating the growth of the telematics market. The telematics industry in cooperation with the automobile

industry and mobile carriers, is expected to grow into a comprehensive information communication service industry that has related services with various traditional brick and mortars industries such as handsets, tool manufactures, SI, contents, safety, insurance, pre-owned cars, rental cars, and automobile repairs. Hence, the government, with the Ministry of Information and Communication (MIC) and the Ministry of Commerce Industry and Energy (MOCIE) at the center, is planning support measures to foster telematics as the core industry of next generation growth engines.

In Korea, Daewoo Motors first introduced Dreamnet services in 2002, followed by Nate Drive Service of SKTelecom, and Hyundai Motors recently released Mozen service. It is expected that 3.7 million cars, 23% of all cars registered, are to be equipped with telematics by 2005. As an infrastructure of telematics, Intellectual Transport Society and Location-based Services are being actively promoted, and telecommunication providers are working hard to secure related basic solutions. Also, Hyundai Motors, Samsung Renault Motors, Ssangyong Motors are making heavy investment in enabler technologies. In this process, the Korea Telematics Business

Association (KOTBA) was launched to realize strategic partnerships between different industries and a community consisting of 30 different companies including major equipment companies, insurance companies, the three main mobile carriers and major motor companies was formed.

The main works of the government in order to promote telematics services are launching core technology development projects, building an effective telematics industry cluster to create a cooperative system between different sectors, establishing an R&D cooperation system centered around Daeduk research center, and leading the efforts in domestic and international standardization activities. The total budget for these works is approximately 328.1 billion won.

2.5 National Grid Policy

Grid refers to an information and communication infrastructure that allows highly effective research resources, such as supercomputers, large capacity storage devices, high voltage electron microscope and others, to be selected on a user demand basis and for those resources that were selected like a local system to be easily used. Korea implements the policy on grid computing to integrate the grid industry with high-tech industries like bio and nanotechnology.

The key accomplishments of 2003 are △ the construction of computing grid database with the participation of 9 institutions including Seoul National University and Pohang University of Science and Technology △ ten test grid application researches including a bio grid aimed at finding a grid based industrial science technology application research model △ the development of a grid portal protocol type mainly for bio and nanotechnology grid

Table 3-01 Eleven Main Telematics Projects

Plan of operation	
1	Developing core technologies of telematics
2	Constructing industry clusters
3	Building R&D Hub
4	Supporting domestic standardization and leading international technology standards
5	Constructing a telematics information center(TELIC)
6	Constructing a testbed
7	Constructing a pilot city
8	Expansion of terminal installation
9	Policy on tax and fees for the expansion of service
10	Operating a cooperative system for related organizations
11	Fostering professional manpower

Source: Ministry of Information and Communication(MIC), Dec. 2003

users △ the implementation of APEC APGrid
construction △ a joint research on grid

computing with iHPC of Singapore.



3. Internet Business Policy

3.1 Promotion of Internet Business

Internet-related the third quarter of 2003, the Internet supporting industry has grown by 10.1 trillion won and Internet application industries, such as Contents, e-Business (only open types are included in cases of B2B), have grown by 58.8 trillion won. Especially, the 'dot-com' industry (Internet application industry) has grown enormously in spite of a long economic slump.

In order for Internet businesses entering development stages to continuously develop, cooperation is required between the government and the industry to create a better business environment, protect consumers, and prevent adverse effects. The government is publicizing easier Internet service access for people in their 40s and 50s to help them access services needed in everyday life, since only business models for 10~20s (game, avatar, messenger) have been developed. Also for Internet enterprises that have superior technologies and business models but a weak management foundation, consultations on financial strategies and fund raising were held and through investment exhibitions a total fund of 9.2 billion won was raised.

3.2 Towards an Active m-Commerce

The gateway of mobile communication companies has been opened so that more portal providers and independent content providers (CP) can directly connect to wireless Internet networks and provide individual services. In short, by requiring three mobile carriers to outline terms and conditions that allow their gateways to be used by third parties, many portals have entered into the m-Commerce market in equal terms with mobile carriers, and introduced services interlinking wired and wireless platforms.

The terms and conditions for using gateway allow CPs, who are linked to the gateway, to use platform information, terminal information, location information, which were used only by mobile carriers or exclusive CPs. And upon the request of the linked CPs, mobile carriers are obliged to collect service fees from the end-user for the contents or services provided by those CPs on their behalf, so in the near future the appearance of more various and new m-Commerce services can be expected.

In addition, number portability has been enforced so people can keep their own numbers even if they switch the mobile carrier. As a result of this, the lock-in effect has been eliminated, inducing mobile carriers to provide more diverse m-Commerce contents and services.



4. Information Protection Policy

4.1 Creation of an Environment to Protect Information and Communications Infrastructure

■ The Protection of Major Information and Communications Infrastructure

The government established and enforced the Information Infrastructure Protection Act in January 2001 to protect major information and communication networks in finance, communications, transportatory, energy the government, which have a significant influence on national security and the economy, from cyber attacks such as hacking and computer viruses. Especially in May 2003, emergency guidelines were distributed to allow people to swiftly counter cyber attacks against major information and communication facilities. Also, in response to the possible cyber crimes that are becoming increasingly more sophisticated over time, the organization responsible for managing information and communication facilities came up with information protection measures and introduced a policy to designate a consulting company for information protection in order to build a system to use advanced technologies of the private sector. In the future, in hopes to enhance service quality and reliance on professional information protection enterprises, there are plans to reinforce education training of technical manpower and internal protection measures. In this regard, there are 89 information and communication infrastructure facilities, which have been appointed by the government since 2001.

■ Hacking Virus Prevention and Countermeasures

In December, there were a total of 26,179 reported cases of hacking attacks in Korea, and damage reports due to computer viruses record 85,023 cases. When compared with the same period in 2002, hacking has increased by 50% and virus attacks have increased by more than 100%.

As information and communication systems of key infrastructures are interconnected, even cyber threats such as hacking are being interconnected and shared. This kind of advanced information infrastructure environment has become the target for international hackers. Therefore, in order to effectively confront increasing cyber attacks, the Ministry of Information and Communication, along with the Korea Information Security Agency, is issuing alerts and early warnings regarding hacking attacks while supporting the operation of CERT to accelerate people's autonomous information protection activity.

In this regard, the government is planning to advance the cyber terror response system through joint action with the private sector, and to strengthen the efforts to tackle global cyber terrorism.

■ Toward the Active Use of Digital Signatures

To ensure the safety and reliance of electronic transactions and information distribution using the Internet, the government enacted the Digital Signature Act. The Digital Signature Act

introduced the concept of authorized electronic signature, which recognizes the same legal validity with a handwritten signature, and this law stipulates safety requirements that should be met. The authorized digital signature is verified by a digital signature certificate, which is issued by the accredited certification authorities. The current technology of authorized e-signature is based on an asymmetrical encryption technology.

Without regard to the issuing organizations, the government introduced an interlinking system that allows various electronic transactions to take place using just one authorized certificate. As the importance of digital signatures started to grow, certificate users that only numbered 50,000 at the end of 2000, exceeded 8.71 million at the end of December 2003 and the number of agencies that introduced authorized certificates increased to 390.

Korea at present, have people actively using digital signatures in Internet transactions such as e-Procurement and bidding, Internet banking, on-line stock transactions, e-Government services. It is expected that in the future, by using authorized certificates, people will be able to make safer electronic transactions in various fields by increasing the use of digital signatures in fields such as online payment and medical treatment.

4.2 Protecting Personal Information and Establishing a Sound Cyber Culture

■ Protecting Personal Information

Due to the increase in Internet users, building a healthy information society has become an important issue. In order to strengthen the protection of personal information, a foundation of laws and polices such as the Personal Information Dispute Mediation Committee (PICO) has been established. Also, the government set up a guideline, which it is distributing across the industry that specifies the relevant laws and regulations for enterprises to abide by, in order to establish a self-regulation environment. A part of this initiative, the government has outlined a 'policy to protect the personal data of clients who have terminated contract with a mobile carrier'. On the other hand, by providing 'technical and administrative guidelines for preventing personal data violation,' and 'privacy mark system,' the possibility of abusing personal data has been blocked.

■ Ensuring a healthy information culture

In order to regulate mobile phone spam text messages, the government limited spam messages

Table 3-02 Current States of Authorized Digital Signature Users

(Unit: Persons)

Authorization certificate Issuing Agencies	2001	2002	2003
Korea Information Certificate Authority Inc.	260,996	558,806	771,272
Korea Securities Computer Corp.	281,634	748,840	1,865,042
Korea Financial Telecommunication and Clearings Institute	1,363,016	3,925,522	5,249,970
National Computerization Agency	11,992	485,388	697,857
Crosscert.Inc	-	53,092	117,803
Korea Trade Network	-	857	11,285
Total	1,917,638	5,772,505	8,713,229

Source: Ministry of Information and Communication(MIC), Dec. 2003

by amending the terms and conditions of the end user agreements in October 2003 among the three main mobile carriers so that no text messages can be sent without the consent of the user. Also to enhance a healthy information culture, in 2004, the government plans make information and communication service providers liable for the circulation of illegal and harmful information, implement an opt-in method for cellular phone spam and to improve the legal system to enhance the control of violators of the law and giving a more severe penalty. Also, countermeasures will be taken to confront harmful information circulation, and the 'evaluation system for self-regulation by service providers' will be introduced to allow the Information Communication Ethics Committee (ICEC) to monitor and deliberate the circulation of harmful telephone information services such as one-to-one indecent phone call service.

4.3 Laying the Foundation for the Information Security Industry

■ Technology Development and Standardization

Information security technology prevents information leaks, and forgery over communication networks, and these days, countries around the world increasingly focus on nurturing this technology. As for Korea, in 2004, the government will push ahead with the development of advanced network information security system, harmful information blocking system, and human recognition technology, investing 24.9 billion won, and from 2004 to 2007, it will place focus on the development of information security technology as a core strategic area.

■ Cultural Campaign for Information Security

For a year, in 2003, the government started education on information security by providing various curriculums to workers of information and communication industries and to the general public. In 2004, a Specialist for Information Security (SIS) system and various education programs will be introduced to constantly raise the awareness and level of information security.

■ Evaluating the Information Security System

In order to verify and safely construct the information security system, an information security evaluation system is being implemented. Starting with the evaluation of intrusion blockage system, the scope of subjects to be evaluated was expanded to include virtual private network products, operation security system, fingerprint recognition system and smart card. Also, in order to quickly correspond with evaluation systems that are being internationally standardized, Korea will outline the Common Criteria (CC) and make continuous efforts to secure CC-based evaluation technology, improve the evaluation system and to strengthen manpower.

4.4 Bridging the Digital Divide

■ Current Status of the Digital Divide

With the development of information technology, the widening gap between the technology-enabled and the technology-deprived has emerged as a new social problem. As a result, the government enacted an 'Act on Resolving the

Digital Divide' and has made vigorous efforts to reduce the information discrepancy such as providing a computer training to 10 million people, but it appears that neglected groups such as low-income households, the disabled, the elderly and people with a lower education have a significantly lower percentage of Internet users compared to the its Internet sawy group (information leading group). According to age group, academic background, vocation and the presence of a disability, the gap ranges from a low of 36.55% to a high of 80.3%. The discrepancy in the percentage of Internet users among those with and without disabilities, and those in their youth and elderly ranging from age groups between 10~50 years old, are each 37.0% and 82.1%, which are higher than the 14.8% and 31.5% of the U.S.. Also, the gap in Internet user proportion among those with and without disabilities, and those in their youth and elderly ranging from their 10s and 50s, is by 1.7 times higher than the average discrepancy level of advanced countries such as the U.S. and the U.K..

■ Efforts to Resolve the Digital Divide

In order to bridge the digital divide, the government set out a comprehensive government-wide digital bridge plan. In accordance with this plan, in 2004, 13 Ministries including the Ministry of Education and Human Resources Development are establishing and promoting a joint action plan to narrow the digital divide.

Table 3-03 Current Status of the Digital Divide (based on the Internet Usage Rate)

Category	Presence of disability	Gender	Age	Academic background	Income	Vocation	Region
Compared group	Total population	Male	20's	University graduates or higher	More than 2.5 million won	Office work	Big cities
Proportion of Internet users (%)	64.1	70.7	94.3	87.7	76.4	88.7	66.1
Weak group	Disabled	Female	Above 50's	Middle school graduates or lower	Less than 1.5 million won	Production work	District regions
Proportion of Internet users (%)	27.6	57.5	14.0	8.0	40.1	31.8	44.2
Discrepancy (% p)	36.5	13.2	80.3	79.7	36.3	56.9	21.9

※ 1\$ = 1,200 won

Source: Korea Agency for Digital Opportunity and Promotion(KADO), Jun. 2003

Table 3-01 2004 Action Plan to Bridge Digital Divide

Organization	Content
Ministry of Education and Human Resources Development	Support of PC and communication fees for children in low-income households
Ministry of Foreign Affairs and Trade	Provide support in bridging digital divide in developing countries
Ministry of Justice	Provide information education for prisoners and children under juvenile protection
Ministry of Government Administration and Home Affairs	<ul style="list-style-type: none"> · Establish a test cyber town · Provide Information Education for local residents and public service personnel
Ministry of Culture and Tourism	Establish information DB for the visually impaired
Ministry of Agriculture and Forestry	<ul style="list-style-type: none"> · Support agriculture, informatization of rural areas, and e-Commerce of agriculture products · Information education for farmers · Expand support system for shipping and consultation system for farming
Ministry of Information and Communication	<ul style="list-style-type: none"> · Construct broadband networks in agriculture and fishing areas · Expand reduction of mobile phone fees for low-income groups and the disabled · Support establishment of free-of-charge information facilities · Provide support for PCs, support devices for the disabled, digital TVs · Develop and supply contents for the elderly and disabled · Provide information education for isolated groups · Carry out international cooperation to bridge digital divide
Ministry of Health and Welfare	Provide information education for the elderly
Ministry of Labor	<ul style="list-style-type: none"> · Provide information education for workers and the disabled · Operate employment information system for the disabled
Ministry of Gender Equity	<ul style="list-style-type: none"> · Provide advanced IT education for women · Hold digital contents' exhibition for women
Ministry of Maritime Affairs and Fisheries	<ul style="list-style-type: none"> · Provide information education for fishers · Establish an information community in fishing areas
Small and Medium Business Administration	<ul style="list-style-type: none"> · Provide information education for workers of small to mid-sized businesses · Construct a foundation for informatization in regions where many small to mid-sized businesses are located

Source: Ministry of Information and Communication(MIC), Dec. 2003

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1. Internet Content

1.1 Portal / Community

Web portals have been expanded to include not only search engines and directory services but also communication services (chatting, e-mails etc), community services (special interest clubs), entertainment (online games, VOD, Sports etc), information services (finance information, news etc), and online shopping. Furthermore, platforms have diversified from PCs to mobile handsets such as mobile phones and PDAs. The convergence of telecommunications and broadcasting is predicted to become a widespread phenomenon in the future. The domestic web portal industry posted record earnings growth in 2003 as leading companies diversified their revenue sources by charging for previously free services, attracting more advertisers, and receiving commissions from e-Commerce transactions. In line with this trend, the intense competition among leading web portals have led them to expand their mobile content offerings after mobile phone companies were ordered by the government to open their networks to third parties. Web portals have seized this new opportunity to beef up their entertainment content which also includes games and have also rolled out knowledge search services.

1.2 Online community

In 2003, online community experienced rapid growth and change. In particular, there are now over 6 million online communities hosted by

numerous web portals. Furthermore, with the introduction of blogs, communities now feature personal online diaries, online photo albums, and video broadcasting. Blogs have also expanded into the wireless platform so now people can access a mobile blog (moblog) on their mobile phones.

In the past, many online communities were formed among close friends but the current communities are centered around people who share similar interests.

1.3 Game

The size of the domestic gaming market is approximately 4.43 trillion won and has posted a growth rate of 10.1%. The online gaming market is a 704.2 billion won-market that has a higher growth rate of 28 %. Korean online games account for 7.1% of the global online gaming market. In 2003, online games were exported to China, Taiwan and Southeast Asia countries. In 2003, Korean online games accounted for 60.8% of the total game export and compared to last year there has been a growth rate of 906%. As the domestic game market is expected to become saturated in 2006 or 2007, companies are focusing their strategies on foreign markets such as Southeast Asia.

1.4 Entertainment

■ Digital music

Total sales for the digital music industry grew to 185 billion won in 2003, which is a 37.6% increase from the previous year. The digital music market depends on wireless content (ringtones) for 70% of its sales. On the other hand, the market for streaming music and downloading songs is experiencing difficulties in wooing consumers due to the proliferation of free file-sharing services. As conflicts deepened between the online music services and record companies, the government gave the order that all online music services must charge a fee and pay licensing royalties for each song. Except for Bugs Music, the largest streaming music company, all other companies began to charge a fee for their services. However, none of them became profitable since Bugs Music refused to follow the government's order and still remains the largest and most popular service provider. The online music market still has a long way to go as it struggles with the problems posed by free music sites, file-sharing sites, and the

reluctance of users to pay for songs that they can download for free on the Internet.

■ Internet movies

Domestic online movie market has grown from 70 billion won in 2002 to 80 billion in 2003 and total online movie website number over 300. Recently, online movie websites have been showing movies before or at the same time when the movie's video or DVD have been released. In the case of the movie "Desire," it was released at theaters and shown on online movie websites simultaneously for the first time in Korea. Meanwhile, the revenue structure of the online movie websites is changing. The sales ratio for adult movies and domestic feature movies was about 6:4 in 2002 but changed to 3:7 in 2003. This

Table 4-02 Revenue Portfolio of the Digital Music Providers (unit: million won)

Classification	Online		Offline	Total
	Wired	wireless		
Revenue	12,397	130,356	42,275	185,028
Proportion	6.7%	70.5%	22.8%	100%

Source: Korea IT Industry Promotion Agency, Dec. 2003

Table 4-01 Game Market Forecast

(Unit: 100 million won)

Classification	2000	2001	2002	2003	2004	2005	2006	2007	annual growth rate	
Online game	1,628	2,985	4,656	7,042	9,330	11,168	12,406	13,145	28.0%	
Mobile game	17	497	727	1,352	2,474	4,125	6,422	9,491	63.5%	
PC game	1,323	1,810	902	1,275	1,276	1,277	1,278	1,278	-5.6%	
Arcade game	5,844	3,528	4,142	3,984	3,894	3,830	3,782	3,745	1.0%	
Console game	H/W	18	29	1,012	1,015	1,512	1,649	1,947	2,238	106.3%
	S/W	72	117	898	943	1,009	1,435	1,700	1,973	60.1%
	Total	90	146	1,910	1,958	2,521	3,084	3,647	4,211	75.1%
Subtotal	8,902	8,966	12,337	15,611	19,495	23,484	27,535	31,870	23.5%	
Online Internet cafe	13,343	19,832	19,441	22,763	23,873	24,446	24,731	24,870	3.8%	
Computer game room	8,634	5,969	6,570	5,928	5,703	5,543	5,422	5,329	-1.9%	
Total	30,879	34,767	38,348	44,301	49,072	53,473	57,688	62,069	10.1%	

※ 1\$ ≙ 1,200 won

Source: Korea Entertainment System Industry Association, Dec. 2003

indicates that there is more demand for domestic feature movies. The success of the online movie market will be determined by such factors as piracy, viewing environment, marketing, competition, hardware performance, and image and sound quality.

1.5 Internet media

■ Online newspaper/webzine

The competition in the online news business intensified in 2003. The online versions of the major dailies were threatened by Internet-only news websites. Some major dailies like "Joins.com", the subsidiary company of Joong Ang Daily and "Naver" agreed to form a strategic partnership to share content and provide each other with technical assistance. Such efforts to forge alliances among competitors have enabled companies to serve the market with more news content while showcasing cutting-edge multimedia technology.

In terms of performance, the Internet ventures of the major dailies recorded losses while Internet-only news websites became profitable. The Internet-only news companies have been able to diversify their revenue stream while reducing their dependency on advertisements. Furthermore, companies such as "OhmyNew.com" became an influential media company. Politically conservative-leaning Internet-only news websites also emerged in 2003 to challenge the majority of liberal-leaning news websites. However, these conservative websites were swiftly challenged by the established liberal players on a wide range of political and social issues.

■ Internet Broadcasting

Korea's Internet broadcasting industry started to grow in 2000 and reached its peak during 2001. The market stabilized in 2003. The Internet broadcasting business has experienced many difficulties in many areas including the quality of content, cutthroat competition, business performance and government regulations concerning adult-oriented websites.

As of 2003, the number of Internet broadcasting companies decreased drastically from previous years, and the Internet broadcasters accounted for 80% of the total of 719 Internet broadcasting-related companies while the remaining 20% were shared by broadcasting solution providers and production companies. The size of the industry has also declined. According to industry experts, the smaller and less profitable companies exited the market during the period of intense competition while only the larger companies that were able to weather the market downturn were able to survive and remain in the market today. In terms of broadcasting content, 28% of all content was entertainment content followed by educational content at 14.3% that targeted young school children. Among entertainment content, music was

Table 4-03 2003 Top On-line Newspaper Sites
(unit: persons)

Rank	Site	No. of Visitors
1	chosun.com	8,573,765
2	imbc.com	8,135,012
3	kbs.co.kr	7,855,645
4	joins.com	7,687,431
5	sbs.co.kr	6,587,180
6	donga.com	4,862,305
7	sportsseoul.com	4,807,197
8	stoo.com	4,504,887
9	hot.co.kr	4,426,054
10	mk.co.kr	3,867,551

Source: KoreanClick, Dec. 2003

the leading item and the large broadband subscriber base in Korea helped create momentum for Internet broadcasters who streamed movies and video to paying customers.

■ Internet Advertisements

Cross media advertisements that incorporate both online and traditional advertising methods has gained popularity. The Internet advertisement business remained strong as more companies chose to advertise their products online. According to a recent survey taken among advertisers, advertising on the Internet ranked second to TV advertisements as the most cost-effective and favorable medium. The actual money spent on Internet ads is still substantially lower than what advertisers spend on TV ads. However, the share of Internet ads in the overall advertising market is steadily growing. The Internet advertisement market grew by 38% in 2003 and the total volume reached 240 billion won. And if the 95 billion won from keywords search services are added, the market grew even larger than before. In 2003, the keyword advertising market grew by 260% compared to 2002.

Table 4-04 Internet Broadcasting Industry

Classification	2001	2002	2003
No. of companies related to Internet broadcast	1,218	865	719
Revenue of Internet broadcasting industry	500 billion won	427.9 billion won	250.8 billion won

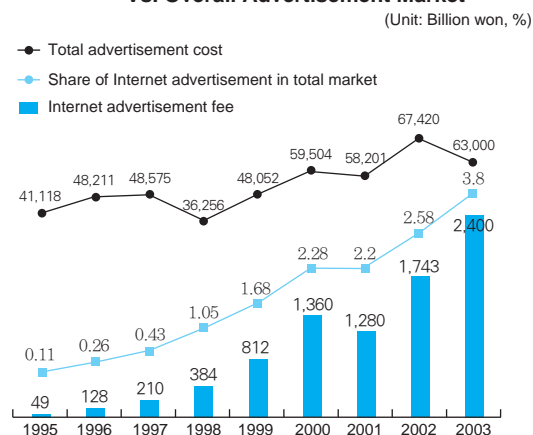
※ 1\$ ≙ 1,200 won Source: Korea Webcasting Association, Dec. 2003

Table 4-05 Classification of Internet Broadcasting
(Unit: Number of cases, %)

Classification	No. of Internet broadcasts	Proportion (%)
Education/Study	66	14.3
Vocational education	29	6.3
School	44	9.5
Sports	14	3.0
Animation	6	1.3
Entertainment	14	3.0
Movies	21	4.5
Music	60	13.0
Games	4	0.9
Other amusements	11	2.4
Public institutions	12	2.6
Companies/Organizations	10	2.2
Society/Culture/Welfare	30	6.5
Regional information/Living information	50	10.8
Current issues/Economy/Management	22	4.8
Arts	5	1.1
Religion	18	3.9
Teens	11	2.4
Hobby/Leisure	26	5.6
News	4	0.9
Health/Medicine	5	1.1
Total	462	100.0

Source : IT Public Webcasting (<http://www.webcast.or.kr>), Dec. 2003

Figure 4-01 Internet Advertisement Market Volume Vs. Overall Advertisement Market



※ 1\$ ≙ 1,200 won

Source: IT Public Webcasting, Dec. 2003

1.6 Education content

The domestic e-Learning service of the industry market has grown from 30 billion won in 2001 to 78 billion won in 2003. The public education sector grew from 10 billion won in 2001 to 30 billion won in 2003, while the elementary, middle and high school education market grew from 32 billion won in 2001 to 130 billion won in 2003. In particular, it was shown that about 15.2% of domestic companies have introduced online training to educate their staff. Included in the benefits of online education are, improvement in job performance, reduction in training costs, better evaluation of employees, and a boost in morale among employees. Meanwhile, e-Learning companies adopted various strategies to adapt to

the changing environment and strengthened their business partnerships with other industries. Furthermore, educational courses that can be delivered over mobile phones and PDAs is also being tested. The government has been exploring the implementation of supporting policies to promote the online education market. For example in December 2003, the "Promotion Act for the e-Learning Industry" was enacted. This act ensures that there is no discrimination between online and traditional forms of education and thereby encourages the active use of online education in educational institutes. In this regard, the government plans to pursue various policies that will help companies introduce an online education system while public institutes will also include online education in their courses.



2. e-Commerce

The total size of e-Commerce in 2003 was 235.25 trillion won. This is a 32.2% increase from 2002. B2B comprised 88% of all e-Commerce trade (206.854 trillion won) while B2G captured 9.2% of all transactions (21.634 trillion won). B2C came in last place with only 2.6% of the entire e-Commerce market (6.95 trillion won). Compared to 2002, B2B increased by 32.8% (51.147 trillion won), B2G by 30.1% (5.2 trillion won) and B2C by 20.9% (1.52 trillion won)

2.1 B2B

In 2003, the B2B market became a 206 trillion-won market posting a 32.8% increase from the previous year. A close look revealed that buyer-driven transactions came to 150.69 trillion won, taking up 72.8% of the total B2B market. This is a 33.1% increase on a year-on-year basis. Supplier-driven transactions increased by 33.6%, reaching a volume of 48.77 trillion won. Middle trader-driven transactions only recorded 7.4 trillion won, an increase of 24.5% from the previous year while only accounting for 3.6% of the total market.

Meanwhile, 96.4% of all B2B activity was

conducted over the Internet, indicating that Internet-based commerce will remain the most common form of commerce. The manufacturing industry is the leading industry in terms of volume after posting 37.939 trillion won (77.8%) in sales and followed by the electricity and electronics industries (32.8%) and primary metals such as steel (33.9%) make up two-thirds of the total market. Meanwhile at the end of 2003, the number of e-Marketplaces came to 260 and international trade had the most with 37 followed by electronics with 32, mechanical and commercial equipment with 31. The maintenance/repair/operation (MRO) sector had 24 e-Marketplaces, agricultural and marine area and food and drink sector had 22. Trading volume at e-Marketplaces in 2003 reached 7.4 trillion won, and according to business sector, the MRO (2.182 trillion won, 29.5%) led the industry followed by construction and building materials (1.362 trillion won, 18.4%), chemicals

(1.24 trillion won 15.3%), and steel (697 billion won).

2.2 B2C (Shopping Mall)

The domestic B2C market that used to rely heavily on advertising to drive sales is now witnessing a new shift in the market as web portals have also set up online shopping sites in addition to rolling out fee-based content. The success of the large e-Retailers drove the growth of the B2C market in Korea. In recent years, the domestic B2C market increased by 20.9% (1,052 billion won) to generate about 6.95 trillion won in sales.

As of the end of 2003, large e-Retailers accounted for only 11% of total sales in the B2C market. However, in terms of sales volume, e-Retailers comprised 72.4% (5 trillion won) of all sales. Thus, small specialty e-Retailers are losing

Table 4-06 Volume of e-Commerce

(Unit: Billion won, %)

	2002		2003		Year-on-Year	
		Ratio		Ratio	Increased amount	Increase rate
Total volume of e-Commerce	177,810	100.0	235,025	100.0	57,215	32.3
Business to Business (B2B)	155,707	87.6	206,854	88.0	51,147	32.8
Business to Government (B2G)	16,632	9.4	21,634	9.2	5,002	30.1
Business to Consumer (B2C)	5,043	2.8	6,095	2.6	1,052	20.9
Others	427	0.2	442	0.2	15	3.5

※ 1\$ ≙ 1,200 won

Source: Korea National Statistical Office(NSO), Feb. 2004

Table 4-07 Size of e-Commerce according to traders

(Unit: Billion won, %)

	2002		2003		Year-on-year	
		proportion		proportion	Increased amount	Increase rate
B2B	155,707	100.0	206,854	100.0	51,147	32.8
Buyer-oriented	113,254	72.7	150,688	72.8	37,434	33.1
· Open	23,281	(20.6)	34,270	(22.7)	10,989	47.2
· Cooperative	89,973	(79.4)	116,418	(77.3)	26,445	29.4
Seller-oriented	36,509	23.4	48,766	23.6	12,257	33.6
· Open	4,430	(12.1)	6,279	(12.9)	1,848	41.7
· Cooperative	32,078	(87.9)	42,487	(87.1)	10,409	32.4
Broker oriented	5,944	3.8	7,400	3.6	1,455	24.5

※ 1\$ ≙ 1,200 won

Source: Korea National Statistical Office(NSO), Feb. 2004

Table 4-08 e-Market Place; Scale and Scope (third/fourth quarter)

(Unit: Number, Billion won, %)

	e-Marketplace			
	No. of companies		Amount of transaction	
		Ratio (%)		Ratio (%)
Total	260	100.0	7,400	100.0
Chemicals	20	7.7	1,124	15.2
Construction (Materials)	16	6.2	1,362	18.4
Agriculture, livestock, fishery products / Food & beverages	22	8.5	609	8.2
Steel	9	3.5	697	9.4
MRO	24	9.2	2,182	29.5
Textiles, clothes	12	4.6	11	0.1
Trade	37	14.2	187	2.5
Healthcare	11	4.2	337	4.6
Oil	5	1.9	432	5.8
Machinery and industrial material	31	11.9	113	1.5
Electronics	32	12.3	313	4.2
Others	41	15.8	34	0.5

※ 1\$ ≙ 1,200 won

Source: National Statistical Office (NSO), Feb. 2004

market share while a handful of large e-Retailers are dominating the market.

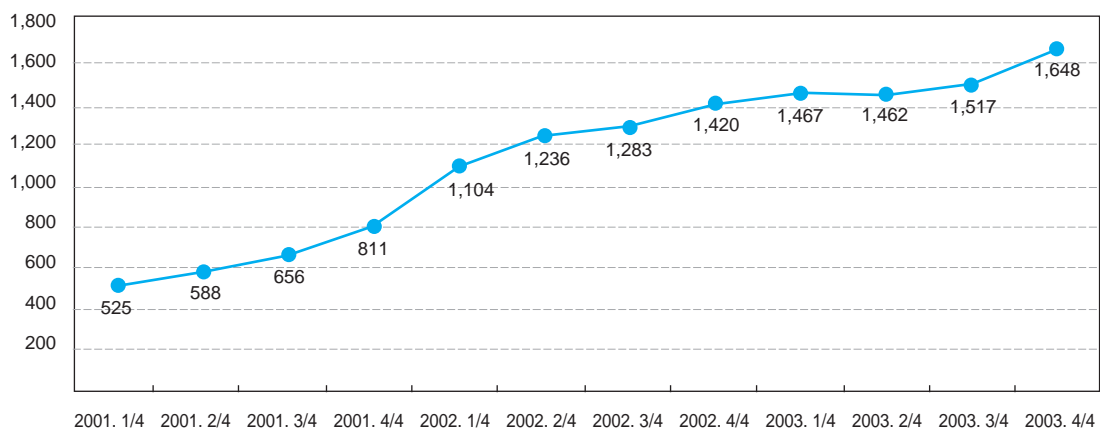
A breakdown of B2C trade shows that appliances/electronic/communication equipments (18.3%) was the leading category among consumers and was followed by computer and related equipments (12.9%), daily equipments/car equipments (11.6%), clothes/fashion and related products (10.3%), and travel and reservation

services (7.4%).

With an average yearly growth rate of 100%, B2C is rapidly becoming a legitimate and profitable distribution channel along with cable shopping channels.

Figure 4-02 B2C Market Volume

(Unit: Billion won)



※ 1\$ ≙ 1,200won

Source: National Statistical Office(NSO), Feb. 2004

2.3 B2G

In 2003, the volume of trade in the B2G market increased to 21.63 trillion won, which is an increase of 5.2 trillion won (30.1%) from the previous year. These numbers indicate that online bidding is becoming a standard procedure in the government procurement process. A breakdown of the types of trade showed that building materials had the largest share at 3.6 trillion won (42.8% of all B2G transactions), followed by tangible goods at 2.6 trillion won (31.0% of all B2G transactions), while equipment and machinery came in at 1.233 trillion won (14.7% of all B2G transactions).

2.4 Financial trading service

■ Internet banking

As of December 2003, Internet banking services were provided by 21 financial institutions (18 domestic banks, Citibank, HSBC and the national post office). In 2003, about 22.75 million people

were registered as users of Internet banking services, which is an increase of 27.8% compared to 2002. About one million businesses are using online banking services recording a sharp increase of 44.2% compared to 700,000 in 2002.

Through online banking services, customers can check the balance in their accounts, make a wire transfer, apply for a loan, open a savings account, as well as send money to a foreign-based account. In addition, more banks are providing services such as accounts aggregation, electronic bill present and payment (EBPP), and mail banking.

In December 2003, the number of online transactions exceeded 6.16 million which means that over 85.3% of all bank transactions were conducted over the Internet. The number of transactions of electronic funds reached 1.06 million, accounting for 14.6% of all online transactions. Online applications for loans were miniscule in comparison to other online transactions. It only composed 0.1% of the total. However, 49.3% of these online loan applications were approved.

In December 2003, there were 2.56 million

Table 4-09 Market Volume by Medium

(Unit: 100 million won)

Classification	2002	2003	Year-on-year increase rate
TV home shopping	37,810	36,980	-2.2%
B2C	50,434	60,950	20.9%
Catalogue	11,510	7,000	-39.1%
M-Commerce	280	340	21.4%
Total	87,300	96,270	10.2%

* 1\$ = 1,200won

Source: Korea e-Commerce & Direct Marketing Association (KEDMA), Feb. 2004

Table 4-10 B2G e-Commerce Volume

(Unit: Billion won, %)

	2002		2003		Year-on-Year	
	Amount	Rate	Amount	Rate	Increasing or decreasing amount	Increasing or decreasing rate
G2B	16,632	100.0	21,634	100.0	5,002	30.1
- Purchase of goods and services	6,792	40.8	8,411	38.9	1,619	23.8
- Construction	9,840	59.2	13,223	61.1	3,383	34.4

* 1\$ = 1,200 won

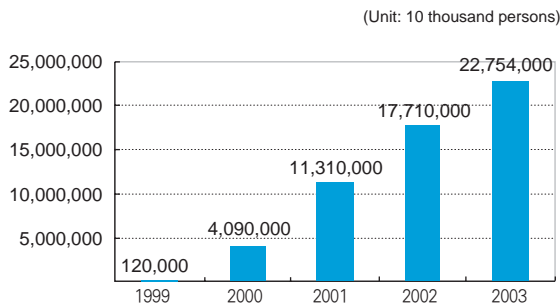
Source: National Statistical Office(NSO), Feb. 2004

mobile banking transactions. The mobile banking service is provided by domestic banks and the post office. The number of mobile transactions using this service more than doubled since the year before. This is mainly because of the Bank-On Service of Kookmin Bank that was launched in September 2003. The Bank-On Service allows users to use his or her mobile phone to pay for public transportation fees, conduct transactions over a mobile phone, and withdraw money from an ATM machine.

■ Online Stock Trading

Online stock trading is steadily gaining popularity and therefore the number of online trading accounts has been increasing. As of June 2003, the number of online accounts reached 5.59 million which is equivalent to 83.6% of the total number of accounts. Since the end of 1998, the

Figure 4-03 Upward Trend in the number of On-line Banking Users



Source: Bank of Korea (BOK), Dec. 2003

Table 4-11 Number of Mobile Banking Transactions

	Inquiry	Electronic funds transfer	Total
Dec. 2002	1,081,262	14,482	1,095,744
Mar. 2003	1,106,000	25,000	1,131,000
Jun. 2003	1,176,000	23,000	1,199,000
Sep. 2003	1,272,000	58,000	1,330,000
Dec. 2003	2,173,000	387,000	2,560,000

Source: Bank of Korea (BOK), Dec. 2003

total number of active accounts increased by 70% while online accounts increased 24-fold in the same period of 4 years. Online stock trading comprises 55.2% of all securities transactions including stocks, futures, and options.

36 out of 43 domestic securities companies provide online services and there are a few companies where more than 90% of all transactions are conducted online.

■ New services

Financial services have changed in many ways not only in terms of the trading format but also in the content of its services it aims to create a Financial Portal through horizontal and vertical expansion of services. Online financial services are converging with mobile financial services, adding a wider selection of convenient services to customers. In addition, to the existing financial services over the Internet such as online comparison charts of interest rates and information services regarding new financial instruments, financial portals accessed by mobile handsets provide a new form of financial services that combine the features of mobile technology with the financial web portals.

Table 4-12 Number of On-line Accounts and Customers' Active Accounts

(Unit: No. of accounts, %)

	On-line account	Active account	Ratio of online account
Dec. 1998	227,350	3,792,456	6.0
Dec. 1999	1,887,245	7,572,839	24.9
Dec. 2000	3,849,240	8,668,187	44.4
Dec. 2001	4,578,651	8,385,376	54.6
Dec. 2002	5,321,259	8,010,496	66.4
Jun. 2003	5,597,881	6,698,085	83.6

Source: Korea Securities Dealers Association(KSDA), Dec. 2003

Table 4-13 Trend of Total Stock Trade and On-line Stock Trade Amount

(Unit: Trillion won, %)

	On-line stock trade		Total stock trade		On-line ratio	Increase or decrease
	Amount	Increase rate	Amount	Increase rate		
1998	22.5	-	1,205.2	-	1.9	-
1999	684.3	2,845.8	3,607.5	199.3	19.0	17.1
2000	1,939.7	183.4	4,163.9	15.4	46.6	27.6
2001	2,189.5	12.9	4,185.0	0.5	52.3	5.7
2002	3,293.5	50.4	6,321.8	51.1	52.1	-0.2
First half of 2003	1,918.5		3,473.0		55.2	

* 1\$ = 1,200 won

Source: Korea Securities Dealers Association (KSDA), Dec. 2003

3. Mobile Internet

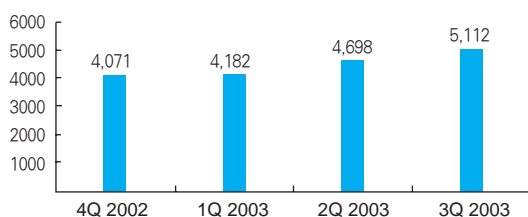
Domestic mobile Internet market size has been showing a quarterly increase rate of about 10.6% in sales and is taking over 10% of the total sales of mobile communication services. Such growth is made possible by the introduction of diverse mobile content, taking advantage of network evolution to cdma 2000-1x and EV-DO.

3.1 Mobile Content

Ringtones is one of the most popular contents. Recently, ringtones that can produce 64 chords are

Figure 4-04 Quarterly Sales of the Korean Wireless Internet Market

(Unit: 100 million won)



* 1\$ = 1,200 won

Source: Total of Mobile Carriers Quarterly sales

being offered and many diverse application contents are being introduced.

A new m-card service delivers a ringtone with an animated character to mobile phone subscribers.

More than 30% of data traffic in mobile Internet is generated by games. The domestic market for mobile games has increased from 10 billion in 2000 to 250 billion won in 2003 and it will soon reach the industry sale levels of online and PC games.

The most common feature in the character (avatar) service is a downloadable character that can appear in the background of the mobile phone screen. The user can choose several photos and save them as a background screen or make a certain photo appear when there is an incoming call or while the user is accessing the wireless Internet.

MMS goes beyond simple text messaging by allowing users to attach photos, background pictures, images, and music to their text messages.

■ **Future services**

First, an MMS service will allow users to send content such as video, photos, maps, and business cards. The service will also support large data files such as flash animation clips or video advertisements.

The current MMS market is centered around sending and receiving text messages while the technology also supports the transmission of photos, ring tones. In the future, it will become more diverse to allow communication between person and server using push technology for sending mobile advertisements and news.

Secondly, VOD is becoming a promising business as it delivers video streams to mobile phones that can also be downloaded. Since 2002, full-scale VOD service based on MPEC-4 technology has been expanding. SK Telecom and KTF are already providing multimedia content via EV-DO networks under the JUNE and FIMM branded service. Popular content among users is entertainment such as music video, movie trailers, soap operas, and sports.

Thirdly, various services and mobile content that use location-based information are becoming established. Services that can track the location of

friends, family members, and cars while providing information about nearby restaurants and accommodations is gaining a lot of attention.

3.2 m-Commerce

In 2003 the registered users of cdma 2000 1x EVDO, which can be referred to as 3rd generation mobile communications, reached 24.8 million out of the total 33.6 million users in December 2003, thus establishing a basis for an active full scale data service market. Upon this momentum, the size of Average Revenue per User (ARPU) is increasing in the area of data services. The mobile Internet market size has grown to 2 trillion won while the W-CDMA network where full-scale investment is taking place, the rate of growth will accelerate even further. Following the introduction of a full-scale ubiquitous service environment and new convergence products, the m-Commerce market is becoming more active not only in the existing payment of small purchases and mobile trading but also in new m-Commerce markets such as MMS, LBS and telematics.

In line with the above trend,, the existing wired high speed internet companies, major portals, banks and financial institutions will be providing new products that merge the functions of telecommunication and finance, forming a competitive market structure. The mobile Internet network and accelerating convergence of telecommunication and finance.

Table 4-14 Frequently Used Mobile Contents (Unit: %)

Rank	contents	Ratio
1	Bell sounds	45.3
2	Games	12.5
3	Ringtones	9.2
4	Music	7.3
5	Characters	5.5
6	GIS	2.7
7	Sing Along	2.6
8	Traffic Information	2.3
9	Stock Information	1.4
10	Sports News	1.4

Source: Yonsei University HCI Lab, Dec. 2003

Table 4-15 Comparison of Micro Payment Service of Mobile Phone with Fixed-line Phone, ADSL and Credit Card

(Unit : One million cases, 100 million won)

Classification	2001		2002		2003	
	No. of Settlement	Amount of Settlement	No. of Settlement	Amount of Settlement	No. of Settlement	Amount of Settlement
Fixed-line	234	217	1,736	1,365	2,081	1,926
Mobile phone	1,506	793	4,866	2,613	9,412	4,718
Credit card	16	433	67	2,803	78	1,080
ADSL			13	9	68	56
Total	1,756	1,443	6,682	6,790	11,639	7,780

※ 1\$ = 1,200 won

Source: SKTelecom, Dec. 2003

1. Backbone Network

1.1 Internet eXchange(IX)

■ IX

At present, the Korea Internet eXchange (IX) service is provided by NCA (KIX, www.kix.ne.kr), KT (KT-IX, www.kornet.net), Dacom (Dacom-IX, www.bora.net), and KINX (KINX, www.kinx.net).

The non-profit public networks are interconnected to NCA's KI while the commercial ISPs are linked to KT-IX, Dacom-IX or KINX. KT-IX and D-IX were built by KT and Dacom respectively and are operated by these backbone providers, which are also ISPs. KINX is managed by KINX

Inc., which was established by a consortium of small-and mid-sized ISPs.

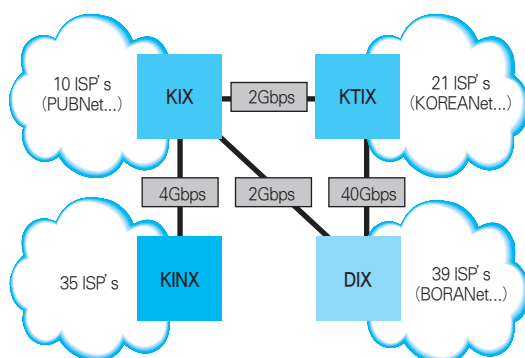
In the meantime, IX in Busan is the nation's first regional eXchange (R-IX) that the government set up with the goal to improve Korea's Internet interconnection structure that is centered around Seoul, and bridge the digital divide by regions. Since May 2003, 13 ISPs of 11 organizations in this region have been interconnected, handling Internet traffic originating from Busan and South Gyeongsang Province.

■ ISP

Commercial ISPs emerged in 1994, and the number of small-sized ISPs has continuously increased by 2001. In particular, the presence of ISPs offering Internet services via CATV network like Thrunet has rapidly expanded. However, 2002 marked the turning point in the Korean Internet access service market as it reached a saturation point in terms of quantity. This in turn led to a full-fledged competition in the market, accelerating M&As targeting small-sized ISPs.

Korean ISPs have spurred efforts to introduce services using new technologies, based on which

Figure 5-01 IX Connectivity Map



Source: National Computerization Agency(NCA), Dec. 2003

Table 5-01 State of IX bandwidth

Classification	IX	Operating Entity	No. of ISPs connected	Total Connection Bandwidth
Public	KIX	NCA	10	30.5 Gbps
	KT-IX	KT	21	130 Gbps
Commercial	Dacom-IX	Dacom	39	92 Gbps
	KINX	KINX	35	44 Gbps

Source: National Computerization Agency(NCA), Dec. 2003

they tried to develop a profitable business model. In line with this, these providers have continuously pushed ahead with expanding their businesses into Internet telephony, contents business and portals while maintaining the existing server hosting and Internet data center (IDC) services. In addition,

Korean ISPs are exploring ways to build a better profit structure and change their current flat-rate tariff policy by reviewing the Service Level Agreement (SLA) that is under discussion overseas.

1.2 Commercial Network

Currently, Korea commercial networks are provided by 78 ISPs including KT (KORNET), Dacom Corp. (BORANET), Onse Telecom Corp. (Shinbiro), Hanaro Telecom Corp. (Hananet),

Table 5-02 No. of IDC's ISP Members by Year
(Unit: Number of ISPs)

Year	2000	2001	2002	2003
No. of ISP members	83	99	82	78

Source : Korea Internet Data Center(IDC). Feb. 2004

Table 5-03 Major Commercial Network State

Company	Service Name	Network State	Network Connection	
			Domestic	Foreign
KT	KORNET	<ul style="list-style-type: none"> Total nodes nationwide: 100 Links between major cities: 2.5Gbps~10Gbps Links between small and mid-sized cities: 155~622Mbps 	(Total bandwidth of IX:42Gbps · DIX: 40Gbps · KIX:2Gbps) (Total connected ISPs:130.5G)	(Total 17.5Gbps) · U.S.(UUNET and 6 companies) : 13Gbps · Japan, China, Hong Kong, Australia, New Zealand, Southeast Asia: 4.5Gbps
Dacom	BORANET	<ul style="list-style-type: none"> Total nodes nationwide: 71 Links between major cities: 310Mbps~5Gbps, 2 lines Links between small and mid-sized cities: 45~155Mbps 	(Total bandwidth of IX:42Gbps · KTIK:40Gbps · KIX:2Gbps) (Total connected ISPs: 50Gbps)	(Total 5.2Gbps) · U.S.(Qwest, PAIX etc.) : 2Gbps · Asia(9 countries like Japan(555M) and China(555M) : 3.0G
Hanaro Telecom	HANANET	<ul style="list-style-type: none"> Total nodes nationwide: 200 Links between major cities: 40Gbps~800Gbps Links between small and mid-sized cities: 155Mbps~2.5Gbps 	(Total bandwidth of IX: 83.5Gbps · DIX: 25Gbps · KINX: 5Gbps · KIX: 1Gbps · KTIK: 52.5Gbps) (Total connected ISPs:25.7G)	(Total 5.2Gbps) · U.S. : 3.3Gbps · U.K. : 310Mbps · Asia : 1Gbps · Others : 620Mbps
Onse Telecom	SHINBIRO	<ul style="list-style-type: none"> Total nodes nationwide: 19 Links between major cities: 465M~5Gbps Links between small and mid-sized cities: 45Mbps~310Mbps 	(Total bandwidth of IX: 12Gbps · DIX: 4.5Gbps · KINX: 4Gbps · KTIK: 3.5Gbps) (Total connected ISPs: Total 4.7Gbps)	(Total 1,030Mbps) · U.S. (Onse US POP) : 975Mbps · Japan(Japan Telecom) : 45Mbps · Taiwan : 10Mbps · Hong Kong(NWT) : 128Kbps
Thrunet	Thrunet	<ul style="list-style-type: none"> Total nodes nationwide: 124 Links between major cities: 5Gbps~10Gbps 	(Total bandwidth of IX: 19.5Gbps · KT-IX : 7.5Gbps · KNIX:5Gbps/KIDC:5Gbps · DIX: 2Gbps) (Total connected ISPs: 17.1Gbps)	(Total 1,705bps) · U.S.(Dacomcrossing, Onse Telecom) : 1,395Mbps · Asia(Transit node, AGC) : 310Mbps

Table 5-03 Major Commercial Network State

Company	Service Name	Network State	Network Connection	
			Domestic	Foreign
Enterprise Networks	GNGIDC	<ul style="list-style-type: none"> Total nodes nationwide: 63 Links between major cities: 2.5Gbps node-to-node duplexing 	(Total bandwidth of IX: 13.6Gbps) <ul style="list-style-type: none"> KT-IX : 7.5Gbps KINX : 3Gbps DIX: 2Gbps KIX : 1Gbps BIX : 100Mbps) (Total connected ISPs: 8.6Gbps)	(Total 775Mbps) <ul style="list-style-type: none"> U.S.(MCI,Reach): 465Mbps Japan(NTT): 310Mbps
SK Telecom	SK speedNet	<ul style="list-style-type: none"> Links between major cities: 622MGbps Links between small and mid-sized cities: 155MGbps Jeju: 45Mbps 	(Total bandwidth of IX: 6Gbps) <ul style="list-style-type: none"> KT-IX : 2.5Gbps/DIX: 2Gbps KINX : 1Gbps) (Total connected ISPs: 2.545Mbps)	(Total 155Mbps) <ul style="list-style-type: none"> Dacom-international: 155Mbps
Dreamline	DreamLine	<ul style="list-style-type: none"> Between major node links: 45Mbps~2Gbps 	(Total bandwidth of IX: 7Gbps) <ul style="list-style-type: none"> KIX : 5Gbps KINX : 2Gbps) (Total connected ISPs: 7.4Gbps)	(Total 310Mbps) <ul style="list-style-type: none"> Hanaro Telecom: 155Mbps AGC: 155Mbps
Powercomm	POWER-COMM	<ul style="list-style-type: none"> Total nodes nationwide: 75 City links: 2.5Gbps Subscriber network: 155Mbps 	-	-

Source: National Computerization Agency(NCA), Dec. 2003

Thrunet Corp. (Thrunet), Enterprise Networks (GNGIDC), SK Telecom (SKSpeedNet), Dreamline (DreamX), and Powercomm Corp. (POWERCOMM). The total number of ISPs has decreased from 98 in 2001 to 78 in 2003. The following table shows the current status of Internet backbone networks in Korea with the nationwide backbone network operators.

Internet network based on ATM switch networks has been constructed and upgraded, and 18 nodes were completely built in the end of 2002. The subscriber access networks in 144 cities across the nation accommodate subscribers through ATM lines and frame relay lines. The backbone sector of the ATM switches networks is providing access speeds of 155~622 Mbps between major cities within the backbone sector of ATM switches, and 155 Mbps between small and mid-sized cities. The interconnected links between major nodes will be upgraded to speeds faster than 2.5 Gbps.

1.3 Non-Profit Networks

■ PUBNET- KT

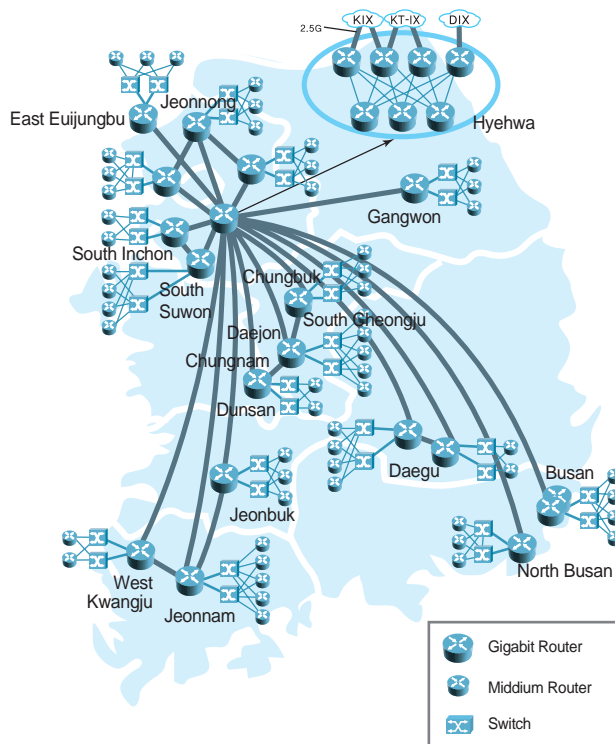
PUBNET has commenced providing commercial service in January 1998 to serve the need of the government and public sector. Since 1998, an

Table 5-04 Major Non-Profit Network State

Company (Service Name)	Network State	Service Targets	Network Connection	
			Domestic	Foreign
KT (PUBNet)	<ul style="list-style-type: none"> · ATM network-based nodes nationwide: 18 · Between majors cities: 155M~622Mbps · Between small and mid-sized cities: 155Mbps 	<ul style="list-style-type: none"> · Public & non-profit organizations · Elementary & secondary schools 	(Total bandwidth of IX: 13.6Gbps · KIX : 5G · KT-IX : 7.5G · DIX : 2.5G) (Connected ISPs: Connected to KIX, KT-IX)	<ul style="list-style-type: none"> · U.S.(KIX): 75Mbps
Dacom (PUBNET-PLUS)	<ul style="list-style-type: none"> · Between ATM network-based nodes nationwide: 45Mbps, 155Mbps, 622Mbps 	<ul style="list-style-type: none"> · Public & non-profit organizations 	(Total bandwidth of IX: 4Gbps · 6KANet: 2Gbps · BORANet : 2Gbps) (Connected ISPs: Connected to KIX, DIX)	<ul style="list-style-type: none"> · U.S.(KIX): 75Mbps
NCA (6KANet)	<ul style="list-style-type: none"> · Between Seoul and Youngin: 45Mbps 	<ul style="list-style-type: none"> · Central administration, judiciary & legislative bodies · Educational organization, organizations in leading application business 	(Total bandwidth of IX: 1Gbps 6NGIX : 1G) (Connected ISPs: 2.5Gbps -Interconnected via 6NGIX)	<ul style="list-style-type: none"> · U.S.(6NGIX, KIX) :775Mbps
KERIS (EDUNET)	<ul style="list-style-type: none"> · Between the six nodes nationwide: 2Mbps~4Mbps 	<ul style="list-style-type: none"> · All citizens including students, teachers, parents 	(Total bandwidth of IX: 310Mbps · KT-IX : 155M · DIX : 155M (Connected ISPs: 400Mbps)	<ul style="list-style-type: none"> · 155M (Interconnection via KIX)

Source: National Computerization Agency(NCA), Dec. 2003

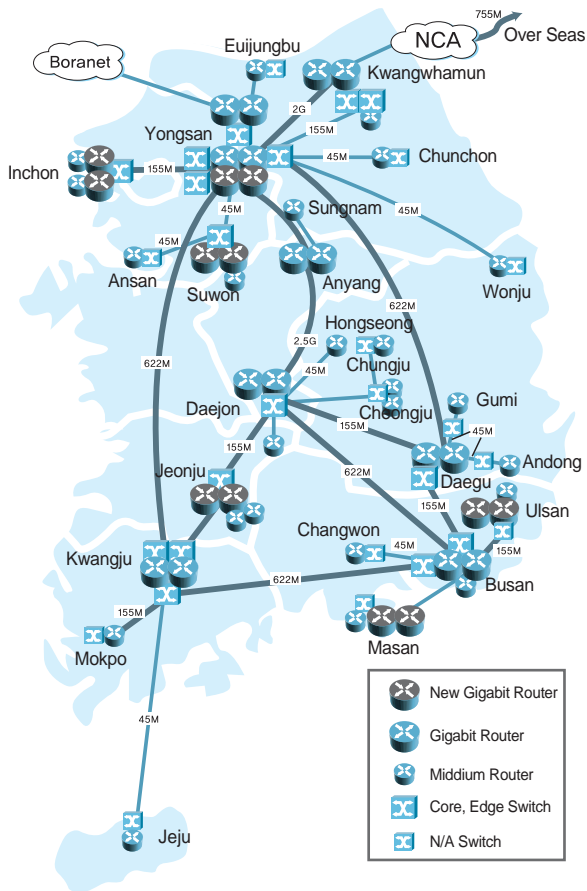
Figure 5-02 PUBNET Network



■ **PUBNETPLUS - Dacom Corp.**

PUBNETPLUS is offering broadband Internet services to the government and public agencies through ATM switch networks. Internet backbone networks have offered elementary and secondary schools nationwide ATM Metro service since 2003. In order to provide high-quality Internet services such as real-time multimedia streaming service and voice telephony service over the Internet, Dacom is vigorously working on the establishment of Multi-Protocol Label Switching (MPLS) networks based on ATM switch networks. The speeds of lines are mostly 45Mbps, 155Mbps, and 622Mbps while maintaining reliable service by dualizing the routes between the nodes.

Figure 5-03 PUBNETPLUS Network



■ **6KANet - National Computerization Agency (NCA)**

The KOSINet service, which was delivered to the government and non-profit organizations was shut down, and a next generation Internet network, 6KANet, is replacing the KOSINet. 6KANet is a next-generation Internet network based on IPv6 and plans to provide high-quality Internet services to the government and public agencies by supporting IPv6 security functions, QoS and multicast. At present, a total of 47 agencies are using the 6KANet service. 6KANet network offers 6NGIX service along with such common services as IPv6 DNS, Web, IPv6 messenger and IPv6 streaming services. Services like IPv4/IPv6

Tunnel Broker, ISATAP, NAT-PT and Teredo are currently being provided or scheduled to be offered.

■ **EDUNET - Korea Education Research Information Service (KERIS)**

EDUNET offers a comprehensive information on education that is built up systematically, thereby allowing students, teachers, parents and citizens to have access to a wide range of academic information and research resources with ease anytime anywhere. Since EDUNET launched service in September 1996, it has offered teaching and studying materials as well as support for teaching activities. EDUNET provides educational resource service in alliance with Education Agencies in 16 cities and provinces. As of the end of 2003, EDUNET has about 5.16 million subscribers.

1.4 Advanced Research Networks

■ **Korea Advanced Research Network (KOREN)**

KOREN is a non-profit network that provides a research environment for universities, research labs, and corporations to develop high-speed communication equipment and new application services. For the access, backbone lines are provided for free, but subscriber lines are charged to the using subscribers. KOREN serves its subscribers via POP established in 6 areas nationwide, and the bandwidth of its backbone network is 40Gbps between Seoul and Daejeon, and 155Mbps in other backbone links.

Expectedly, the backbone will be upgraded to 1Gbps. KOREN is integrated with STAR TAP

(155Mbps) of the U.S., SingAREN (6Mbps) of Singapore, and RENATER(17Mbps)of France through APII Testbed to offer service for R&D activities.

■ Asia Pacific Information Infrastructure (APII)

APII has two main objectives. The first objective is to facilitate international collaboration project among countries in the Asia-Pacific region, and the second one is to build and operate APII Testbed. APII international collaboration project aims to liberalize investment in the ICT sector, strengthen cooperation in joint research projects, realize the Asia Pacific Information Society (APIS). As of December 2003, Korea operates APII Testbeds between Korean and Japan and between Korea and Singapore with the bandwidth of 1Gbps and 6Mbps respectively. The Korea-U.S. link is 155Mbps. The Testbed will be connected to CERNET of China and AARNET of Australia. The links with CERNET of China will be 45Mbps in the 1st half of 2004. Korea-Japan and Korea-Singapore networks are connected to KOREN and managed by NCA while Korea-U.S. APII Testbed is linked to KREONET of Korea Institute of Science and Technology Information(KISTI).

■ Trans-Eurasia Information Network (TEIN)

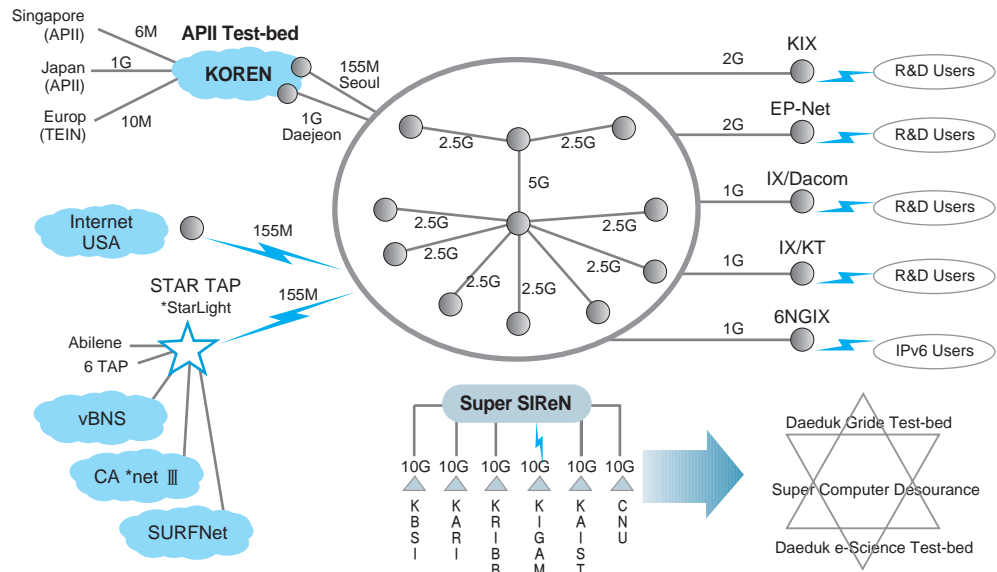
TEIN is a telecommunications infrastructure that facilitates joint research projects and shares information among ASEM members(between Asia & Europe). TEIN, which is the first inter-continental link between Asia and Europe, has enabled the dynamic exchanges of information between Asia and Europe and, in the long run, it is expected to improve the global telecommuni-

cations infrastructure where communications traffic is concentrated in North America. For better network service, TEIN was upgraded to the bandwidths of 10Mbps in March 2003, and to SCR 17Mbps and PCR 34Mbps in the end of 2003. There is also ongoing discussion between Korea, European and Southeast Asian countries over extending TEIN to Southeast Asia. In Korea, about 30 KOREN and 200 KREONET member institutes can access TEIN.

■ Korea Research Environment Open Network (KREONET)

KREONET, which was conceived as a nationwide network that allows researchers in science and technology to share databases, has built 15 regional network centers for the first time in Korea to introduce Internet services. KREONET has served as one of the nation's key research networks by opening up direct international research links with the signing of the Science and Technology Agreement with other countries. (U.S.: 1991, CERFnet/NSFNET(SD SC), Europe: 1994, EuroPaNET(ULCC/UK), Japan:1995, IMNET(KDD/JST)) KREONET is connected to STAR TAP/Abilene with the capacity of 155Mbps and to KOREN with 1Gbps(Daejeon). The network is also linked to overseas BORANet(Dacome) at 55Mbps to provide research network services for R&D users at home.

Figure 5-04 KREONet Backbone Network



Source: KREONet, Dec. 2003

Table 5-05 International Submarine Optic Cables

	Cable	Constructed Sections	System Capacity	Length (km)	Beginning Date of service
International	JKC	Korea-Japan	36M	200	1980
	HJK	Korea-Japan-Hong Kong	280M × 1	4,587	1999
	RJK	Korea-Japan-Russia	560M × 2	1,762	1995
	CKC	Korea-China	560M × 2	549	1996
	APCN	Korea-Taiwan-Malaysia-Australia and 10 countries	10G × 2	11,839	1997
	FLAG	Korea-Japan-Hong Kong-Middle East-Europe and 13 countries	5G × 2	27,943	1997
	SMW-3	Korea-Northeast Asia-Southeast Asia-Middle East-Europe and 35 countries	40G	38,000	1999
	CUCN	Korea-U.S.-China-Japan-Taiwan-Guam	20G × 4	26,000	2000
	APCN-2	Korea-Japan-China-Hong Kong-Taiwan-Singapore-Malaysia	2.56Tera	20,000	2001
	KJCN	Korea-Japan	2.88Tera	500	2002
	EAC	Korea-Japan-Taiwan-Hong Kong	2.56Tera	10,600	2001
	C2C	Korea-Japan-Taiwan-China-Hong Kong-Taiwan-Singapore-Malaysia	7.68Tera	17,000	2001
	FNAL	Korea, Japan, Taiwan, Hong Kong	2.4 / 3.8Tera	9,600	2002
Domestic	No. 1 Jeju-Continental Korea	Jeju-Goheung	280M × 3	169	1990
	Ullung-continental Korea	Ullung-Hosan	2.5G	159	1993
	No. 2 Jeju-Continental Korea	Jeju-Goheung	2.5G × 4	191	1996
	No. 3 Jeju-continental Korea	Jeju-Namhang	2.5G × 2	236	2000

Source: National Computerization Agency(NCA), Dec. 2003

1.5 International Cables and Satellite Communications in Korea and Abroad

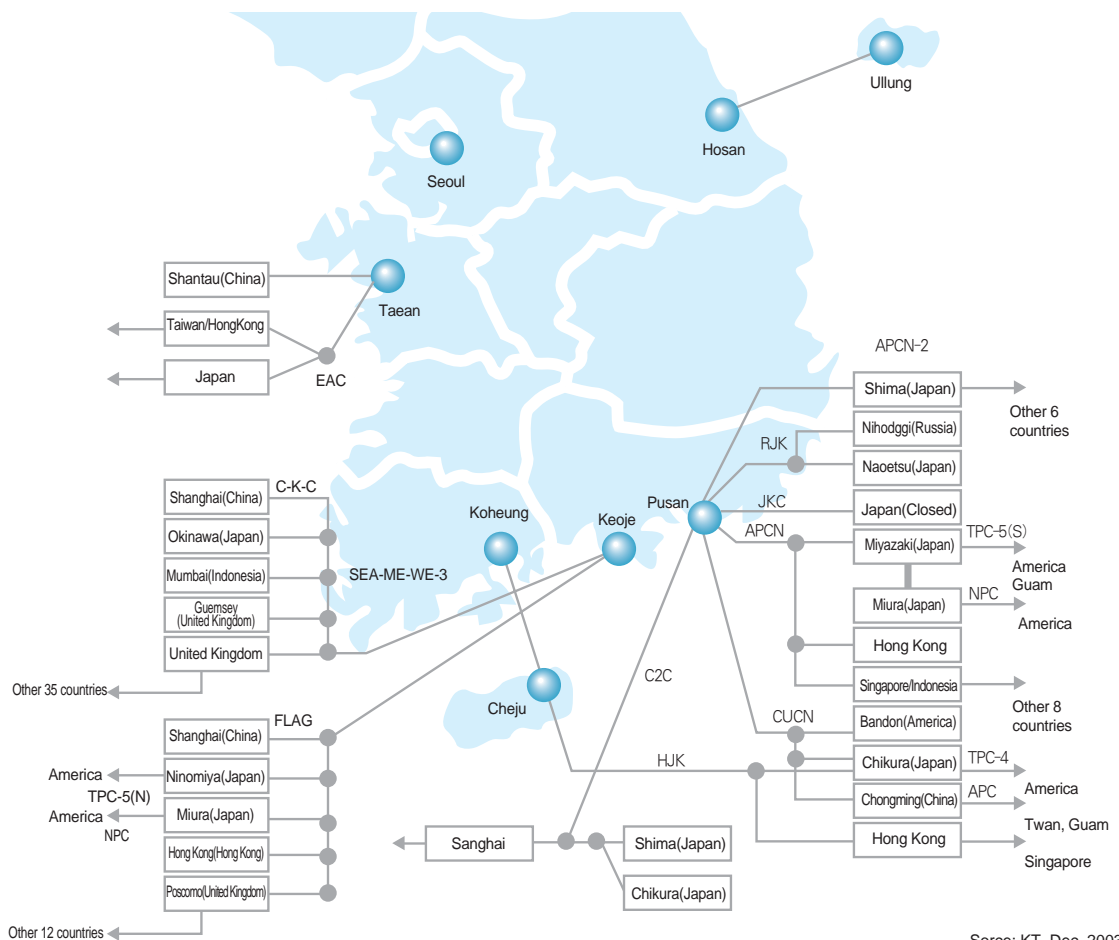
International submarine optic cables play an important role with satellite as a communications tool that connects countries with Tbps-scale submarine optic cables, thereby transmitting a large volume of data. General lifespan of submarine optic cables is 25 years on average, and there are all told 12 optic cables (HJK, RJK, CKC, APCN, FLAG, SMW-3, CUCN, APCN-2, KJCN, C2C, EAC, FNAL) under operation in Korea with a total capacity reaching 19Tbps.

With the global telecommunications market,

which has been in the grip of a sweeping recession since 2001, the construction of new undersea cables is very slow in 2004, and most telecommunications operators across the globe are expected to meet the demands by increasing the current systems or acquiring bankrupt cable companies or leasing the lines in the short term from the cables market.

As part of global efforts to reasonably maintain the network since 2003, old and low-bandwidth cables have been removed across the world. Nevertheless, the number of international undersea optic cables connecting North American countries centered around the U.S. and Canada, and countries like the U.K., France and Germany in

Figure 5-05 Submarine Optic Cables in Korea



Source: KT, Dec. 2003

Europe, and Singapore, Malaysia, and Hong Kong in Asia surpass 24 and their total capacity reaches

dozens of Tbps-scale.



2. Subscriber Network

2.1 Fixed-line Network

The fixed-line network can be classified into an xDSL based network (VDSL : Very high-bit[data] rate Digital Subscriber Line, ADSL, HDSL : High bit[data] rate DSL, SDSL : Symmetric DSL, ADSL : Asymmetric DSL), which uses copper lines, and a cable modem using a HFC (Hybrid Fiber Coaxial) network. Out among 11.1 million total fixed-line network users, 6.44 million people hook up to xDSL and 3.83 million people are connected to cable modems.

■ VDSL (Very high-bit[data] rate Digital Subscriber Line)

VDSL is one of the several types of DSL technology that is transmitted over copper lines. In the VDSL standard, T1.424, the asymmetrical transmission speed is 22Mbps on the downlink and 3Mbps on the uplink. As for symmetrical transmission speed, the service is provided at speeds of 6Mbps~13Mbps on the downlink and uplink. VDSL works only over relatively short transmission distance (0.3Km~1.5Km) compared to ADSL. Despite such a weakness, VDSL service is gaining great popularity as it can offer service with the speed of 13Mbps. Given the characteristics of VDSL, it has to maintain a short

Table 5-06 No. of Broadband Internet Service Subscribers

(Unit : Person)

Classification	xDSL	Cable Modem	LAN of Apartment	Satellite	Total	Market Share
KT	5,230,342	-	353,880	4,836	5,589,058	50.0%
Hanaro Telecom	1,093,261	1,290,150	342,152	-	2,725,563	24.4%
Thrunet	-	1,287,502	5,862	-	1,293,364	11.6%
Onse Telecom	-	419,293	3,769	-	423,062	3.8%
Dreamline	56,178	89,546	3,874	-	149,598	1.3%
Dacom	-	135,884	65,820	-	201,704	1.8%
Value-added telecom operators	3,362	605,791	9,950	-	619,103	5.5%
Resellers	52,812	-	124,235	-	177,047	1.6%
Total	6,435,955	3,828,166	909,542	4,836	11,178,499	100%
Market Share	57.6%	34.2%	8.1%	0.1%	100%	-

Source : Ministry of Information and Communication, 2003. 12

transmission distance. To this end, VDSL should evolve to FTTC and FTTH, so the networks of VDSL are formed mainly around high-density residential areas like apartments. VDSL chipset makers released a 20Mbps-scale VDSL product followed by 50Mbps-scale as a commercial service.

■ **ADSL**
(Asymmetric Digital Subscriber Line)

ADSL is a communication tool that enables high-speed data communications using the existing copper lines. ADSL can send 1.5Mbps~8Mbps data rates downstream, and 16Kbps~640Kbps upstream. The fact that local exchanges in large cities are located within the radius of 3-4km offered an ideal environment to provide an ADSL service. And upon the introduction of the service, it has quickly spread across all users centering around densely populated apartment complexes. As a result, as of the end of 2002, the number of subscribers recorded 5.7 million people and the ADSL market got saturated in 2003. Now, the service is moving to VDSL.

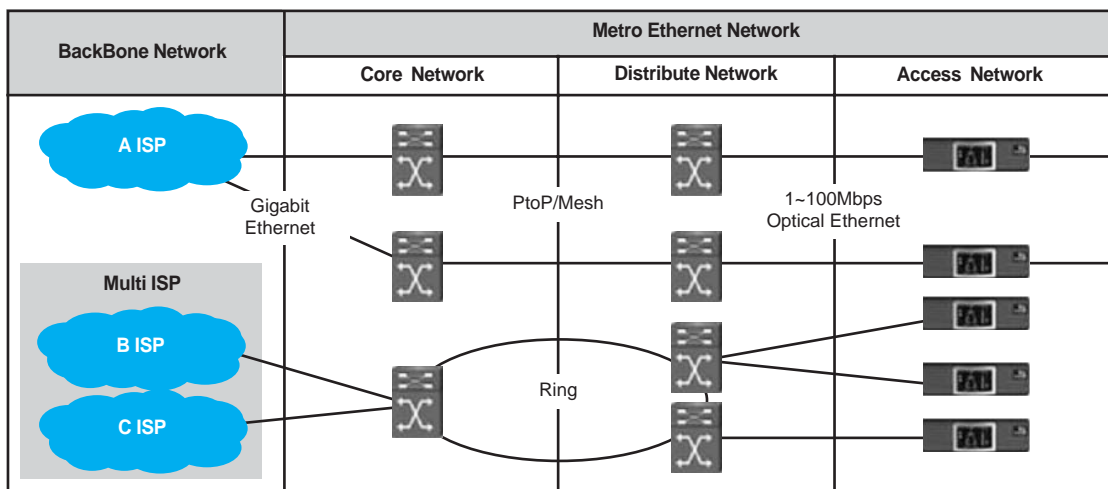
■ **Cable Modem**

Cable modem broadband Internet service uses a hybrid fiber coax (HFC) network that is composed of fiber optic cable connections and coaxial cable connections. Since the introduction, the service has continued to evolve, extending its lifespan and accelerating the technological development more than the existing services like ISDN, HomePNA and ADSL. In the existing service areas, service operators (SO), which used to retransmit broadcasting programmes using cable networks, and multiple system operators (MSO) started providing broadband Internet service either independently or in cooperation with ISPs. And those SOs and MSOs, which worked with ISPs to provide broadband Internet service in the initial stage, are now transforming themselves as an ISP taking a form of SO. They are expected to deliver 100Mbps-capable service around 2005.

■ **Metro Ethernet Service**

The existing leased line has offered the service with speeds of 256K, 512K, 1.544K, 2,048K, 45M and 155M, using the TDM (Time Division

Figure 5-06 Metro Ethernet Structure



Multiplexing) method. The TDM entails a high cost and triggers a bottleneck problem. In 2001, Metro Ethernet services commenced. Customers demanded access to a high speed Internet service at work or a PC room. Nowadays, the price of Ethernet-based equipment is steadily dropping and new Metro Ethernet equipment have been launched. Metro Ethernet service is composed of switch equipment that offers services in the various speed ranges of 1M, 3M, 5M, 10M, 50M and 100M~1G, and supports End-to-End QoS (Quality of Service), VoIP and VPN.

mobile subscribers. With the rapid take-up of mobile phone services, the radio paging service has seen a drastic decrease in its subscribers while TRS and wireless data communications services are maintaining a steady growth by attacking the niche markets. As of the end of April 2004, the number of wireless Internet service in Korea is 33.09 million people, taking up 94.5% of the total mobile subscribers that amount to 35 million. Out of which, the subscribers who have an exclusive wireless Internet browser or platform built-in such as WAP/ME, stand at 31.82 million or 96% of the total.

2.2 Wireless Network

■ Mobile Communications

Currently, mobile communications services are offered in the form of mobile phones, radio paging, TRS and wireless data communications etc. And the cellular phone service subscribers account for 98.7% of the mobile communications service. This figure shows that the penetration-to-population ratio stands at 70%, indicating that the mobile service market will reach a saturation point in no time unless a new variable emerges. Thus, mobile operators are expected to engage in a much fiercer competition with each other to secure more

■ Wireless LAN

Wireless LAN allows the transmission of data by using radio frequency technology. In addition, wireless LAN consumes less power, and has a strong signal reception even in places where interference exists. As the price of wireless LAN products goes down, the technology is more widely used. Recently, KT and Hanaro Telecom launched their wireless LAN commercial services in the hotspot areas using the 2.4GHz ISM band, and SK Telecom is also providing trial service, paying attention to Wireless LAN as a complementary technology of mobile telephones as it offers far faster transmission speed than the

Table 5-07 No. of Mobile Communications Subscribers in Korea

Classification	End of Mar. 2004	Market Share	Carriers
Mobile Communications	35,003,983	60.0%	SK Telecom, KTF, LG Telecom
Radio Pager	63,597	0.1%	Real Telecom(nationwide provider), Seoul Mobile Telecom, Eyesvision, Selim, Centis(local provider)
TRS	304,852	0.5%	KT Powertel, Anam Telecom, Seoul TRS, Daegoo TRS, Powertel TRS, KB Telecom, Jeju TRS
Wireless Data Communications	105,718	0.2%	Air Media, Real Telecom
Total	58,324,664	100%	-

Source: Ministry of Information and Communication, Wired & Wireless Telecommunications Service Subscribers, 2004. 3

latter. At present, KT is leading the wireless LAN market in Korea followed by Hanaro Telecom. Dacom is providing free service in some subway stations and airports. As for SK Telecom, the company is delivering trial service in some 80 hotspot locations including universities, airports and horse racing tracks in pursuit of creating synergy effects with mobile phone services. However, in Korea, KT is the only carrier which is aggressively attacking the wireless LAN market. KT is providing not only wireless LAN products, but also wireless LAN services in areas where wireless LAN is set up through 'NESPOT-swing', and for other areas, KT is providing services that allow wireless data communications via mobile telephone networks. At the same time, in order to create a new income source in the fixed and wireless services, KT is pushing ahead with the business in cooperation with KTF.

infrastructure is difficult to be deployed. Satellite uplink transmissions are made over telephone lines or mobile telephone networks. As for areas like ordinary households and buildings, they use fixed-line networks like leased lines, PSTN, ISDN for the uplink, and satellite Internet on the move uses mobile telephone networks. And the downlink which carries a lot of traffic offers service using a satellite dish. Internet service via satellite is being offered as part of KT's broadband Internet service, 'Megapass', but is limited to remote areas which find it difficult to receive fixed-line broadband Internet services like xDSL, cable modems and apartment LAN, or areas where satellite broadcasting equipment is set up. These days, with the convergence of telecommunications and broadcasting, efforts are made to expand subscribers by combining satellite broadcasting with wireless Internet service.

■ Satellite Communications

With the launch of Mugungwha Satellite in August 1995, the full-fledged satellite era has begun in Korea. A variety of broadcasting and telecommunications services are being provided through satellite communications such as DAMA/SCPC service, satellite VAN service of VSAT, digital satellite broadcasting service and on-the-spot news reports. Internet service via satellite uses Mugungwha Satellite, and achieves transmission speed up to 1Mbps anywhere in the country including remote areas where fixed-line

Table 5-08 No. of Wireless Internet Subscribers in Korea

Classification	SK Telecom	KTF	LG Telecom	Total
WAP/ME Method	16,879,400	10,489,518	4,451,709	31,820,627
ISMS Method	482,993	605,474	184,001	1,272,468
Total	17,362,393	11,094,992	4,635,710	33,093,095

* ISMS method is not a mere SMS but a service that allows you to log on to the Internet and search the web without a web-browser by linking the ISMS system to the Internet gateway.

Source: Ministry of Information and Communication, 2004. 3

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A p p e n d i x

1. List of Internet-related Organizations

Field Related	Organizations	URL	TEL
Policy & Statistics	National Computerization Agency (NCA)	http://www.nca.or.kr	+82-02-2131-0114
	Korea Information Society Development Institute (KISDI)	http://www.kisdi.re.kr	+82-02-570-4114
	Information Communication Ethics Committee (ICEC)	http://www.icec.or.kr	+82-02-3415-0114
	Korea Network Information Center (KRNIC)	http://www.nic.or.kr	+82-02-2186-4500
	Information Culture Center of Korea (ICC)	http://www.icc.or.kr	+82-02-3660-2633
Technology & Research	Electronics and Telecommunications Research Institute (ETRI)	http://www.etri.re.kr	+82-42-860-6114
	Korea Institute of Science and Technology Information (KISTI)	http://www.kisti.re.kr	+82-02-962-6682
	Korea Information Security Agency (KISA)	http://www.kisa.or.kr	+82-02-3488-4500
	Korea Association of Information and Telecommunication (KAIT)	http://www.kait.or.kr	+82-02-580-0580
	Telecommunications Technology Association (TTA)	http://www.tta.or.kr	+82-02-723-7073
	Institute of Information Technology Assessment (ITA)	http://www.iita.re.kr	+82-42-869-1114
Industry & Corporation	Korea Internet Corporations Association (Kinternet)	http://www.kinternet.org	+82-02-528-4114
	Korea Information & Contents Business Association (KIBA)	http://www.kiba.or.kr	+82-02-2264-3636
	Federation of Korean Information Industries (FKII)	http://www.fkii.or.kr	+82-02-780-0201
	Promising Information & Communication Companies Association (PICCA)	http://www.picca.or.kr	+82-02-3424-6155
	Korea Venture Business Association (KOVA)	http://www.kova.or.kr	+82-02-562-5914
	Open Standards and Internet Association (OSIA)	http://www.osia.or.kr	+82-02-562-7041
	Korea ISPs Association	http://www.kispa.or.kr	+82-26007-6200
e-Commerce	Korea Institute for Electronic Commerce (KIEC)	http://www.kiec.or.kr	+82-02-3453-0404
	KOREA CALS/EC ASSOCIATION (KCALS)	http://www.kcals.or.kr	+82-02-551-1452
	CommerceNet Korea (CNK)	http://www.commercenet.or.kr	+82-02-774-8558
	Korea IT Industry Promotion Agency (KIPA)	http://www.software.or.kr	+82-02-3469-1500
Infrastructure	Korea Database Promotion Center (KDPC)	http://www.dpc.or.kr	+82-02-318-5050
	Korea Software Industry Association (KOSA)	http://www.sw.or.kr	+82-02-586-3411
	Korea Software Financial Cooperative (KSFC)	http://www.ksfc.or.kr	+82-02-3469-1100

2. List of ISPs

Non-Commercial Network

Network Operator	Service Name	Tel	E-Mail	URL
National Computerization Agency	6KANet	+82-02-2131-0757	ssy@nca.or.kr	www.ngix.ne.kr
KERIS	EDUNET	+82-02-3488-6471	ip-tech@keris.or.kr	www.keris.or.kr
KISTI	HPCNET	+82-042-869-0582	help@hpcnet.ne.kr	www.hpcnet.ne.kr
KISTI	KREONet	+82-042-828-5166	hjjung@kisti.re.kr	www.kreonet.re.kr
Korea Telecom-PUBNET	PUBNET	+82-331-260-2387~8	ip@pubnet.ne.kr	www.pubnet.ne.kr
DACOM-PUBNETPLUS	PUBNETPLUS	+82-02-6220-6695	uspark@dacom.net	www.pubnetplus.ne.kr

Commercial Network

Network Operator	Service Name	Tel	E-Mail	URL
KIC for Agriculture	AFFIS	+82-031-299-8833	hwangjs@affis.net	www.affis.net
Hangaram Networks	BITSRO	+82-42-670-4690	parkyj@hangaram.co.kr	www.hangaram.co.kr
Bittel	Bittel	+82-02-338-7942	help@bittel.net	www.bittel.net
DACOM Corporation	BORANET	+82-02-6220-7007,02-709-3700	market@bora.net	www.bora.net , www.chollian.net
BANDOCABLELINE	CABLELINE	+82-063-900-9051	modem@cableline.com	www.cableline.com
EZCEN	CENNET	+82-02-815-5651	ezcen@ezcen.com	www.ezcen.com
CPS	CNIDC	+82-02-3218-0782	sales@cps.co.kr	www.cps.co.kr
Kyonggi Cable TV	DigitalSystem	+82-031-910-1000	webmaster@digitalsystem.co.kr	www.digitalsystem.co.kr
ABN	DITIZONE	+82-031-710-8952	jspark@abn.co.kr	WWW.ABN.CO.KR
DreamcityMedia	DREAMPLUS	+82-1566-1234	ymjoo@dreamcity.co.kr	www.dreamcity.co.kr
DREAMLINE CO.	DREAMX	+82-1566-0606	ip@dreamx.net	www.dreamline.co.kr
KILT.,Co.Ltd	DUALLINE	+82-32-423-6100	psm@kilt.co.kr	www.dualline.net
eGIOS	eGIOSNET	+82-02-2116-8014	rnoh@egios.com	www.egios.com
ELIMNET, INC.	ELIMNET	+82-02-3149-4900	webmaster@elim.net	www.elim.net

Commercial Network

Network Operator	Service Name	Tel	E-Mail	URL
GNG Networks, Inc	GNGIDC	+82-1588-2464	sales@epnetworks.co.k	www.epnetworks.co.kr
ETRI	ETRI	+82-042-860-4847	mkshin@pec.etri.re.kr	www.etri.re.kr
eyesvision	EYES	+82-051-850-5000	ip@ns.eyes.co.kr	www.eyes.co.kr
NTT KOREA	GIN	+82-02-2016-5006	korea-ip-gl@ntt.com	www.ntt.com/kr
Hanaro Telecom Inc.	HANANET	+82-106	info@hanaro.com	www.hanaro.com
HANINTERNET	HANINTERNET	+82-02-860-8000	iservice@haninternet.co.kr	www.haninternet.co.kr
SERVERBANK	HANNET	+82-02-829-3333	marketing@e-serverbank.com	www.e-serverbank.com
HanQnet Co.,Ltd	HANQ	+82-80-211-1242	webmaster@hanq.net	www.hanq.net
hansol iGlobe	HANSOLNET	+82-02-3488-7770	sales@higlobe.net	www.hansoliglobe.com
Hanvitinb	HANVITINB	+82-031-414-4000	pslee@hanvit.net	www.hanvit.net
HANVITDIGITALPLUS	MAGICPOWER	+82-02-553-2130	hjlee@hanvitdp.com	www.hanvitdp.com
DAEJONTELECOM	HIPASS	+82-042-633-0033	ksi1202@daejon.com	www.daejon.com
IBSat Co.,Ltd.	IBSat	+82-080-555-7100	ibsat@ibsat.co.kr	www.ibsat.co.kr
ILINKKOREA	INDICLUB	+82-02-2109-5255	ip@iilinkkorea.co.kr	www.indiclub.co.kr
Inet Hosting, Inc.	INET	+82-02-2103-7500/7600	baram@inet.co.kr	www.inet.co.kr
PrismCommunications	INTELLICENTER	+82-02-310-0400	ip@prism.co.kr	www.intellicenter.co.kr
ISSAN CO.,Ltd	ISSAN	+82-02-789-9114	ykoh@issan.net	www.issan.net
IOSYSTEM	JIGUNET	+82-02-413-9005	jdm@iosystem.co.kr	www.jigu.net
INTERTNS	JLAN	+82-063-224-6774	intertns@intertns.com	www.intertns.com
Kwacheon Broadcasting Network	KBN	+82-02-507-4000	ceo@kbntv.co.kr	www.kbntv.co.kr
Kwan-ak Television Network Co	KCNET	+82-02-837-6008-9	webmaster@kcnets.com	www.kcnets.com
KOREAINTERNETDATACENTERInc.	KIDC	+82-02-6440-2900	market@kidc.net	www.kidc.net
KT Solutions Corporation	KITINET	+82-080-2580-410	lhwt0@groupnet.co.kr	www.ktsolutions.co.kr
KOREAINTERNETTELECOM	KITNET	+82-62-511-6670	choi@kitclub.co.kr	www.kitclub.co.kr
KangNam CableTV	KNCTV	+82-02-2056-7777	sysop@knctv.co.kr	www.knctv.co.kr
Korea Telecom Hitel	KOLNET	+82-02-3289-2200	mkchoi01@hitel.net	www.hitel.net, www.nhitel.net
Korea Telecom	KORNET	+82-080-014-1414	ceo@kt.co.kr	www.kornet.net
KRISP	KRISP	+82-32-442-6000	sos@krisp.co.kr	www.krisp.co.kr
KrLine Internet Service Inc.	KrLine	+82-02-3461-3282	sgbang@krline.net	www.krline.net
Korea Telecom I com	KTICOM	+82-02-3488-1333	webmaster@kticom.com	www.kticom.com
Korea Trade Network	KTNET	+82-02-6000-2119	doshin@ktnet.co.kr	www.ktnet.co.kr
ARISOO	Living114	+82-02-584-5363	ukyo@web114.com	www.living114.net
mire.net	MIRENET	+82-02-2009-2660	rlatjsska@mire-net.co.kr	www.mire-net.co.kr
Korea Mobile Internet eXchange	MIXNET	+82-02-563-3399	ix@kmix.net	www.kmix.net
Mouminformation Co.,Ltd	MoumNet	+82-080-561-8888	jkim@moumnet.com	www.moumnet.com
KoreaMultinet	MULTINET	+82-02-3443-3006	johnjung@koreamultinet.com	www.koreamultinet.com
MINS	NCABLENET	+82-53-263-7000	jamesmin@ncable.net	www.mins.co.kr
Reach Network Service Korea	NETPLUS	+82-02-550-3709	contact@reach.co.kr	www.reach.co.kr
NETSGO	NETSGO	+82-02-3479-0700 +82-080-011-4295	lineinfo@netsgo.com	www.netsgo.com
NEXTEL	NEXTEL	+82-02-2202-9300	homerun@nextelnet.co.kr	www.nextelnet.co.kr
NOWCOM Co.,Ltd	NOWCOM	+82-02-590-3800	nowweb@nownuri.net	www.nownuri.net
OKSUNG TEL-Communication Co., Ltd	OK-NET	+82-02-2107-3114	oksung@oksung.com	www.oksung.com
pacifccsi	PCSI	+82-02-776-3179	seo813@korea.com	www.pcsi.co.kr
QrixNetworks	QRIXNET	+82-02-999-8855	qrix-admin@qrix.com	www.qrix.com
GORayNet	RayNet	+82-02-2109-8282	ip@raynet.co.kr	www.raynet.co.kr
SAEROUNNET	SAEROUNNET	+82-02-2102-3345	hamm@saeroun.co.kr	www.saeroun.co.kr
ESOLTECH	SAFELINE24	+82-055-266-6924	network@esoltech.co.kr	www.safeline24.net
Samsung Networks Inc.	SAMSUNGNETWORKS	+82-02-1577-0300	ygpark@samsung.com	www.samsungnetworks.co.kr
ONSE Telecom	SHINBIRO	+82-083-100	kyh@onsetel.co.kr	www.shinbiro.com
KICA	SINGGATE	+82-02-360-3003	asia44@signgate.com	www.signgate.com
SK Global co., Ltd	SKGNW	+82-1588-7555	bjlee1@skglobal.com	www.skglobal.co.kr
SK C&C Co., Ltd.	SK-NET	+82-02-2196-8254	mrdeer@skcc.com	www.sk-net.com
SK Telecom	SKSpeedNet	+82-02-2121-3457	jsg@sktelecom.com	www.sktelecom.com
SKTelink	SKTelink	+82-02-829-2968	lineinfo@sktelink.com	www.sktelink.net
SuperNet	SUPERNET	+82-02-568-3003	ysong@supercdn.net	www.supercdn.net
SKTelecom	SYNCROAD	+82-02-3709-1466	dreamtr@sktelecom.com	www.skwin.com
Thrunet Co., Ltd (THRUNET)	THRUNET	+82-1588-3488	abuse@thrunet.com	www.thrunet.com
Tomis Information & Telecom Corp	TOMISNET	+82-02-784-0110 (204)	ski21@tomis.co.kr	www.tomis.co.kr
Today and Tomorrow	TTNet	+82-1566-1577	iwlee@tt.co.kr	www.tt.co.kr
WEBURO	WEBURO	+82-631-284-4650	apply@weburo.net	www.weburo.net
cablei	XNET	+82-02-878-5481/2	cmpark@cablei.co.kr	www.cablei.co.kr
MCIWORLDCOM	XPRESSNET	+82-02-6281-7921	parksang2001@hanmir.com	www.wcom.co.kr

3. List of Government Agencies and Other Agencies

APNIC: Asia Pacific Network information Center (http://apan.net)
CRERIS: Korea Education and Research Information Service (http://www.kmec.net)
DDC: Domain Dispute Committee (http://dispute.nic.or.kr)
EC: Engineering Committee (http://ec.nic.or.kr)
ECRC: Electronic Commerce Resource Center (http://www.ecrc.or.kr)
ETRI: Electronics and Telecommunications Research Institute (http://www.etri.re.kr)
GIA: Government Information Agency (http://www.allim.go.kr)
ICANN: Internet Corporation for Assigned and Numbers (http://www.icann.net)
ICC: Information Culture Center Korea (http://www.icc.or.kr)
IETF: Internet Engineering Task Force (http://www.ietf.org)
Internet Appliance Promotion Council (http://iapc.kait.or.kr)
KAIT: Korea Entertainment System Industry Association (http://www.kait.or.kr)
Kinternet: Korea Internet Corporations Association (http://www.kinternet.or.kr)
KINX: Korea Internet Neutral eXchange (http://www.kinx.net)
KIPA: Korea IT Industry Promotion Agency (http://www.kipa.or.kr)
KIPO: Korea Intellectual Property Office (http://www.kipo.go.kr)
KISA: Korea Information Security Agency (http://www.kisa.or.kr)
KISDI: Korea Information Society Development Institute (http://www.kisdi.re.kr)
KISTI: Korea Institute of Science and Technology Information (http://www.kisti.re.kr)
KCCT: Korea Chamber of Commerce & Industry (http://www.korcham.net)
KCS: Korea Customs Service (http://www.customs.go.kr)
Korea Fair Trade (http://www.ftc.go.kr)
Korea Institute for Industrial Economics & Trade (http://www.kiet.re.kr)
Korea Meteorological Administration(http://www.kma.go.kr)
Korea National Railroad (http://www.korail.go.kr)
KRPA: Korea Radio Promotion Association (http://www.rapa.or.kr)
KRNIC: Korea Network Information Center (http://www.nic.or.kr)
MIC: Ministry of Information and Communication (http://www.mic.go.kr)
Ministry of Culture and Tourism (http://www.mct.go.kr)
Ministry of Education & Human Resources Development (http://www.moe.go.kr)
Ministry of Labor (http://www.molab.go.kr)
Ministry of Maritime Affairs and Fisheries (http://www.momf.go.kr)
Ministry of Patriots & Veterans Affairs (http://www.pvaa.go.kr)
MOCIE: Ministry of Commerce, Industry and Energy (http://www.mocie.go.kr)
MOGAHA: Ministry of Government Administration and Home Affairs (http://www.mogaha.go.kr)
National Tax Service (http://www.nts.go.kr)
NC: Name Committee (http://namecom.nic.or.kr)
NCA: National Computerization Agency (http://www.nca.or.kr)
NNC: Number & Name Committee (http://nnc.nic.or.kr)
PAC: Protocol and Address Committe (http://namecom.nic.or.kr)
Personal Data Protection Center (http://www.cyberprivacy.or.kr)
PICCA: Promissing Information & Communication Company Association (http://www.picca.or.kr)
PPS : Public Procurement Servic (http://www.pps.go.kr)
SPPO: The Supreme Public Prosecutor's Office (http://www.sppo.go.kr)
Supreme Court of Korea (http://www.scourt.go.kr)
TTA: Telecommunications Technology Association (http://www.tta.or.kr)
The Constitutional Court of Korea (http://www.ccourt.go.kr)

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