

IP TELEPHONY AND THE INTERNET: REPUBLIC OF KOREA CASE STUDY



January 2001

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1. Introduction

The introduction of Internet services in 1994 in the Republic of Korea has resulted in an explosive increase in the size of the Internet service market with 82 ISPs (Internet Service Providers) in operation and 19 million users of the Internet as of the end of December 2000. In addition, advances in technology have changed the primary means of Internet access from dial-up via the PSTN to broadband Internet access via ADSL (Asymmetric Digital Subscriber Line) or Cable Modems. High-speed Internet services have shown tremendous growth since their introduction in July 1998 and, as of December 2000, there were seven Facilities-based Service Providers (FSPs) in operation with 4 million subscribers in total.

Following the WTO Agreement on Basic Telecommunications, the Korean government has opened the domestic market by introducing voice resale services and lifting foreign ownership limitations on domestic service providers in 1998. This provided an opportunity for Special Service Providers (SSPs) to begin offering voice resale services mainly by circuit-switching methods utilizing the telecom networks of FSPs. As a result, the SSPs have changed the landscape of the international service market by offering services with 60 per cent lower charges compared to the incumbent FSPs.

With rapid growth in Internet demand for, and development of, Voice over Internet Protocol (VoIP) technology, Serome Technology, Inc. launched a free IP Telephony service named Dialpad in January 2000. There are currently more than ten IP Telephony Service Providers (IPTSPs) offering PC-to-Phone type services. Within one month of its launch, Serome Technology via Dialpad <www.dialpad.co.kr> signed up approximately 950'000 new users.

From February 2000, the average number of new subscriptions per month grew to approximately 300'000. By the end of December 2000, the total number of subscribers reached 4.3 million members. The total number of members subscribing to IP Telephony service for the major companies including Serome Technology, Telefree Co. Ltd., Kitel, Great Human Software Co., Ltd. and Web2Phone is estimated to be about 7.6 million users.

The introduction of IP Telephony service in Korea has had a significant impact on the landscape of the telecommunication market. Similar to the emergence of voice resale since early 1998, the benefits to customers have increased thanks to the availability of domestic as well as international services with lower price or even free charges. In addition, IP Telephony services have also affected the revenue flows of Public Telecommunication Operators (PTOs) through reduced retail and interconnection charges among FSPs.

IP Telephony service in Korea has been driven by small and medium-sized Value-added Service Providers (VSPs) which are seeking a new business model that distinguishes it from voice resale service as means of enhancing competition in the market and thereby lowering charges starting in late 1980s. The major source of revenue for IPTSPs is through advertisements such as banners, e-Commerce, Web-hosting and Portal-site operations. IP Telephony calls were initially placed without charge, but this has recently changed.

On January 2000, the Korean Communications Commission (KCC) allowed Serome Technology to provide a PC-to-Phone style IP Telephony service via Dialpad. From the perspective of functional equivalence, IPTSPs that offered voice service to the public were

regulated only lightly. Examples of the regulations in force include: pre-registrations to confirm *a priori* to given measures of financial and technical capability, consumer protection plans before launching and filing for mergers and acquisitions. No

burden of universal service funds or responsibility for an initial market entrance fee or R&D contributions were required under this light-touch regulation. This helped to spur market growth.

2. Status of the Internet service market

The utilization of Internet services in Korea began in 1994 with the introduction of KORNET by Korea Telecom in June and Boranet by Dacom in October of the same year. There has been a dramatic growth in the number of Internet Service Providers (ISPs). Starting with only 11 ISPs in 1995, this number more than doubled in 1998 with 26 ISPs. In 1999 alone, the number of ISPs rose to 54 companies. Now, as of the end of December 2000, there are 82 ISPs providing Internet services (Table1).

The Internet subscriber base has increased from approximately 140'000 subscribers in 1994 to about 3.1 million subscribers in 1998. In 1999, the number of users was estimated at 10 million—that is an increase of more than 300 per cent compared to the previous year. As of the end of December 2000, the estimated number of Internet subscribers amounted to 19 million users, or 38 per 100 inhabitants.

The popularization of the Internet in Korea is attributed to online services and dial-up services called 014XY. Having already offered X.25 protocol style services since 1980, online service providers have greatly contributed to the growth in the demand for Internet services by providing it as value-added service to existing subscribers, without extra membership procedures, since 1995. In pace with the popularization of the Internet, online service providers are now changing into web-based ISPs. Dial-up users are able to pay reduced

fees to local FSPs or pay a flat rate during off-peak hours through the so-called 014XY service. The number of domains for authorized IP addresses on the Internet has grown to over 510'000 registrations.

In the past, Internet access from computers in Korea was mainly through dial-up access, utilizing the PSTNs of local FSPs, but now advances in information technology have led to various types of broadband access. Thrunet, using existing TV cables in the form of cable modem, introduced broadband Internet services for the first time in July 1998. Soon after, beginning in the middle of 1999, local FSPs such as Hanaro Telecom and Korea Telecom began offering their ADSL services. Now, there are seven FSPs that offer Internet services.

With fierce competition in the broadband Internet access market, the number of subscribers reached 4 million as of December 2000 with household penetration being around 28 per cent.

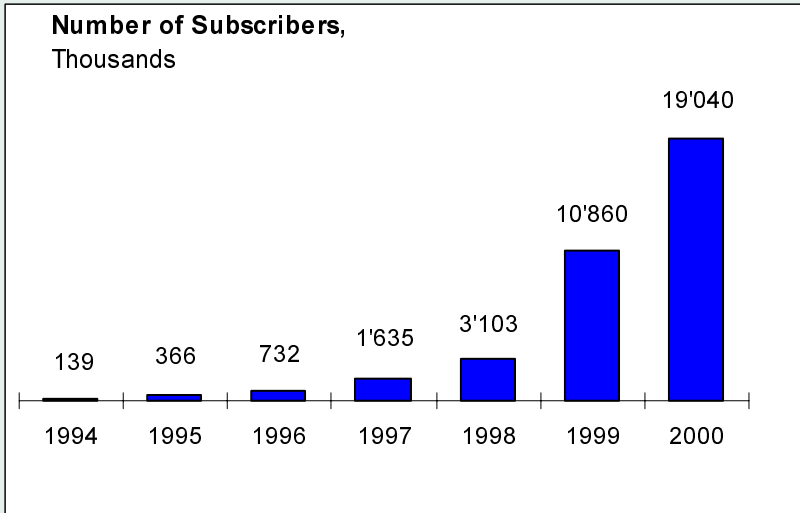
It should be noted that the telecom network is becoming more advanced with the installation of optical fibre cable, FTTC (Fibre-to-the-curb), by new entrants such as Hanaro Telecom. For the purpose of spurring the growth in the broadband Internet access market, open access for ISPs and unbundling of the local loops of incumbent public telecom operators are scheduled to be implemented by the Korean government by early 2001.

Table 1: ISP growth

Year	1994	1995	1996	1997	1998	1999	2000
Number of companies	2	11	16	21	26	54	82

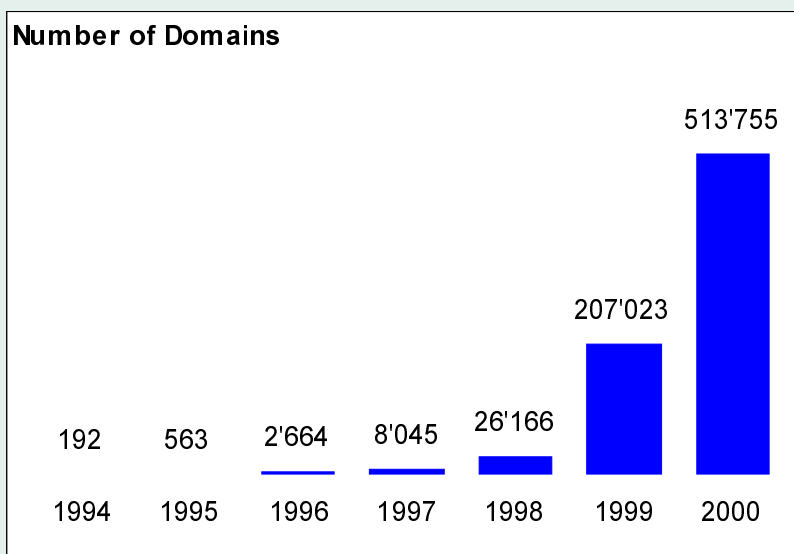
Source: Korea Network Information Center.

Figure 1: Estimated number of Internet subscribers



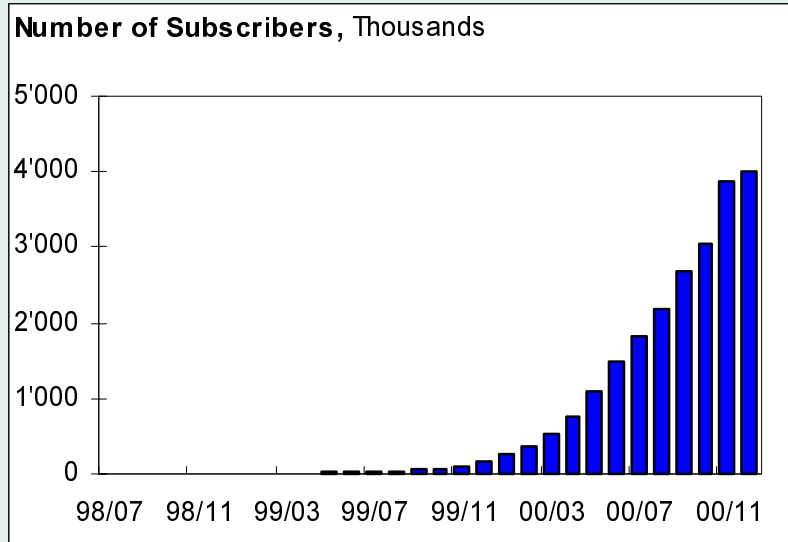
Source: Korea Network Information Center.

Figure 2: Growth in kr domain



Source: Korea Network Information Center

Figure 3: Growth in broadband Internet subscribers



Sources: Broadband Service Providers, Ministry of Information and Communication.

3. Advent of IP Telephony

3.1 Introduction of resale service and its impact

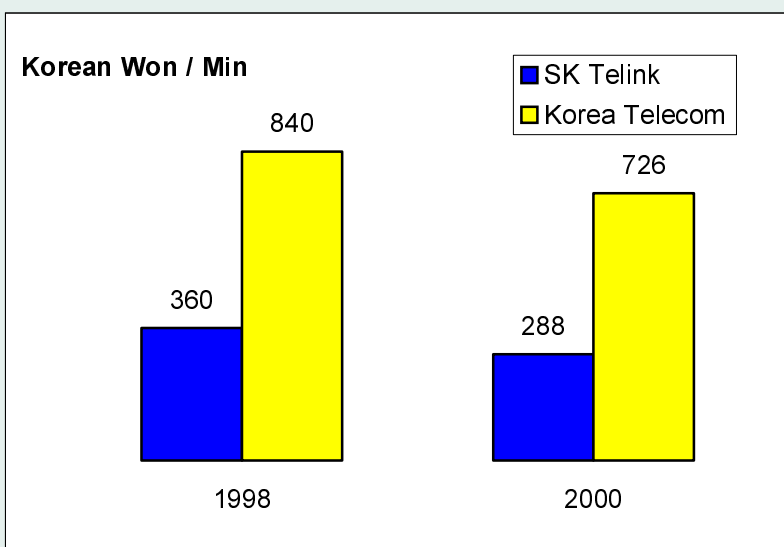
In accordance with the WTO agreement on basic telecommunications, the Korean government opened the domestic market by introducing voice resale service and lifting foreign ownership limitations on domestic service providers in January 1998. This move has changed the landscape of the international market by providing the opportunity for SSPs to begin offering voice resale service, mainly through circuit-switching methods utilizing the telecommunication networks of FSPs.¹

SSPs, including SK Telink, were able to charge 60 per cent less for their services compared to the FSPs² by bypassing the existing international settlement regime through minimal investments in telecommunication

facilities, allowing reduced settlement payments. Owing to both demand substitution from FSPs and the potential growth for SSPs, the market share of originating calls for SSPs grew to 22.9 per cent out of a total 706 million call minutes in the first half of 2000. As of January 2001, there were 34 SSPs in operation.

In response to the expansion of voice resale services, the FSPs have offered weekend calling programmes based on flat monthly rate fees and discount services based on sign-up fees entitling the user to save up to 65 per cent of the regular charges for calls. Moreover, beginning in 2000, full-scale efforts have begun for resale of voice services. Ultimately, through the emergence of SSPs, the greatest beneficiaries are the users who profit from widening choices and reduced calling charges.

Figure 4: Comparison of international call charges to the United States between a major SSP and an FSP



Note: Charge is based on first one minute.

Sources: Korea Telecom, SK Telink.

Box 1: Serome Technology as an IP Telephony pioneer

Established in 1993, Serome Technology, Inc. has concentrated its efforts on research and development on voice and image transmission technology to develop Internet software such as "Teleman", "Faxman" and "Dataman". It launched one of the first free-of-charge web-based IP Telephony services in the world with Dialpad in the United States in October 1999. In the following year, in January 2000, Dialpad became available in Korea. With the growing demand for Internet access, the rise of venture capital companies, and the appeal of free IP Telephony, the number of users has increased to 4.3 million as of December 2000.

The critical factors leading to the success of Dialpad are attributed to the effort and investments directed at ensuring technological advances. At Serome Technology, the company is built on research and development with over 34 per cent of the all employees holding advanced degrees or national technical licences. To ensure the development of VoIP technology, Serome Technology opened an IT branch in Silicon Valley, California in 1996 and transferred their research staff at the height of the financial crisis in Korea in 1997. R&D was devoted fully to developing VoIP technology in 1998. Also, the creation of a user-friendly environment with the development of small applets, maintaining market lead, ensuring type and loyalty of customers through advertisements and marketing are major factor in the success. Lastly, the expanding Internet base may be the cause of the explosive demand for Dialpad, but the more important factor is the free call service. Serome Technology does not charge subscribers for usage. Instead, advertising banners are used as the main form of revenue.

However, while offering free Internet telephone services was part of the effort to ensure a lead in the subscriber market, it also created problems in that the advertising-based business model proved insufficient for raising revenue. Therefore, starting in the middle of 2000, "free" IP Telephony service providers have begun to charge for their services in Korea. Serome Technology has also followed this trend by charging for their services in the United States beginning in 2000 and call charges are expected also in Korea.

3.2 IP Telephony service market**3.2.1 IP Telephony Service Providers (IPTSPs)**

Owing to the developments in VoIP technology and the increasing demand for Internet access, PC-to-Phone IP Telephony services have been offered since early 2000 in Korea. In 1999, for one of the first times anywhere in the world, Serome Technology Inc. began offering free IP Telephony service in the United States through its subsidiary Dialpad.Com. In Korea, following the launch of the free service in January 2000, Serome Technology introduced a video telephony service based on MPEG-4 technology in December 2000.

As of January 2001, there were more than ten companies offering PC-to-Phone type service and six more PC-to-PC type companies.³

The services offered by the IPTSPs are domestic services such as local/long-distance and international service, as well as calls received from both fixed and mobile phones. For international calls, the terminating country is limited to the United States for Serome Technology, but other IPTSPs provide IP Telephony service to various other countries.

3.2.2 Subscribers

The number of subscribers might be a good proxy for market size for PC-to-Phone type service since major IPTSPs offer service for free. Serome Technology, via <www.dialpad.co.kr>, recorded approximately 950'000 new users within a month of the service launch in January 2000. After February 2000, the average number of new users added per month was approximately 300'000 users, with a total of 4.3 million users at the end of December (Figure 5). The estimate for

Table 2: Classification of major IPTSPs

Type	Company
Phone-to-Phone	SK Telink, Inc.; Dizzocom; Hanwha Corp. Information Services Div.; NARAY Telecom, Inc.; Seoul Telnat, Inc.; Unitel.Co,Ltd.; Inet Telecom, Inc.; Nextelecom Co., Ltd
PC-to-Phone	Serome Technology, Inc.; Web2phone Co., Ltd; Telefree Co., Ltd; Kitel; Great Human Software Co., Ltd; Moohannet Korea Co., Ltd; Korea Telecom Venture Corp. E & Tel; JOYLINK Korea Inc.; Arisoo Internet Inc.; IntersoftPhone Co., Ltd
PC-to-PC	Serome Technology, Inc.; Kitel; Great Human Software Co., Ltd; Arisoo Internet Inc.; Daum Communications Corp.; @PHONE TELECOM Inc

Note: Some companies offer several types of services.

the total number using IP Telephony services is 7.6 million users for all major companies including Serome Technology, Telefree Co., Ltd., Kitel, Great Human Software Co., Ltd. and Web2Phone.

3.2.3 Traffic Patterns for Dialpad

It is worth mentioning the usage patterns for the traffic originated by Serome Technology via <www.dialpad.co.kr>. In January 2000, there were 4.4 million separate calls and 12.6 million call minutes recorded (average duration per call is 2.86 minutes). This number has continued to grow over the year and, at the end of December 2000, the accumulated number of separate calls and call minutes was 81.6 million and 382.8 million, respectively (average length per call is 4.69 minutes).

The balance between domestic and international originated calls, over the course of the first half of 2000 was 90.2 and 9.8 per cent, respectively. The share of local and long distance among domestic calls was 57.3 and 42.7 per cent, respectively. The average call duration for a domestic call increased to 5.67 minutes in September 2000 from 2.86 minutes in January 2000.

During a five-month period, from July to November 2000, the percentage of users placing less than 30 minutes of calls per month was 68 per cent, and 32 per cent of users for over 30 minutes. Approximately 68'000 members, or 14 per cent of users, were placing over 120 minutes of calls per month. The latter fact stresses the point that the popularity of IP Telephony continues to grow in spite of quality problems.

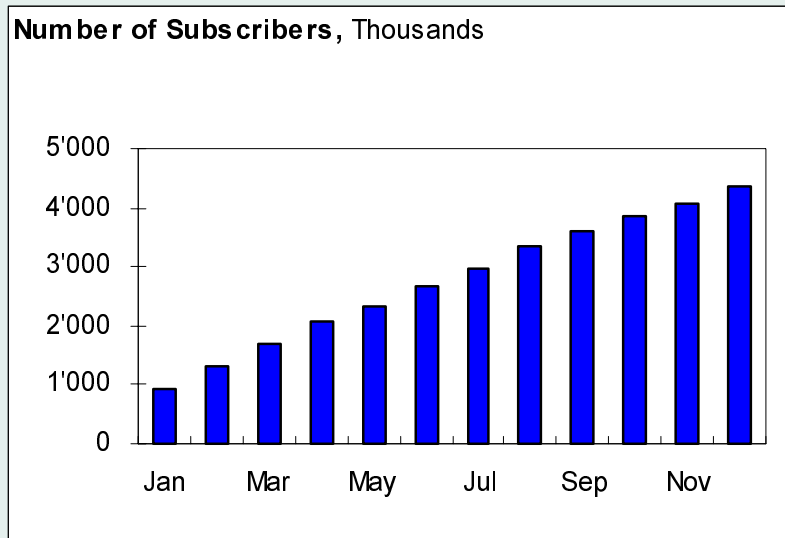
3.2.4 Revenue model

The services of many IPTSPs were initially offered for free, but recently these have changed to paid services. Major sources of revenue for IPTSPs are from advertising such as banners, together with e-commerce, Web-hosting and Portal-site operations. The IPTSPs are utilizing various methods to encourage members to click on sponsored advertisements, for instance by installing a dialer in the sponsor company's homepage or by requiring them to accumulate cyber-money through clicks, the purchase of advertised products or participating in an event. In addition to IP Telephony service, these companies offer other value-added services such as e-mail, fax, and Unified Messaging Services (UMS).

Table 3: Status of Major IPTSPs

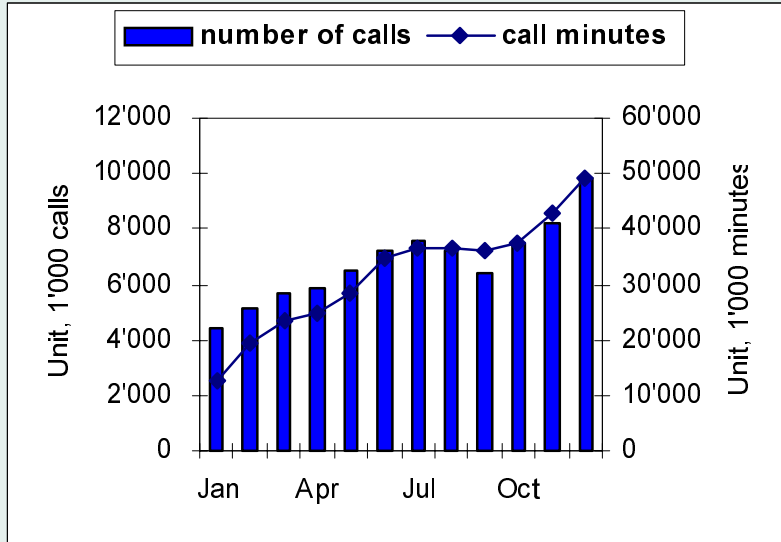
Company	Service	Website	Launch Date	Availability	Charges	Type
Serome Technology, Inc.	Dialpad	< www.dialpad.co.kr >	January 2000	Domestic(mobile n/a) Int'l (US)	Free	PC-to-Phone, PC-to-PC
Telefree Co. Ltd.	TeleFree	< www.telefree.co.kr >	May 2000	Domestic Int'l (190 countries)	Free	PC-to-Phone
Kitel	Qptel	< www.kitel.net >	June 2000	Domestic Int'l (240 countries)	Free except PC-to-Phone (Nov. 2000)	PC-to-Phone, Phone-to-PC, PC-to-PC
Great Human Software Co. Ltd.	Elthe	< www.elthe.co.kr >	May 2000	Domestic Int'l (US)	Free except PC-to-Phone (Feb. 2001)	PC-to-Phone, PC-to-PC
Web2Phone	Wowcall	< www.wowcall.com >	July 2000	Domestic Int'l (21 countries)	Free except Calling card	PC-to-Phone

Figure 5: Serome Technology, growth of IP Telephony subscribers in 2000



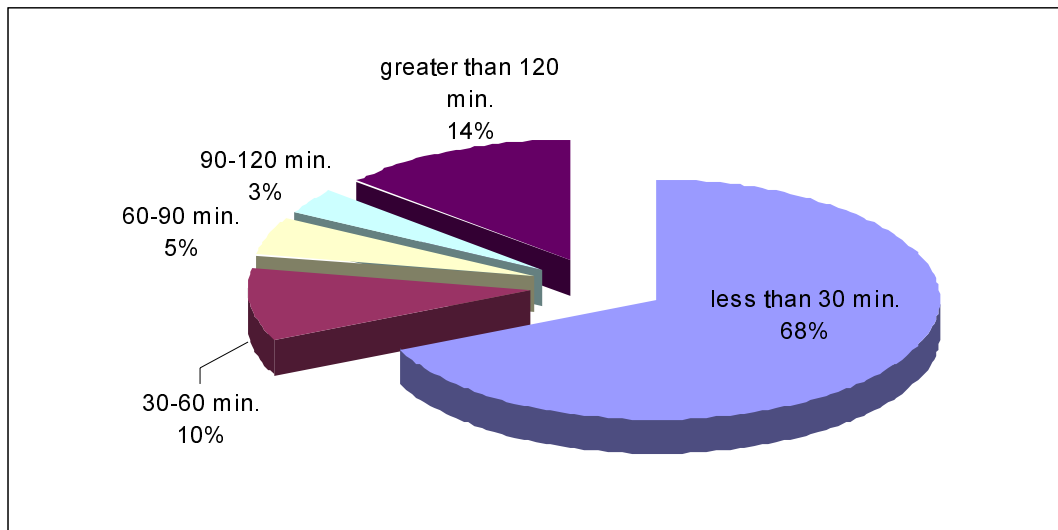
Source: Serome Technology.

Figure 6: Trend in number of calls and call minutes for Serome Technology in 2000



Source: Serome Technology.

Figure 7: User pattern of members of Serome Technology



Source: Serome Technology.

¹ SSPs in those days used prototypes of Phone-to-Phone IP Telephony service and are gradually shifting to utilizing packet-switching methods.

² For more details see "Korea's Telecom Service Reform through Trade Negotiations," Nae-Chan Lee and Hanyoung Lie, <<http://www.nber.org/books/ease11>>.

³ PC-to-PC type service includes IP Phone-to-IP Phone service.

4. Impact of IP Telephony service

4.1 User benefits

The emergence of IP Telephony service offers great benefits to the user through relatively low, or even free, call charges for domestic services as well as international services. It is worth noting that consumer benefits are greater for international services than domestic services on a saving per call minute basis, although domestic calls tend to be longer than international ones. Although there is an increase in user benefits in IP Telephony, the net benefit may be limited depending on the type of service the subscriber is using such as dial-up, ADSL, or Cable Modem. If users access the Internet through dial-up 014XY service, the net benefit calculation should take into account costs paid to local FSPs, which are usually 40 per cent of normal local charge. On the other hand, broadband Internet services are charged at a flat rate, which is one of the major drivers that increase the demand for IP Telephony services.

4.2 IP Telephony Service Providers

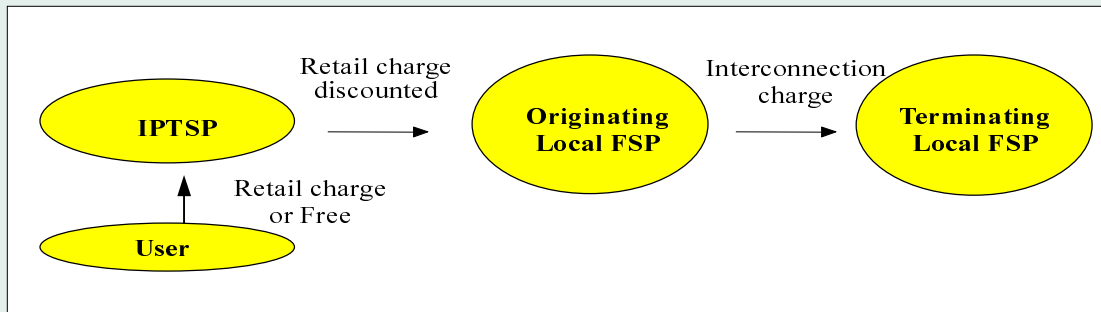
In the case of domestic services, IPTSPs pay retail charges to corresponding FSPs regardless of whether the calls are charged to the final users or not, but unlike end users, they are eligible for volume discounts for the aggregation of calls by 10 to 30 per cent. IPTSPs arbitrage their discounts to provide services to end users at lower charges than those of FSPs. Although IPTSPs do not pay retail charges for international service to FSPs, they pay and receive settlement charges for originating and terminating calls, respectively, with a foreign counterpart reseller.

4.3 Facilities-based Service Providers

For local calls, an originating local FSP first converts packets generated from an IP Telephony user's PC to voice, and then collects retail charges from IPTSPs and pays interconnection charges to a terminating local FSP for network usage. The originating and terminating local FSPs may or may not be the same. In the case of long-distance calls, a long-distance FSP collects retail charges from IPTSPs and pays interconnection charges to both originating and terminating local FSPs. The interconnection charges of the incumbent local FSP, Korea Telecom, is regulated on the principle of cost orientation, and new entrants, such as Hanaro Telecom, on the principle of non-discrimination, have the same interconnection charges as Korea Telecom. Through IPTSPs, FSPs can expand their market share even though revenues may decrease due to discounted charges that are dependent on the amount of call aggregated by IPTSPs. Market competition will likely increase due to the entrance of new FSPs combining their growing net revenue.

For outgoing international calls, IPTSPs do not pay retail charges to FSPs, but instead pay negotiated settlement charges to a foreign counterpart reseller. Consequently, international FSPs lose retail revenue net interconnection charges paid to foreign FSPs. Incoming international calls might be generated either through an IPTSP's website or a foreign counterpart's. In the latter case, the foreign reseller pays a negotiated settlement charge to the domestic IPTSP. Since calls bypass the existing international leased line owned by both corresponding international FSPs, they lose the opportunity of earning settlement revenue.

Figure 8: Flows of revenue among IPTSPs and FSPs: Case of local service



Box 2: FSP's (Korea Telecom) response to IP Telephony

Korea Telecom is a leading telecommunication carrier in Korea offering voice telephony, Internet, data and satellite communication services with a subscriber base of 20.15 million for its telephony service and total revenue of 1.03 billion won (US\$ 900 million). As VoIP service has become popular in Korea recently, as well as in other countries, Korea Telecom has begun providing a phone-to-phone VoIP service to its international telephone service customers. However, it had not put much emphasis on expanding the market since the PC-to-phone based VoIP services offered by other domestic VoIP operators were not threatening its revenue basis, although the VoIP service was in a competitive position with the existing international telephone service it provides. During 1999, Korean Telecom's revenues from international service fell by more than 30 per cent (see Table A3).

Instead, Korea Telecom has focused on the high-speed Internet access service (ADSL) market in Korea and secured a dominant position in this market. As a result, the number of Korea Telecom's ADSL subscribers had grown rapidly for the past two years, reaching 1.73 million as of December 2000 (43 per cent of the total domestic subscribers). It believes that high ADSL penetration in households would form a basis for expanding diverse VoIP services in the future as well as Internet and other broadband services. In addition, Korea Telecom has a plan to eventually migrate all of its telecommunication networks—circuit-switched PSTN/ISDN, IP-based dedicated data communication network and the high-speed ATM network—to an IP-based network in the future, with 2010 set as a tentative target year.

Since last year, Korea Telecom has taken up a more active approach toward VoIP service, and it is now seeking business opportunities in several service areas. In addition to direct VoIP service for its customers, it is offering a wide range of VoIP services, including a call transit service through its VoIP gateway, UMS (Unified Messaging Service), Web-to-phone service (i080), IP VPN (Virtual Private Network) service for business customers and VoIP Clearing House service for ISPs.

5. Regulatory aspects of IP Telephony

5.1 Classification of telecommunication services and providers

Telecommunication services in Korea are divided into facilities-based services and value-added services; the former includes fixed telephony such as local, long distance, international services, leased line, and wireless services with assigned radio spectrum such as mobile services, whereas the remaining telecommunication services correspond to the latter.

Telecommunication service providers can be classified into Facilities-based Service Providers (FSPs), Special Service Providers (SSPs) and Value-added Service Providers (VSPs). FSP sets up telecommunication facilities and offers facilities-based services, whereas a VSP offers value-added services by leasing telecommunication facilities from FSPs. SSP provides facilities-based services similar to FSP with leased facilities or any in-building telecommunication services.

On 25 January 2000, under the designation of an SSP without switching facilities (excluding routers, servers and system) from KCC, Serome Technology offered for the first time real-time voice services via Dialpad to the public, thus activating IP Telephony services in Korea. PC-to-PC, including IP phone-to-IP phone type IPTSPs, is classified as VSP, since it cannot be provided to the public and hence its effect may be small on the domestic industry and on public interest.

5.2 Regulations

To offer telecommunication services, a process of notification for VSPs and registration for SSPs is necessary. For SSPs, this includes holding standard technology qualifications indicating technological capabilities and proving financial ability before launching. In addition, SSPs should register any upcoming mergers and acquisitions that may influence the change in the telecommunication industry configuration and changes in the trading name, designation, address, representative, types of services and capital.

Within the international interconnection regime, SSPs are prohibited from committing one-way bypass. In a domestic interconnection regime, SSPs are paying retail charges to a corresponding FSP instead of interconnection charge for usage of facilities-based networks as among FSPs, although discounted for the aggregation of calls. The entrance fee and R&D contributions are being offered conditionally and there are no obligations for the provision of universal service and cost burdens.

From the perspective of functional equivalence of the regulations in offering voice services to the public through IP Telephony, the Korean government has minimized the control over VoIP in terms of market activity, which is different from FSPs. From 1 January 2001, foreign ownership limitations in SSPs have been completely removed, thereby opening further the telecommunication market.

Table 4: Classification of Service Providers

Category	Facilities-based Service Providers	Special Service Providers	Value-added Service Providers
Facilities	Own facilities	Leased Facilities	Leased Facilities
Sub-services	Fixed Telephony, telegraph, telegram, private leased circuits, mobile services, and other services specified by the Ministry	Voice resale, IP Telephony, int'l call-back, aggregator, rebiller, in-building communication services	All value-added telecommunication services
Market Entry	Licensing	Registration	Notification
Universal Service	Cost-burden	None	None

Source: Ministry of Information and Communication.

Box 3: Status of standardization of IP Telephony technology in Korea

Standardization is required for ensuring compatible connections among terminals, gateways and gateway keepers in order to offer IP Telephony services. Generally, the IP Telephony services in use follow the H.323-series recommended by ITU-T Study Group 16. As the standard is designed to offer multimedia services in the initial LAN environment, problems in the complexity of the protocol and expansion have arisen in the application of IP Telephony service in a PSTN environment based on the developed standard. Therefore, improvements are being made in ITU-T SG 16 along with IETF developing a protocol standard such as the Session Initiation Protocol (SIP). For IP Telephony services, Korea currently follows version 2 of H.323 of ITU-T.

To activate an IP Telephony industry and to ensure compatibility among products in Korea, the Korea VoIP Forum was established in April 2000. The forum is composed of H.323 Technology Standards, Next Generation VoIP Technology, and Test Technology subcommittees. At present, it is promoting the development of technology standards through converging opinions among member organizations, as well as conducting research on the next generation VoIP technology standards such as SIP, MEGACO. It is also introducing a programme of interoperability tests for VoIP equipment. The forum is developing a standard profile for ensuring compatibility for gateway equipment and terminals which offer H.323 based IP Telephony services. On the other hand, the next step is to develop a profile standard based on Next Generation VoIP technology such as SIP. Currently, as of December 2000, there are 124 industry players, two research centres, 21 universities, and one other organization, for a total of 148 organizations which have joined and are now participating in the VoIP Forum.

6. Conclusion

The factors that have led to the popularity of IP Telephony in Korea are the increasing demand for the Internet, via dial-up and high-speed Internet services, the development of VoIP technology through R&D by small to medium-sized companies, and market liberalization which permits resale services to stimulate competition with minimal regulations. IP Telephony service has provided a new revenue model, based on the VoIP technology of small and medium-sized VSPs, that is different from the lowered rates and increased competitiveness of the

telephony service offered by SSPs since the late 1990s. IP Telephony services were initially offered without charge in order to capture a lead in the market, although charges have been introduced recently.

The government is regulating IP Telephony Service Providers based on functional equivalence, with minimal regulations compared with FSPs. The emergence of IPTSPs has contributed to expanding the Internet and inducing lower rates for the international market.

Annex

Table A1: Telephone service subscriber growth

Position	1993	1994	1995	1996	1997	1998
Number of Lines (Thousand Lines)	20'141	21'783	21'684	22'789	23'795	24'455
Number of Subscribers (Thousand Persons)	16'633	17'647	18'600	19'940	20'421	20'211
Number of Subscribers per 100 Persons	37.8	39.5	41.5	43.0	44.4	43.2

Table A2: Changes in the international call traffic of Korea Telecom

Category	1994	1995	1996	1997	1998	1999	
Originating Call Traffic	Minutes	326'960	421'990	529'550	619'560	560'741	485'000
	Increase or Decrease Rate	23.4%	35.9%	25.5%	20%	-9.5%	-13.5%

Table A3: Earnings of Korea Telecom for international telephone services

(Unit: 100 Million Won, %)

Position	1995	1996	1997	1998	1999
Amount	5'480	6'475	7'033	9'336	6'382
Increase or Decrease Rate	+14.4%	+18.0%	+18.0%	+32.7%	-31.6%

Table A4: Mobile phone subscribers, 1998 - June 2000

(Unit: Subscribers)

Company	End of '98	End of '99	End of Jan.	End of Feb.	End of Mar.	End of Apr.	End of May	End of June
SK Telecom	5'966'474	10'075'797	10'425'046	10'848'522	11'229'834	11'891'858	11'611'345	11'509'261
Shinsegi Telecom	2'142'142	3'235'522	3'270'931	3'523'720	3'608'000	4'028'419	3'899'214	3'750'998
KT Freetel	2'353'374	4'267'131	4'382'238	4'605'234	4'678'726	4'836'575	5'098'398	4'968'939
KT M.com	1'411'080	2'741'188	2'741'189	3'016'768	3'042'203	3'044'944	2'781'296	2'721'200
LG Telecom	2'115'900	3'085'567	3'270'967	3'410'342	3'508'242	3'677'060	3'605'486	3'605'486
Total	13'988'970	23'405'205	24'090'371	25'404'586	26'067'00	27'478'856	27'092'984	26'555'884

Table A5: Classification of special telecommunication service providers

Classification	Services provided	Telecommunication facilities	Service types
Special Category 1	Facilities-based telecommunication services	Switched	Voice Resale, Internet Phone, Call-back
Special Category 2		Switchless	Subscriber Collection, Rebilling, Wireless Resale
Special Category 3	Premise telecommunication services	Installation of premise facilities	Premise Telecommunication services, telecommunication service between premise and the outside

Table A6: Market Forecast for special telecommunication services

Classification	1998	1999	2000	2001	2002	2003	2004
Sales (100 Million Won)	548	1'208	1'618	1'857	1'960	2'081	2'170

Table 7: Mid/long-term forecasts for value-added telecommunication services

(Unit: 100 Million Won)

Classification	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average growth rate in 2000~2004
Data Network Service	1'493	2'687	2'699	2'267	3'297	4'221	5'402	6'915	8'851	28.0%
Online Information Provision	1'831	3'668	4'589	8'206	12'260	17'533	23'499	32'734	44'800	38.3%
Others	1'742	3'565	3'632	4'414	4'609	5'392	6'363	7'571	9'086	18.5%
Total	5'067	9'920	10'920	14'887	20'167	27'146	35'264	47'220	62'737	32.8%

Source: Mid/Long-term Market Prospect of Information and Communication Industry (January 2000, Korea Information Society Development Institute) Statistics on Information and Communication Industry (June 2000, Korea Association of Information & Communication).