International Telecommunication Union

QUESTION 19-1/1

Final Report

ITU-D STUDY GROUP 1 4th STUDY PERIOD (2006-2010)

QUESTION 19-1/1:

Implementation of IP telephony in developing countries

THE STUDY GROUPS OF ITU-D

In accordance with Resolution 2 (Doha, 2006), WTDC-06 maintained two study groups and determined the Questions to be studied by them. The working procedures to be followed by the study groups are defined in Resolution 1 (Doha, 2006) adopted by WTDC-06. For the period 2006-2010, Study Group 1 was entrusted with the study of nine Questions in the field of telecommunication development strategies and policies. Study Group 2 was entrusted with the study of ten Questions in the field of development and management of telecommunication services and networks and ICT applications.

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This report has been prepared by many experts from different administrations and companies. The mention of specific companies or products does not imply any endorsement or recommendation by ITU.

ABSTRACT

The document contains the Final Report on Question 19-1/1 and deals with the implementation of IP telephony in developing countries.

This Report examines the work carried out by the Rapporteur's Group for Question 19-1/1 in the study period 2006-2010

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QUESTION 19-1/1

1 Introduction

Question 19-1/1 of ITU-D Study Group 1 is chartered to study:

"How …a nation and its citizens, current telephone operators, cable television operators and other ISPs and new entrants benefit from the introduction of IP telephony and broadband access? How can national telecom policy increase the benefits of the introduction of IP-based technologies?" and

"What are the potential challenges that developing countries experience in attempting to evolve to or implement IP-based networks including IP telephony and broadband access capabilities, and what are possible approaches for overcoming these challenges?"

A Report of this Question was completed in the last study period of ITU-D Study Group 1 and published in 2005 [http://www.itu.int/pub/D-STG-SG01.19-2006/en] following on from an earlier ITU-D Report on IP Telephony (IP Telephony – Report by the group of experts on Internet Protocol (IP) telephony). Since the publication of the last Report on Question 19/1 a good deal of material has been published that is relevant to the introduction of IP Telephony and broadband access such the following reports:

- Handbook on IP-based networks and related topics and issues – 2005
- GSR (Global Symposium for Regulators) VoIP and Regulation – Nov. 2005
- Trends in Telecommunication Reform 2006 – Regulating in the Broadband World

In addition the UN ICT Task Force has published a number of reports on Internet Governance which touch on the issues associated with the introduction of IP Telephony and broadband access (http://www.unicttaskforce.org/).

The last Report on Question 19/1 focused on IP Telephony and this Report continues to consider the introduction of Broadband Access and other IP-based technology in more detail.

Manuel Castells has commented that "core economic, social, political and cultural activities throughout the planet are being structured by and around the Internet, and other computer networks. In fact, exclusion from these networks is one of the most damaging forms of exclusion in our economy and in our culture." And that "The Internet is a fundamental instrument for development…." He emphasizes that this technology should be used to minimize "volatility, insecurity, inequality, social exclusion" and maximize "creativity, innovation, productivity, wealth creation"[1].

The benefits of IP-based technology can be summarised as follows:

- Low transaction costs
- Increases market size
- Increases information flows
- Decreases need to travel
- Increases productivity
- Encourages innovation & entrepeneurship
- Stimulates economic development
- Increases employment and international competitiveness
- Creates opportunities for better education, healthcare and public services
- Improves public safety and security
- Improves the quality of life
- Helps to combat the "brain drain" from developing countries
- Improves the status of women

This study considers the realization of these benefits as well as some of the challenges faced.

2 Trends – Convergence and Mobility

The convergence of voice, data and video telecommunications for both fixed and mobile terminal equipment has recently gathered pace. On the one hand has been a move to converge applications on an Internet Protocol transport infrastructure and on the other to support all applications on a single device. The convergence of applications on a common underlying transmission system is not a new development. There has been a tendency in this direction, based on different technologies at different times, throughout the history of telecommunications. However, on the other hand, it has recently become feasible to converge voice, data and video applications on all terminal equipment types – both fixed and mobile. This has been made possible by advances in miniturisation and the ability in install greater information processing capabilities at reasonable cost on terminal equipment. It is now possible to make telephone calls and watch TV or videos-on-demand on a PC or on a mobile "phone" (and of course the device may incorporate other devices such as a camera and music player).

Various network access technologies for fixed and mobile devices are likely to be used and hybrid solutions may become popular. For example, one may watch TV programmes on a PC that are taken "off-air" at the same time as using an IP connection (using a wireline or radio access technology) for other applications such as video-on-demand. IP telephony has to date been largely seen as a fixed network approach between PCs or telephone adaptors over IP networks but the capability is now being provided to use IP Telephony applications on mobile phones.

There has recently been a remarkable growth in the number of mobile phones in the world. This is particularly impressive in many developing countries in which the number of fixed line subscribers is often declining at the same time as the number of mobile phone subscribers is dramatically increasing. For example, Table 1 shows the number of fixed and mobile subscribers in Tanzania over the period 2000 – 2008. The growth figures are often very impressive. For example, there were over 84 million new mobile subscribers in India in 2007 and the number has continued to increase by about 8 million new subscribers per month.

Table 1 – Number of fixed and mobile subscribers in Tanzania 2000-2008

Year	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Fixed Lines	173,591	177,802	161,590	147,006	148,360	154,420	151,644	163,269	123,809
Mobile	126,646	275,560	606,859	1,295,000	1,942,000	3,389,787	5,614,922	8,322,857	13,006,793
Total	**300,237**	**453,362**	**768,449**	**1,442,006**	**2,090,360**	**3,544,207**	**5,766,566**	**8,486,126**	**13,130,602**
Mobile Share	42%	61%	79%	90%	93%	96%	97%	98%	99%

Source: Tanzania Communications Regulatory Authority http://www.tcra.go.tz/publications/telecom.html

In addition, radio technology (such as WiFi) is often used to access the Internet. It is reasonable to expect the deployment of a number of different broadband wireless access technologies – some of which will provide truly mobile services (i.e. including the capability to handover a call while moving between cells) such as those offered by 3GPP systems and others that provide access to fixed networks such as WiFi and WiMAX. The choice of access technology where more than one is available at any given location is likely to be determined by the price of the service and the convenience of its use. It is interesting that the majority of calls from mobile phones do not involve people in motion but are often made from locations in which there are other fixed telephones. In addition, this radio access network convergence may well pose some regulatory issues as existing policies in some areas, such as restrictions on content, are different for mobile networks and the Internet. For example, mobile network operators may restrict access to adult content [2]. A discussion of mobile VoIP regulation issues in Korea in provided in Annex 2.

3 Possible network migration strategies

The phenomenal recent growth of mobile telecommunication and stagnation of fixed line access in many countries has made it clear that migration to IP networks will not necessarily follow a migration path starting from PSTN / ISDN networks but instead start from a mobile network or even with a leap-frog to broadband access network technology for the introduction of new voice, data and video services. For example, Grameenphone have implemented Community Information Centres (http://www.grameenphone.com/index.php?id=86) that provide access to Internet and provide a range of information services using GSM EDGE/GPRS access technology. There has also been a good deal of investment in WiMAX technology. For example, six WiMAX licenses were awarded in Taiwan in 2007 and there have been WiMAX launches in many countries in Latin America (Argentina, Chile, Brazil, Columbia, and Mexico).

The ITU-T has studied migration from PSTN /ISDN to Next Generation Networks (ITU-T Recommendations Y.2261 and Y.2262) and Fixed – Mobile Convergence is seen by many as an important facet of Next Generations Networks based on an IP infrastructure.

4 Regulatory Trends – Regulation of competition and convergence

The nature of telecommunications regulation has changed over the past 30 years from being defined as "the substitution of rules made by government for the competition of the market" in which "regulation can either involve setting the framework in which ... enterprises operate, or it can mean detailed intervention in their affairs through setting of their rates of return, or their tariffs or by decisions on which particular enterprises can enter a particular market, or what services may be offered" [3] to having the aim to "encourage, nourish and maintain competition in national and international telecommunications services markets" [4]. This, of course, reflects the trends of introducing competition in the provision of telecommunication services and the privatisation of formally state-owned enterprises.

It has been claimed that competitive provision of telecommunication services favours innovation and leads to greater adoption of telecommunications services. For example, "there can be little doubt that the wildfire spread of mobile was triggered partly by the liberalisation of the telecoms markets in many African countries from the mid-1990s, including the issuing of private mobile licenses, often to international operators. Those countries which made an early start down this path – such as Gabon or Mauritius – have mobile penetration rates which might seem surprisingly high given other social and economic indicators, and their size; and the converse is true for countries where there were no early private licences issued, such as Algeria or Nigeria. Research by the World Bank looking at 41 African countries found that the introduction of a second and subsequent (private sector) competitors accelerates mobile penetration, whereas the presence of a state-owned telecoms incumbent in the market inhibits diffusion." The study "Africa – The Impact of Mobile Phones" from which this quotation is made includes the following figure (Table 2) to back up this claim. [5]

Table 2 – In "Africa – The Impact of Mobile Phones" Vodaphone Policy Paper Series No. 3 March 2005

Country	Date of first mobile licence	Date of first competing private licence	State-owned mobile operator?	Mobiles/ 100 population
Algeria	1989	2001	Sí	4,6
Benin	1995	2000	No	3,4
Egypt	1987	1998	No	8,2
Mauritius	1989	1996	No	37,9
Morocco	1987	1994	Sí	24,3
Nigeria	1992	2001	Sí	2,6
Senegal	1992	1998	Sí	7,6

Country	Date of first mobile licence	Date of first competing private licence	State-owned mobile operator?	Mobiles/ 100 population
South Africa	1986	1994	No	36,4
Tunisia	1985	2002	Sí	18,6
Uganda	1995	1998	Sí	3,0

The technological convergence mentioned earlier has also impacted the means of regulation of telecommunications and media (film, broadcasting and print). Three previously separate regulatory traditions (those for telephony, the Internet and media) are converging. Telephony, data communications and media (broadcasting, video and print media) services have been regulated on different principles: basic telephony services have been regulated in detail in particular to ensure universal service; video and print media have been regulated on the basis of content; and the Internet has developed without basic control. However, as social interests have become increasingly dependent on the Internet, demands have been made for basic regulation to establish and maintain confidence in this communication medium. The convergence of the technical means of providing voice, data and video services has led to a reorientation of regulation towards technology-independent schemes.

5 Services & service provision scenarios

5.1 Introduction

Mr. Norio Wada (CEO of NTT) presented his vision of the future of broadband telecommunications at the CCITT / ITU 50th Anniversary Celebrations in Geneva:

"First some background: right now Japan is in a population crisis. The birthrate is shrinking. By 2015, a quarter of the population will be 65 or older. This will rise to one-third by 2050. As the productive population declines and the demand for medical care goes up, the NGN and ICT will make important contributions. One area will be in remote medical diagnosis and monitoring. For example, broadband network enables pathologists in a large hospital to diagnose patients in distant areas. It can also connect the homes of sick and elderly people to a nursing center. This type of system should reduce the cost of nursing care.

The second area of application is for a safe and secure society. As an example, we've developed an emergency notification system to help citizens in a disaster. This system is already used by some governments for disaster prevention and management.

The third area is enhancing productivity and work opportunities. One way this can happen is using broadband for remote working. A specific example is a virtual factory of digital maps, in which workers at home make and maintain digital maps.

The NGN and ICT also support new types of products and services.

Right now we're involved in trials for a digital cinema service. Super-high-definition video, with 8 Mega-pixel resolutions, is delivered over an optical network from Hollywood to theaters in Tokyo and Osaka."

Notice that Mr. Wada did not mention telephony. The previous report of Q19/1 noted that the benefits of a common IP infrastructure and broadband network access were not restricted to the provision of voice services but to providing a whole range of data and video services. Although, there are some regional differences in requirements – for example, in many countries with a young population there is a greater need to emphasize the health care requirements of children and their mothers, rather than that of an aging population – the services outlined by Mr. Wada are of global applicability. Broadband access can provide E-Health, E-Security, E-Education, E-Government and E-Commerce services. In particular, in the commercial area the Internet provides low transaction costs and global market reach. It is therefore an excellent medium

for communicating with a thinly spread public or clientele and make direct contacts possible between producers and consumers. This is well illustrated by the e-Choupal project in India, for example, in which Internet access is provided to villages to provide information on market prices, weather conditions and farming practices in local languages [http://www.echoupal.com/]. Information and communications technology is in all cases a tool for improving productivity, whether related to business or personal use. For example, the convergence on digital media allows one to pursue hobbies, such as photography or music, more efficiently. One can take photographs, transfer them to a computer, edit and print them or create slide shows without involving processing laboratories or incurring long delays. Similarly one can record and edit one's own music and it is straightforward to share ones pictures or music with friends.

The productivity increases that can be expected from the introduction of broadband services follow those that have been reported for telephony.

Roeller and Waverman have suggested [6] that the spread of fixed-line telecommunications networks in the OECD countries was in itself responsible for one third of output growth between 1970 and 1990 and that the impact of the availability of telecommunications infrastructure on growth depends on the initial level of network availability, with the biggest impact occurring when universal service is nearly reached. It has also been concluded that "mobile telephony has a positive and significant impact on economic growth, *and this impact may be twice as large in developing countries compared to developed countries"*. [7]

5.2 The characteristics of the Internet

"The Internet is a communication medium that allows, for the first time, the communication of many-to-many, in chosen time, on a global scale." [1]

The Internet has the following characteristics:

- Decentralised structure
- Distributed control
- Redundant functions
- Dynamic configuration
- Open
- Global reach
- Information rich
- Low transaction costs

These characteristics account for many of the benefits and attractions of the Internet and also conversely some of the dangers and difficulties in applying media regulations. For example, the decentralised structure, distributed control, redundancy, dynamic configuration, openness and global reach of the Internet make it difficult (though not impossible) to block access to content that may be offensive or illegal in certain territories, whereas the richness of information that is available, low transaction costs, openness and global reach make it a very attractive medium for many applications.

5.3 E-Health

The aims of E-health systems are to efficiently improve the quality, range and accessibility of health care services. An extremely wide range of services can be provided such as:

- information to the public on the availability of healthcare services
- on-line medical advice
- patient data & transfer
- remote monitoring – "telecare" – use of active/passive alarm services
- remote diagnosis & treatment – "telemedicine"
- remote support of mobile care staff
- E-Health systems can be promoted by:

- explicit policy addressing ICT's in general healthcare;
- public procurement policy that focus on access to appropriate ICT devises for employees with disabilities; and
- research funding specifically for ICT and healthcare development.

Telecommunications services can also be used to improve the quality of life for people with disabilities. For example, the ITU-T has produced a number of specifications for text telephony to improve accessibility for those with hearing impairments. Recommendation V.151 describes the "Procedures for end-to-end connection of analogue PSTN text telephones over an IP network utilizing text relay" and V.152 the "Procedures for supporting voice-band data over IP networks".

Question 14-2/2 of the ITU-D is also studying "Telecommunications for e-Health" (http://www.itu.int/ITU-D/study_groups/SGP_2006-2010/SG2/SG2Quest.html).

5.4 E-Security

E-Security can be considered in two broad categories: services to increase personal security, such as remote monitoring and emergency services, and systems security to maintain confidence in the use of on-line services and minimise abuses such as fraud, the spread of damaging software and harm to the network.

ITU-D Study Group 2 is working on the "Utilization of ICT for disaster management, resources, and active and passive space-based sensing systems as they apply to disaster and emergency relief situations" in Question 22/2.

5.5 E-Education

In 1968 a UNESCO research group concluded that the goal of providing education for all children was unreachable as the population was growing faster than the number of schools. A decade later Alvin Toffler observed in his book "Future Shock" that knowledge quickly becomes obsolete as ways of life change within a generation [8].

These crises have now been followed by the information explosion of the Internet which of itself creates new demands. Source criticism skills are now essential as are more refined information searching tools ("Find engines" rather than "Search engines") and metadata for the classification of content. From a public policy perspective government should set the framework (rules & budget) and stimulate innovation, by investing in infrastructure for example. [9]

Teachers, of course, need to be taught to use the new tools which allow specialists to participate in lessons remotely and enables the exchange of information between schools. Parents can also be more easily involved in school activities.

The advent of E-Education makes a paradigm shift in education necessary. "Teaching and learning need to be shaped in a different way, with more ***personalisation, individualisation and localisation***. There needs to be less focus on a narrow curriculum. There needs to be development of innovative assessment methods that really ***test for understanding and application rather than just factual recall***. We need to teach learners how to ***locate relevant information and judge the credibility of their sources***. They need to learn how to ***think critically and to solve problems, how to communicate at all levels with a diverse range of people and how to take responsibility for how and what they learn***. Connected schools create the possibilities for changing pedagogy and provide new opportunities to improve the learning experience, so that our children and our societies are ready to meet the challenges of today's Knowledge Society." [10].

5.6 E-Government

The World Bank has characterised E-government as **"**government-owned or operated systems of information and communications technologies (ICTs) that transform relations with citizens, the private sector and/or other government agencies so as to promote citizen empowerment, improve service delivery, strengthen accountability, increase transparency, or improve government efficiency".

There have been some e-government projects in developing countries such the AgRIS (Agricultural Resources Information System) which is intended to stimulate sustainable development in India (see Annex 1 and http://agris.nic.in/Agris-Paper.pdf).

5.7 E-Commerce

Specifications for Electronic Data Interchange between suppliers of goods and specific purchasing organisations were agreed prior to the take-off of the Internet. Closed communities were formed for EDI using the public data services then available such as those based on circuit-switched X.21 or packet-switched X.25 technologies. The great advantage of using the Internet is its ubiquity, openness, low access costs and ease of use.

The Internet economy requires:

- A large set of IP networks spanning the globe with software applications and the human capital needed to create and deploy an open and globally accessible networked environment;
- Interconnected electronic markets with a variety of exchange mechanisms that the IP networks and applications enable;
- Online producers and consumers;
- Electronic intermediaries providing trust, visibility, assurance, certification, and other market-making services;
- One or more electronic currency systems that can be used in Internet based transactions; and
- Legal and policy frameworks. [11]

Businesses can be categorised according to the use they make of e-commerce:

- *category 1* – pure digital-products businesses that offer content, knowledge, or services directly over the Internet (e.g. Yahoo)
- *category 2* – Internet-based companies that deal with physical products, importing goods to be sold from the physical economy (e.g. Amazon)
- *category 3* – traditional businesses that sell some of their products or services directly over the Internet
- *category 4* – content developers, Internet service providers, Web and applications hosting services
- *category 5* – companies that do not sell directly over the Internet

Internet commerce has been quietly but steadily growing. For example, new records for e-commerce in Sweden were announced in the spring of 2008. E-commerce revenues were 17700 million SEK in 2007, compared with 14300 million SEK in 2006, and accounted for about 3.5% of total retail trade. Growth in the fourth quarter of 2007 was 24.5% compared with Q4 2006. Four of ten Swedes buy on the Internet every.

There are some examples of successful use of e-commerce from around the world. One such example is the e-Choupal initiative in India http://www.echoupal.com/.

Access to information is very important for farmers to obtain the best prices for their products. The ITC e-Choupal system in which Internet access is provided in rural villages in India is reported to have helped “to alleviate rural isolation, create more transparency for farmers, and improve their productivity and income" [http://www.digitaldividend.org/case/case_echoupal.htm]. Information is available on weather, market prices and farm practices in local languages. The difficulties reported with this system are of an infrastructural nature (such as the availability of an electricity supply, network connectivity and bandwidth) and of training in the use of the Internet.

Another recent study [12] on the impact of the use of mobile phones on the price of grain in rural markets in Niger concluded that “cell phones reduce grain price dispersion across markets by a minimum of 6.4 percent and reduce intra-annual price variation by 10 percent... The primary mechanism by which cell phones affect market-level outcomes appears to be a reduction in search costs, as grain traders operating in markets with cell phone coverage search over a greater number of markets and sell in more markets... Cell phones have a greater impact on price dispersion for market pairs that are farther away, and for those with lower road

quality... This effect becomes larger as a higher percentage of markets have cell phone coverage... The results suggest that cell phones improved consumer and trader welfare in Niger, perhaps averting an even worse outcome during the 2005 food crisis."

5.8 E-Work

The enormous popularity of mobile phones has already been remarked upon and indicates the value that many of us give to the ability of communicating from any location. Mobility and nomadicity are valued characteristics of modern telecommunication systems that allow more flexible, efficient and innovative ways of working. Mobile communication increases corporate productivity & competitiveness as people stay in touch longer, reducing delays in responding to requests or solving problems. Also the personal nature of mobility shifts communication from a number or a function to a specific person. Time to market, especially for digital content such as news, can be reduced and process efficiency can be improved by tracking things on the move.

The experience of mobile phone usage in Africa illustrates the innovative use that can be made of this technology. Phones are often shared and private resellers of mobile services have established themselves. There are also those who receive and relay text messages to those who are illiterate (in rural communities in South Africa the ratio of inbound to outbound text messages is about 8:1). The mobile has encouraged entrepreneurial activity and helped links workers into the economy.

5.9 ICT and climate change

Telecommunications services have an important role to play in the global effort to stabilise the planet's climate. They provide a component in the systems to monitor climate change; are clearly essential when emergencies occur; and may also be used as a substitute for travel. Some of the applications are follows:

- Monitoring climate change
- Data analysis & climate modelling
- Emergency services & disaster relief
- Travel substitution
  - Smart Work Centres
  - Teleconferencing, Telepresence and Web collaboration
- Collaboration technologies in the creation of innovative work environments
- Transport management systems
  - Vehicle tracking and identification systems
  - Video surveillance
  - Integrated transportation management systems
  - Sensor technologies such as Global Positioning System (GPS) and radio frequency identification (RFID)
  - Sensor networks & process control (e.g. switching off unnecessary devices; production on demand).

ICTs are also part of the problem in that they consume an increasing amount of energy. As far as the Internet is concerned well over half of the total energy consumed is attributable to PCs and monitors.

5.10 E-Entertainment – the "Experience Economy"

The on-line gaming industry is now larger than the music industry and broadband access is being used to provide an increasing range of entertainment from TV (IPTV and Internet TV) and radio shows through to "virtual reality" games. Entertainment should not be forgotten as a source of revenue, an area of innovative application development and also as a customer attractor when considering the mix of services and benefits of providing broadband network access.

6 Challenges

But there are many challenges. An attractive investment environment needs to be created with rules set to stimulate investment & innovation. A number of municipal broadband access projects around the world are indicating the importance of public – private sector cooperation & coordination. The funding of investment in infrastructure is an issue but innovative solutions are now being tried, such as the microeconomic approaches that were pioneered by Grameen Phone.

A supporting infrastructure is also required. An electricity supply and terminal equipment such as PCs need to be available as reasonable cost. IP phones are not line powered as are PSTN terminals and so require a power supply. An interesting initiative is the XO laptop promoted by the "one laptop per child" organisation (http://laptop.org). This is a waterproof, robust laptop intended for use by children in developing countries that can work using mains power, a solar panel or be charged using a mechanical cranking instrument. This laptop is hermetic, can be dropped without breaking and the screen can be seen in the sun.

Clearly a user of the Internet needs to be literate and in many regions literacy levels are low. The level of literacy is a factor determining how ICT is used. This can be illustrated by differences in the use made of text services on mobile phones. For example, in the UK the number of SMS messages sent is greater than the number of voice calls with 0.6 outgoing voice calls made for every SMS message sent whereas in South Africa the ratio of voice calls: SMS messages is 3 :1 for pre-paid mobile subscriptions and in rural communities reaches an average ratio of 13:1. In the rural community of Ndebe, in which only 30 per cent of the population had completed primary education (2001 Census data), the ratio was 17:1. Clearly the combination of illiteracy and use of indigenous languages impacts the use made of SMS messaging. [4]

There are significant privacy issues associated with the use of the Internet and other social concerns such as the reception of unwanted calls or material (SPIT and SPAM), the possibility of accessing content that is illegal in some states, fraud and the situation in which temptations are close at hand (such as games, gambling, chat, shopping, pornography – all of which can become addictive).

Training is another significant challenge. A number of initiatives have been taken, often with corporate assistance, to increase the number of people with competence in IP technologies.

7 Policy aspects

7.1 Generalities

Currently there are trends are to introduce competition in the provision of telecommunication services, to privatise state-owned operators and to create independent regulatory agencies.

Technical convergence has been followed by a trend to implement regulatory policies that are neutral to the technology employed to provide telecommunication services.

The regulators participating in the 2007 Global Symposium for Regulators (Dubai, 5-7 February 2007) approved **Best Practice Guidelines for Next-Generation Networks (NGNs) Migration** to "encourage regulators to define policies that allow for the co-existence of legacy and IP networks, alternative voice services such as VoIP, and bundled services that provide voice together with TV and Internet access (also called triple play). In doing so, regulators are to consider applying the same rules to all operators and providers of telephony services irrespective of how they are delivered to consumers, under the symmetrical regulatory approach. The best practice guidelines cover all aspects of service provision including authorization, access, interconnection and interoperability, numbering and NGN identification systems, universal access, quality of service, consumer awareness, security and protection" (http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR07/index.html).

ICT adoption can be encouraged by:

- Standardisation of key interfaces to encourage market growth, which is beneficial for manufacturers, service providers & users.
- Adoption of a clear regulatory structure.
- Clear rules for access to scarce resources such as radio spectrum.

- Creation of a positive investment environment.
- Public & private sector projects.

The experience of producing harmonized VoIP regulation in Switzerland indicated the paramount importance of bringing all market actors together in discussions. Switzerland started to regulate VoIP in 2004. A workshop was organized and a working group was created with representation from equipment manufacturers, regulators, user organisations, and incumbent and new service providers. This approach was very successful in finding new solutions and Switzerland presented its experience at the European level.

But there are still regulatory concerns about IP Telephony and different approaches are being adopted, as indicated by these excerpts from one information source (TeleGeography's CommsUpdate) during one week in March 2007:

- "State committee proposes 'VoIP licences for all' to ease ILD congestion... A Bangladeshi government committee on legalising voice over internet protocol (VoIP) has recommended allowing VoIP licences to be issued to all operators, including providers of mobile, fixed line and internet services." TeleGeography's CommsUpdate 5 March 2007
- "FCC backs VoIP providers ……US telecoms regulator the Federal Communications Commission (FCC) has overruled authorities in two states and has told incumbent local exchange carriers (ILECs) that they must connect calls from internet telephony operators." TeleGeography's CommsUpdate 7 March 2007
- "Regulator bans VoIP in cyber cafés …..Oman's Telecommunications Regulatory Authority (TRA) has banned the popular voice over internet (VoIP) telephony services offered by many cyber cafés" 12 March 2007

Voice over IP communication is illegal in a number of countries, such as United Arab Emirates, Saudi Arabia, Pakistan, Jordan, Egypt, Oman, Qatar, Yemen, Algeria and Kuwait.

Study Group 3 of the ITU-T conducted a study by questionnaire on the regulatory and economic aspects of IP Telephony in 2008. This study concluded that:

a) With respect to the general regulatory approach to "IP Telephony", a majority of respondents (about 60%) currently adopt a technology-neutral approach and an even larger majority (over 65%) expect to adopt such an approach in the future.

b) "IP Telephony" is at present considered either a basic service or "other", but nearly half of respondents expect that it would be considered a basic service in the future.

c) A majority of respondents state that basic, data, and information services are regulated differently in their country at present, and this is expected to be the case in the future also.

d) A vast majority of respondents (about 90%) believe that regulation should be based on type of service.

e) At present, a minority (about 30%) of respondents indicate that there is specific regulatory treatment for "IP Telephony" in their country, but over 40% indicate that they expect that there will be such specific regulatory treatment in the future.

f) At present, only 12% of respondents indicate that there is a universal service obligation for "IP Telephony", but 30% of respondents expect that there will be such an obligation in the future. And about 20% of respondents expect that there will be a universal service fund for "IP Telephony" in their country in the future.

g) A large majority (nearly 80%) of respondents indicate that calls to emergency services are mandatory at present for "IP Telephony". About half indicate that legal intercept, archiving, quality of service are mandatory at present. About one-third indicate that calls to freephone and premium-rate numbers are mandatory at present.

h) About 90% of respondents indicate that there are, at present, mandatory provisions with respect to interconnection between fixed and mobile PSTN, about half indicate that there are such provisions for interconnection between PSTN and "IP Telephony" and about 40% indicate that there are such

provisions for interconnection within "IP Telephony". Similar percentages are indicated for the future.

i) (...)

j) With respect to pricing models, about half of the respondents indicate that flat-rate, duration-sensitive-rates, and higher-rates-for-international are currently practiced (with the last being the most frequent). For the future, there is an expectation that there will be less duration-sensitive-rates and higher-rates-for-international and more flat-rates.

k) Less than half of the respondents (41%) indicate that, at present, operators provide "IP Telephony" with guaranteed quality of service, but a large majority (75%) expect that such guarantees would be provided in the future.

l) At present half of respondents indicate that, in their country, the regulator monitors the price of "IP Telephony" services, but over two-thirds expect that there will be such monitoring in the future.

m) Most respondents indicate that termination fees for "IP Telephony" are paid only to the "IP Telephony" gateway in the country, not also to the ISP that connects the end-user.

n) Excluding the one response that is very different from the other (from the Telecommunications Company of Iran), respondents indicate that, on average, mobile telephony accounts for about 61% of operator revenues, fixed telephony for 26%, data for 12%, and "IP Telephony" for 1%. The response from Iran is 42%, 43%, 0.7%, and 14.3%.

These results are very much in-line with the study conducted by Q19-1/1 published in 2006.

7.2 Experience of Internet telephony in Korea

What is Internet telephony?

Internet telephony is a voice telephone service which is delivered over IP networks such as the Internet or other packet-switched networks. It is often called as voice over internet protocol (VoIP), Internet Protocol (IP) telephony, voice over broadband (VoBB), broadband telephony, and broadband phone.

IP telephony refers to communications services—voice, facsimile, and/or voice-messaging applications—that are transported via the Internet, rather than the public switched telephone network (PSTN). The basic steps involved in originating an Internet phone call are the conversion of the analog voice signal to digital format and the compression/translation of the signal into IP packets for transmission over the Internet. The process is reversed at the receiving end.[1]

Benefits of Internet telephony

Benefits from the provision of Internet telephony for each interest group are as follows:

1 International Engineering Consortium (2007) *Voice over Internet Protocol. Definition and Overview.* http://www.iec.org/online/tutorials/int_tele/index.asp

Table 3 – Benefits of the Internet Telephony

Interest group	Benefits
Customers	• Saved phone bills and cost efficiency: Customers can save their money for their calls (Costs vary by providers. Some allow unlimited calls with a small fee.) • Integration with audio, data and video applications: Customers can integrate their computer applications such as e-mail, fax, web conferencing and video phone with their telephone needs. • Flexibility: Customers can take their internet telephone adapters anywhere and use their number anywhere only if there is an Internet connection. • Added features: voice mail, call forwarding, call waiting, caller ID, call block, call return, and do-not-disturb services
Incumbent carrier	• In a sense of network evolution, All-IP network is considered as a target network in future. Under the All-IP network, internet telephony is a component to provide telephone services rather than PSTN. • However, it could be a worry of cannibalization effect.
Potential new players	• Internet telephony is one technical option for potential new entrants to telecom market. With less investment they can enter the lucrative markets, such as long distance and international telephone market. Business users' market is also a promising market for the Internet telephony service providers.
Regulators	• Extension of broadband: Provision of internet telephony is usually based on broadband connection. Diffusion of internet telephony leads to extension of broadband network. • Wide provision of fixed telephony service: For the countries in which fixed telephony service is not widely provided, the Internet telephony could be a selective option to provide fixed telephony services. • Promotion of competition in the market: Typically fixed telephone market is monopolized substantially due to the natural monopoly. Internet telephony could be an effective way to promote new entrants to the fixed market. As the result, regulator can promote competition in the fixed market. • Network evolution toward NGN: From the view of network evolution, introduction of the Internet telephony promotes network evolution towards NGN.

Policy regarding Internet telephony

Regarding Internet telephony, several policy options should be determined by regulator. First of all, the classification of services and service providers need to be announced in advance. There are typical alternatives on service classification: the same classification with PSTN-based telephone service and the different scheme for Internet telephony. Followed by service classification, operators' status are determined among types of service operator.

Licensing mechanism is related with the classification of service providers. In most countries, applicants for Internet telephony are required to register in the Government only. As a special case, in Korea, candidates are requested to apply and approve their licenses from the Korean government. Internet telephony is under regulatory boundary of the Government in part.

From the practical view, technical requirements are more critical. Potential customers have worries about the service quality. Governments have to determine whether the government will regulate quality of service (QoS) or not. In case of regulating service quality, governments need to announce technical requirement for the Internet telephony service.

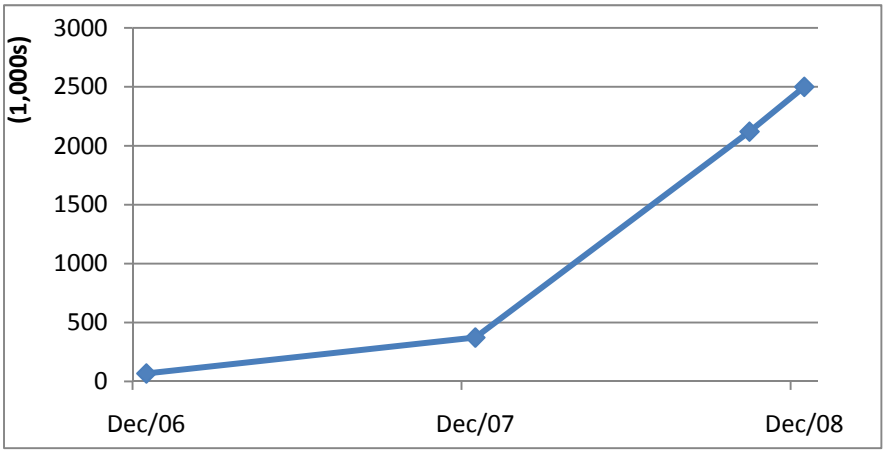
Signaling protocol for Internet telephony differs from the traditional PSTN-based service. Although selection of technical specification regarding network interconnection belongs to service providers, governments of developing countries play a leading role in coming up with how to comply with those different networks about signaling protocol.

Regarding interconnection charges, PSTN and IP networks have substantially different principles. Typically interconnection charges on PSTN are based on network cost. There are lots of cost models for PSTN interconnection. However, on the Internet, peering scheme or transit changes are preferred. The principle of interconnection charges keeps between Internet telephony service providers, but, between PSTN and IP network, it is hard to extend the principle of IP network. In most countries, partial cost-based pricing is applied. That is, customers of IP telephony need to pay for extra charges when they call to PSTN users, though they do not need to pay for it in case of calling to the Internet telephony users.

Numbering issue is typically related with service classification. In most countries, Internet telephony service is assigned with the same numbering scheme with PSTN service. In Japan and Korea, different network identification number systems were assigned to internet telephony service.

Another issue on numbering is number portability. In case of assigning the same identification number with PSTN, number portability covers the internet telephony numbers. However, in case of Japan and Korea, another regulatory selection is necessary to extend number portability to internet telephony service. Provision of number portability often impacts diffusion of the Internet telephony service positively. For instance, in Korea, after providing number portability to the Internet telephony on October 2008, the number of subscription increases dramatically.

Figure 1 – Number of Internet Telephony Subscription in Korea



IP telephony in South Korea

Saerom launched dial-pad service based on soft-phone first on January 2000 in South Korea. On May 2004, “Guideline of Internet telephony” was announced.

Table 4 – Guideline of Internet telephony Policy in South Korea

Policy issue	Policy description
Service classification	Common telecommunications service
Licensing	Common carrier: Require approval from the Government in case of having network (backbone network, subscribers' loop) or network facilities (server, router, gateway, gatekeeper and so on) Specialized service provider: Registration to the related government office without approval
Numbering	Separate service identification number (070) Common carrier: 070-ABYY-YYYY (block unit: 1 million) Specialized service provider: 070-ABCY-YYYY (block unit: 100 thousands)
Quality of service	Quality of voice – Rating value: >70 – One-to-one delay: <150ms Quality of access – Call success rate: >95% * Operators need to get a certification from Telecommunications Technology Association (TTA) in South Korea * Quality evaluation will be held annually.
Interconnection settlement	Internet Telephony → PSTN/Mobile network: current interconnection charges applied PSTN/Mobile network → Internet Telephony: Internet (data network) interconnection charges applied

Since October 2004, the Internet telephony has been one of the common telecom services under regulation and are assigned with "070" service identification numbers.

After expanding number portability to Internet telephony services on October 2008, the number of subscribers of Internet telephony will be expected to increase dramatically.

Lessons learned from the experience of Internet telephony in South Korea

The success factors of the Internet telephony in South Korea are two-fold. First, a proper guideline by the Korean government let users recognize the internet telephony as a plausible option for telephony service. Improved quality of service which came from relatively high requirement by the Government obtained users' attention. Secondly, expansion of number portability toward the Internet telephony removed a barrier on acceptance of the Internet telephony service by the Korean government.

8 Economic aspects – distance overcome

8.1 Regulatory rebalancing of local & long distance call charges

It is now generally recognized that the distance separating communicating parties and also the duration of a call are no longer key parameters in the cost and pricing of telecommunication services. Clearly technological developments have played a role in this development but government policy provided the initial moves in this direction. The monopoly telecommunications regimes, that were the norm prior to the wave of liberalization of telecommunication markets, were perceived as subsidizing local calls by the revenue from long-distance and international traffic. The introduction of competition in the provision of telecommunication services required tariffs to be related to actual costs and one of the initial policy decisions in the first market to be liberalized, the UK, was to rebalance local and long-distance call charges. As can be

seen from Table 5, long distance call charges decreased in the period 1984-1986 in the UK whereas local call charges increased.

Table 5 – Rebalancing of local & long distance call charges – Changes in the effective price of peak period calls in UK (BT) % (Source: OFTEL Annual Report 1988)

	1984	1985	1986	1987	1988
Local	+6.8	+6.4	+18.9	0.0	0.0
National "a"	+6.8	+6.4	+1.6	0.0	0.0
National "b1"	–10.3	–14.0	–12.0	0.0	0.0
National "b2"	–14.0	–6.2	–16.0	0.0	0.0

8.2 Technological impacts on the International Accounting Rate System

International telephone call charges are affected by the system of settlement payments between operators known as the accounting rate system. This system is defined in an international treaty known as the International Telecommunication Regulations that is administered by the ITU. Under this system an operator that originates an international call makes a payment to the operator that terminates the call and there will be a net payment if the originated and terminated traffic is not in balance. In general there has been an imbalance on routes between developed and developing countries in that more calls originate in developed countries than in the developing countries. "Between 1993-98, net flows of settlement payments from developed counties to developing ones amounted to some US$40 billion" [13].

In 1995 US operators made net payments amounting to $5099 million to operators in other countries (see Table 6) and these payments have been a significant source of revenue for operators in developing countries (see Annex 2: Mobile VOIP regulation issue: Technology evolution or a telecommunication service?). For example, Mexico received payments from the USA in excess of US$ 1 billion in 1996 which accounted for more than 10% of Telmex's revenues (US$ 8.5 billion in 1998).

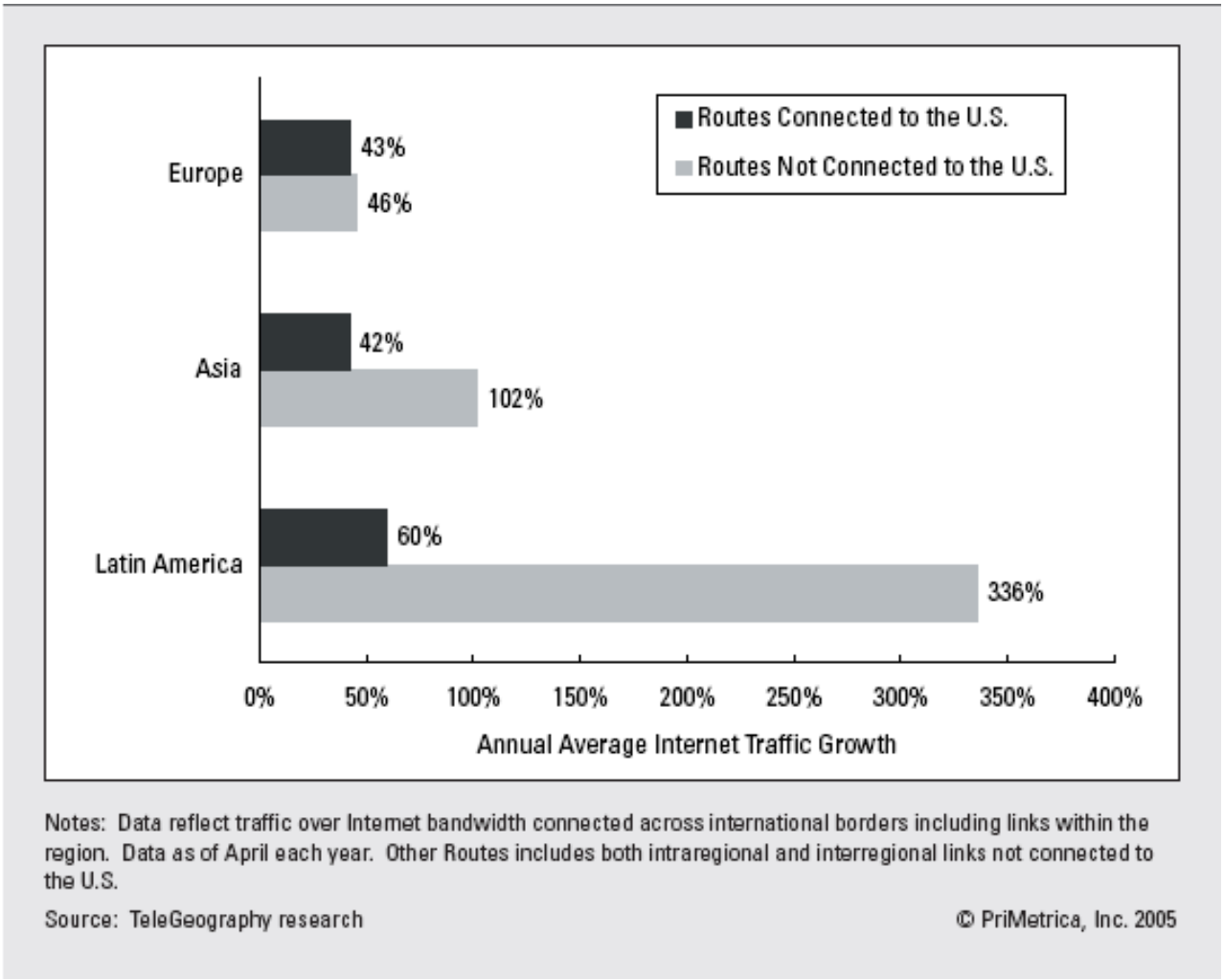
Table 6 – US accounting rate settlement payments – 1995

Region	Revenue (US$ million)	Payment to foreign carrier (US$ million)	Receipts from foreign carrier (US$ million)	Net deficit (US$ million)
Africa	517	302	68	–234
Middle East	692	524	157	–367
Americas	5 732	3 227	925	–2 302
Asia-Pacific	3 715	2 124	682	–1 442
Werstern Europe	2 945	1 048	543	–505
Central & Eastern Europe	489	309	95	–214
Total	14 130	7 571	2 472	–5 099

However, the international accounting rate system has increasingly been by-passed by using voice over IP on leased circuits between countries. In 2000 it was estimated that about half of all international telephone traffic by-passed the accounting rate system. In response to this trend there has been an attempt to reform the accounting rate system so as to set rates that more accurately reflect costs.

The imbalance in international Internet traffic is greater than that for telephony and ISP peering arrangements are such that many ISPs in developing countries must pay the full circuit cost for interconnection with Tier 1 ISPs as they do not meet the conditions set by Tier 1 ISPs for settlement-free interconnection (see for example http://www.verizonbusiness.com/uunet/peering). This reverses the direction of payment flows. However, the dominance of the USA as the hub of the Internet may well decline as more local content is provided around the world and more direct connections are made between countries rather than being made via the USA. TeleGeography have reported that traffic growth is greater on non-USA international links than on US international links in Europe, Asia and Latin America (see Figure 2). IP transit prices have also been falling significantly (see Table 5).

Figure 2 – Traffic growth on US & non-US routes: 2004-2005



Notes: Data reflect traffic over Internet bandwidth connected across international borders including links within the region. Data as of April each year. Other Routes includes both intraregional and interregional links not connected to the U.S.

Source: TeleGeography research

Table 7 – IP Transit price decreases (Source: TeleGeography: Global Internet Geography)

	Change in Price %		
	US	*Europe*	*Asia*
2004 – 2005	–23	–33	–14
2005 – 2006	–23	–22	–23

8.3 Internet eXchange Points and the avoidance of transit links

Efforts are also being made to avoid expensive transit links by deploying Internet eXchange Points (IXPs) in developing countries, such as Ghana, Kenya, Tanzania, Bangladesh, and Mongolia. Without an exchange point, traffic between the customers of two different ISPs must traverse at least one, and sometimes multiple, transit providers and could endure multiple satellite hops, even if the customers are in the same city. Transit links can be a big expense for an ISP, especially in developing countries where these links tend to be international. This situation can also increase traffic delay and related quality of service problems between local customers.

With an IXP, each ISP in the area routes local traffic via the exchange point directly to peering partners. The result is that local traffic stays local. This removes traffic from the expensive transit links, thus reducing costs and response time. In addition, an IXP provides a location for the Internet community in a country to place other services and so offer new and more locally relevant content and services.

8.4 Distance independent costs

And so distance is becoming less significant to the cost of telecommunications services. Prices are tending towards actual costs and these costs are predominantly associated with the origination and termination of traffic. In addition, the duration of calls is also becoming less significant as flat-rate charging is becoming more popular, even for mobile services. The ITU Trends in Telecommunication Reform report – Convergence & Regulation 1999 – noted that "For the future, telecommunications network bandwidth capacity will be the primary factor determining the development of most new services and network investment requirements. Distance is becoming less & less significant….and the duration of network connections is growing in the direction of establishing permanent connections for some services." This leads to the situation in which bandwidth and access capabilities, such as location-based services, become more significant factors in charging and in generating Service Provider revenues.

Telecommunication by its very nature overcomes the limitations of distance and creates a culture of simultaneity. This was recognized long before it became a fact for most of the inhabitants even of developed countries. In 1889 Lord Salisbury noted that the telegraph "combined together at almost one moment.....the opinions of the whole intelligent world with respect to everything that is passing at that time upon the face of the globe." A global village, or rather metropolis, is coming into being but a look at a global Internet bandwidth map clearly indicates that in much of the world distance is still a major limitation. Most of the bandwidth is provided between the main industrial centres in North America, Europe and Japan. There is a great discrepancy in access to telecommunications services between the rural and urban areas of developing countries but the recent revolution in mobile communications in many developing countries indicates than these regions are not predestined to lag behind the developed world. There is a possibility to leap frog technology in the urban areas of developing countries and the World Summit on the Information Society (WSIS) has set a target to provide access to the Internet in every village in the world by 2015.

9 Conclusions

IP Telephony was first used to by-pass the international accounting rate system and so offer lower-price international telephone calls. It is not surprising therefore that many observers commented on the impact that this would have on the revenues of network operators in developing countries. However, lower prices to consumers can lead to increases in traffic volumes and also to the secondary effect of increasing productivity in communities. The Internet allows certain information services to be provided much more efficiently than equivalent services based on telephone calls and also allows direct communication between producers and consumers in many fields.

However, many developing countries lack an existing telecommunications infrastructure and the necessary human resources in this area of technology. Incentives for investment and institutional arrangements for business contracts may also be lacking.

The adoption of broadband applications can:

- increase the productivity of workers,
- encourage entrepeneurship,
- increase employment and international competitiveness,
- create opportunities for better education, healthcare and public services,
- improve public safety and security,
- increase the quality of life,
- help to combat the “brain drain” from developing countries in which there is a tendency for well-educated people to move to developed countries to pursue a career, and
- improve the status of women.

Governments need to lead by example and adopt broadband applications to improve the quality and efficiency of their own operations. Governments should also provide incentives to the private sector to adopt broadband applications through targeted and regulatory incentives.

A study commissioned by the GSM Association (GSMA) concluded that mobile operators are likely to invest as much as $50 billion in sub-Saharan Africa over the next five years. In addition, the International Telecommunication Union (ITU) recently drafted plans to dramatically step up Internet usage on the continent. Today, fewer than four out of 100 Africans use the Internet, while broadband penetration is as low as 1 percent in some places. But if the adoption of mobile phones serves as any indicator, Internet use could very well rise in the next few years. A recent BBC News report said, "more than a third of Africa's citizens should have access to broadband Internet" by 2012.

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In addition to these references many contributions were made to the Group studying this Question. These contributions can be found at: http://www.itu.int/md/D06-RGQ19.1.1-C/e/e and http://www.itu.int/md/meetingdoc.asp?lang=en&parent=D06-SG01-C&question=Q19-1/1

ANNEX 1

Agricultural Resources Information System (AgRIS): An e-Government Programme for fostering agricultural growth, poverty reduction and sustainable resource use in India – A Step towards establishing a location-specific e-Government model for the Poor

"Agricultural Resources Information System (AgRIS): An e-Government Programme for fostering agricultural growth, poverty reduction and sustainable resource use in India"

"A Step towards establishing a location-specific e-Government model for the Poor"

http://agris.nic.in/Agris-Paper.pdf

Madaswamy Moni

Presented at the Regional Workshop on "Implementing e-Government", 31 May – 4 June 2004, UN Conference centre, Bangkok (Thailand), organised by Asian Development Bank Institute (Japan) and UN/ESCAP, Bangkok.

ICT for agricultural development

- Who are our Target groups that we want to reach out to, through ICT for Development projects?
- What are the key information needs of the disadvantaged community?
- What are the existing channels by which information reaches to the disadvantaged community?
- What is the weakest link in the chain of information flows: from source to the disadvantaged community?

Target Groups

- Small farmers with less than 1 acre of land
- Farmers who have land away from roads and markets
- Farmers farming in ecologically fragile areas
- Newly turned farmers, young and women farmers (for instance in HIV/Affected villages)
- Farmers lacking credit, tools to enhance land productivity

Key Information Needs

- Information on identifying and dealing crop pests and livestock diseases
- Technical inputs on how to carry contour bunding, land-leveling, water harvesting activities, composting to increase productivity
- Information on government and NGO subsidies and schemes on seeds, fertilizers, horticulture and minimum support price
- Information on new crop varieties, irrigation frequency, setting up farm-based enterprises
- Information on market prices of the crops, availability of credit, agriculture fairs, soil-testing labs and training programmes

Existing Channels

- Through other farmers, progressive farmers, money lenders, teachers, public phone operator, postman and health workers
- Through government officials, agriculture extensionists, agriculture fairs, agricultural universities and NGOs
- Through radios, televisions, folk songs and newspapers

Weakest Link

- Information may be available at local agricultural centres or in markets but these are not easily accessible by farmers.
- High levels of illiteracy prevent farmers to benefit from available information.
- Agriculture extensionists are knowledgeable but do not visit farmlands away from roads or in remote areas.
- Agriculture extensionists and local agricultural centres do not have updated knowledge of new crop varieties, pest control and government schemes and subsidies.

The Poor Lack:

- Access to information that is vital to their lives and livelihoods:
  - About market prices for the goods they produce,
  - About health,
  - About the structure and services of public institutions;
  - About their rights.
- Political visibility and voice in the institutions and power relations that shape their lives.
- Access to knowledge, education and skills development that could improve their livelihoods.
- Access to markets and institutions, both governmental and societal, which could provide them with needed resources and services.
- Access to, and information about, income-earning opportunities.

ICTs can help a range of intermediary institutions and agents work more effectively

- Health workers can access the latest information; get assistance with diagnosis, and more effectively target interventions and resources with the help of ICTs.
- Agricultural extension agents can more effectively access and share local and global knowledge on crops, pest management, irrigation and other aspects of small-scale agriculture relevant to the needs of the poorest.
- Teachers can access and share new training materials, continue their own training, and expose their students to the ideas and experiences of children elsewhere.
- Local government officials can get better information about the needs of the poor, communicate those needs more effectively to other levels of government, and be held more accountable by the local people they serve.
- ICTs can help local businesses be more productive, and more responsive to their customers.

ETRI
Electronics and Telecommunications Research Institute

Mobile VoIP Regulation Issue:

Technology Evolution or a Telecommunication Service?

2007. 12.

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ETRI
한국전자통신연구원

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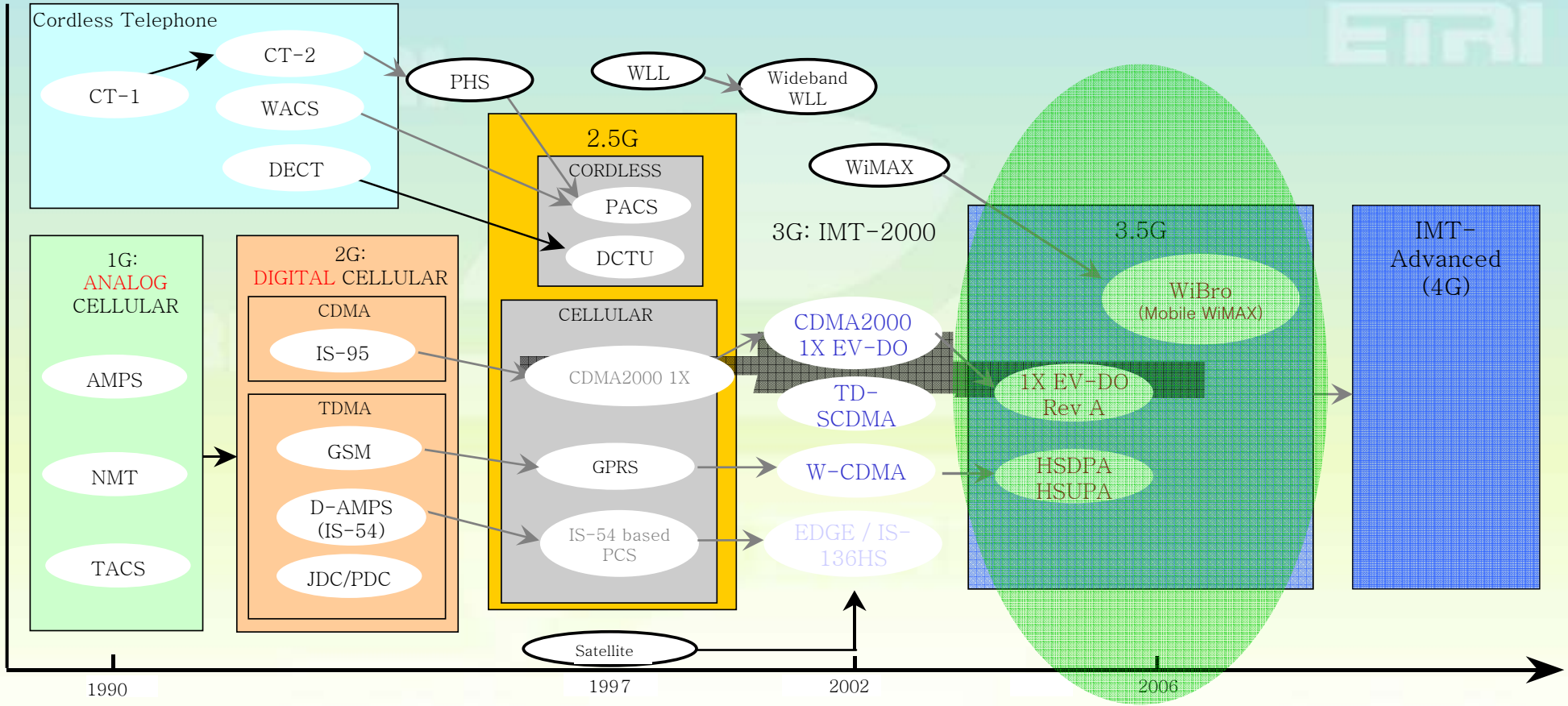
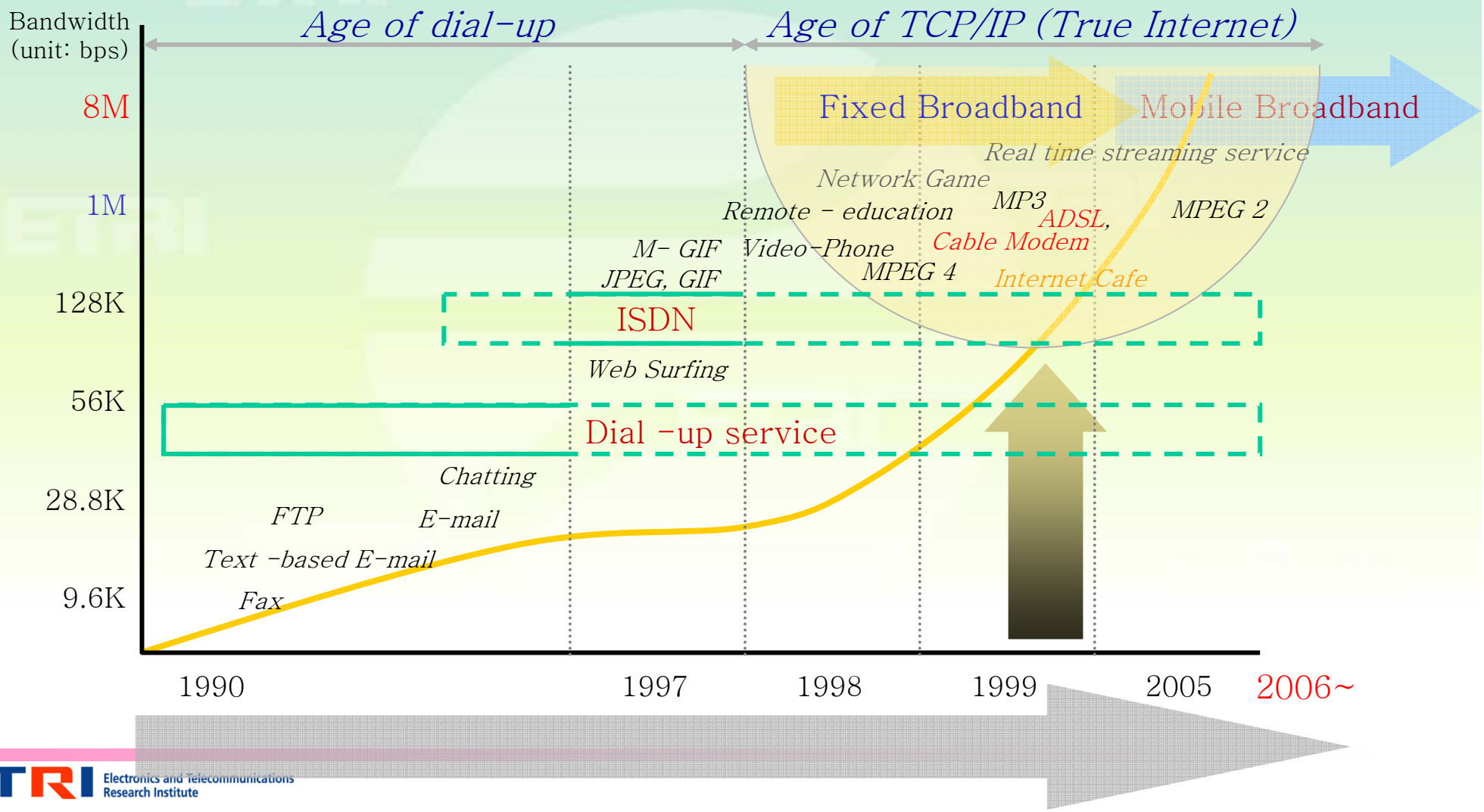
0. Introduction – History of Mobile Development

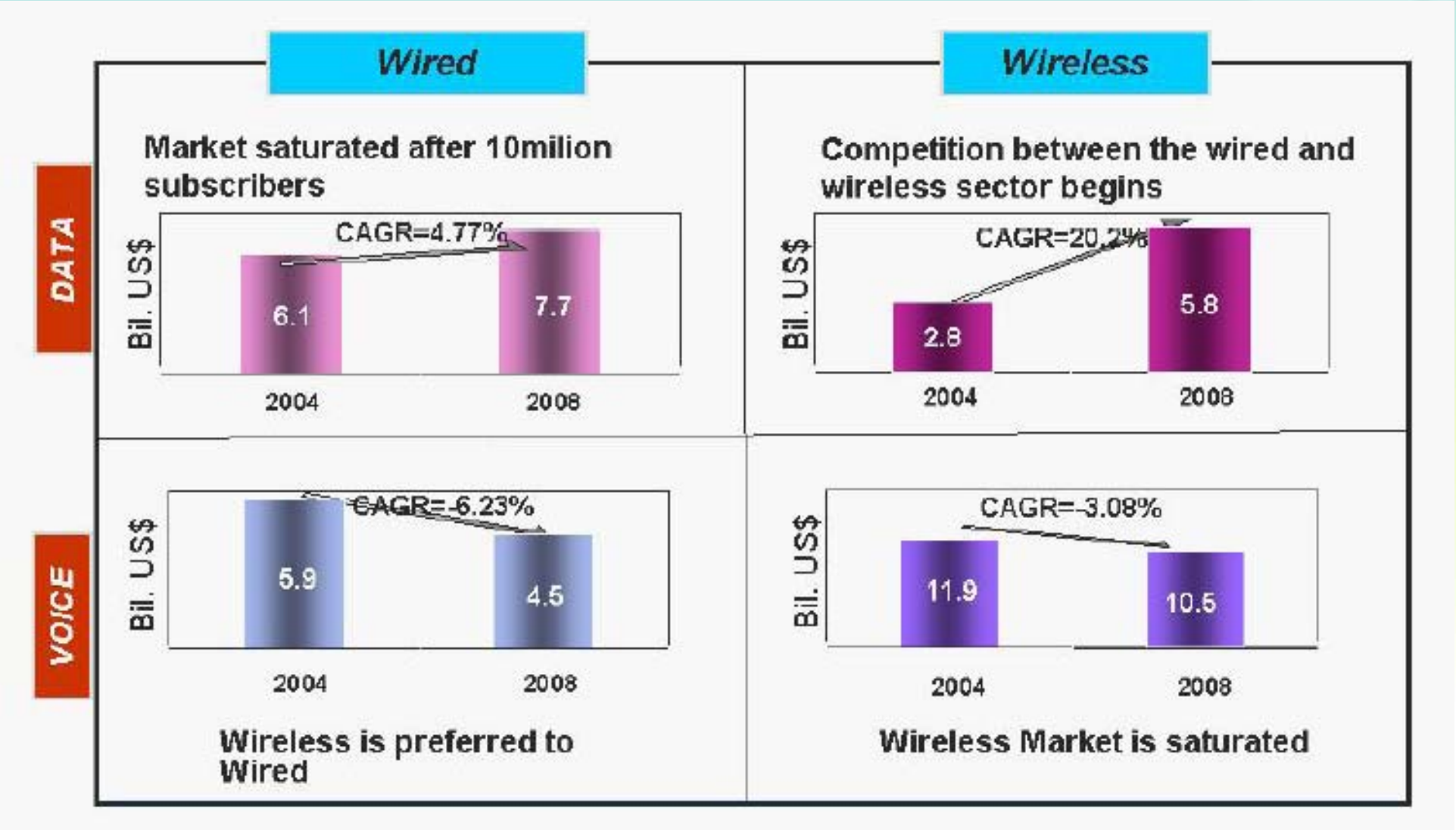


ADC: American Digital Cellular
AMPS:Advanced Mobile Phone System
CT: Cordless Telephone
DCS1800:Digital Cellular System at 1800MHz
TACS:Total Access Communication System
HSDPA : High Speed Downlink Packet Access
HSUPA : High Speed Uplink Packet Access
WiBro : Wireless Broadband
DECT:Digital European Cordless Telephone
DCT-U:Digital Cordless telecommunication-USA
GSM: Group Special Mobile Committee
JDC:Japan Digital Cellular System
WLL:Wireless Local Loop
PDC:Personal Digital Cellular
TD-SCDMA:Time Division Synchronous CDMA
WiMAX: World Interoperability for Microwave Access
DCTU: Dominant Certified Telecommunications Utility
EV-DO : Evolution-Data Only
IMT:International Mobile telecommunication
NMT:Nordic Mobile Telephone
PHS:Personal Handy Phone System
PACS:Personal Access Communication System
WACS:Wireless Access Communication System
EDGE:Enhanced Data Rates for Global Evolution
IS-136HS:Interim Standard 136 High Speed

0. Introduction



0. Introduction - Snapshot of Korean Voice Market



0. Introduction – VoIP Regulation in Korea

- **Korean Government has deregulated** Internet phone service (so called "VoIP service") in the fixed-line telecommunications market several years ago.
  - The VoIP service is categorized "facilities-based telecommunication service" in Korea
- Regulation for the VoIP service, which is adopted firstly **under fixed line environment**, has entered a new phase because there are much needs for introducing VoIP **under mobile environment**
- Hence
  - There would be new regulatory issues arising when the mobile VoIP carriers enter the mobile service market
  - **It is necessary to prepare the best scenario to continue or improve market performance under new market environment**

1. Technology Trend

Current Situation

- VoIP has already **been introduced in Wi-Fi**, and **cellular & Wi-Fi convergence** has reached the level of seamless handoff support
- The portable Internet (WiBro) was introduced in Korea for the first time in the world, while the adoption of the mobile WiMAX will be prevalent worldwide in near future

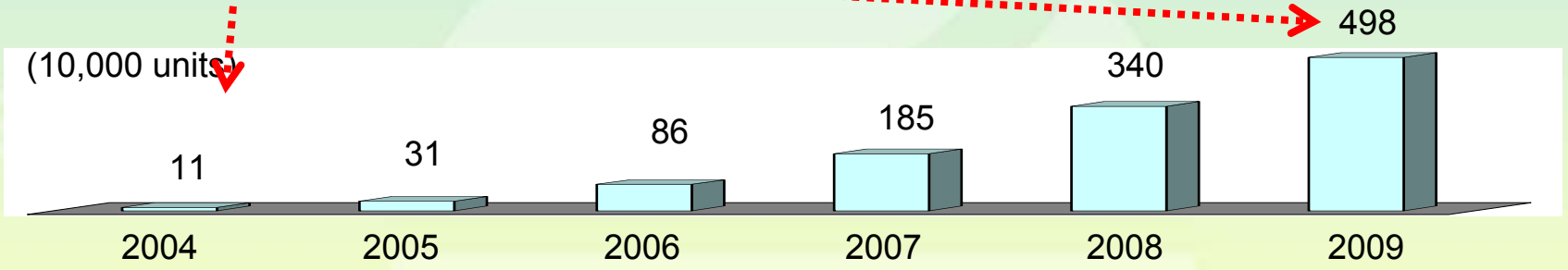
Network	Handset type	commercialization
Wi-Fi	Wi-Fi alone: PC cards, portable	2004~2005
	Dual mode terminal (Cellular & Wi-Fi)	2005
WiMAX	PC cards, portable terminal	2007
Cellular EDGE or 3G	PC cards, portable terminal, communicating PDA	2005

* source: IDATE, Wireless VoIP: What threats to mobile operators?, 2005.

2. Market Prospects(1) - WLAN

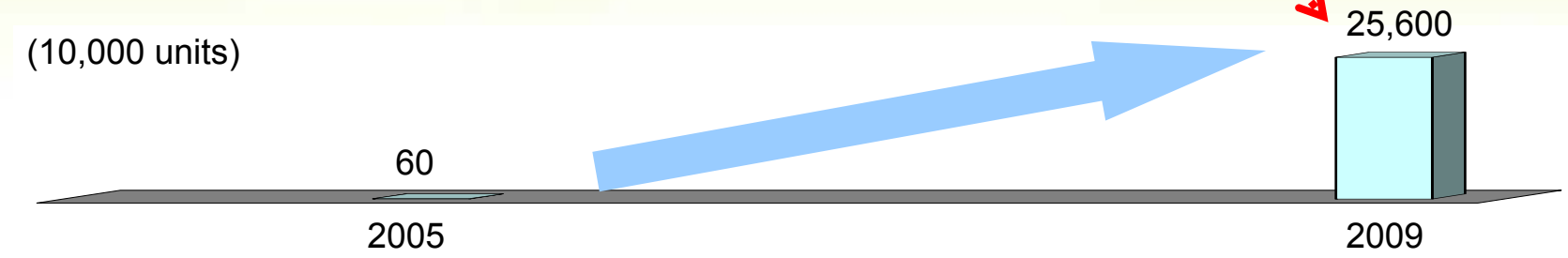
VoWLAN handset shipment prospect (TMRI, 2005)

- In 2004: 110,000 VoWLAN handsets (61.9 million dollars) and 800,000 access points (384 million dollars)
- In 2009: 5 million VoWLAN handsets and 16 million access points



VoWLAN/Cellular combo handset shipment prospect (In-Stat, 2004)

The number of VoWLAN/cellular combo subscribers will reach 256 million by 2009, which represents 12% of the total number of cellular subscribers



2. Market Prospects(2) - WIMAX

Mobile WiMax & bundled VoIP

New WiMAX version will support the mobile network.

- In-Stat(2005) forecast that the WiMAX service will secure 8.5 million subscribers by 2009 and more than **half of the subscribers** to WiMAX will subscribe to the VoIP bundled with WiMAX

WiBro & bundled VoIP in Korea

WiBro has been selected as one of the WiMAX standards

- The number of WiBro subscribers in Korea will be amount to around 9 M
- Accordingly, the number of mobile VoIP service subscribers will be 4~ 5 million in 2011

(10,000 subscribers)

Class	2006	2007	2008	2009	2010	2011
WiBro subscribers[1)]	63	258	545	764	874	922
Bundled VoIP subscribers[2)]	31	129	272	382	437	461

* notes: 1) applying the mean value of the forecasting range

2) assuming that the number of bundled VoIP service subscribers will be half that of the WiBro subscribers referring to the In-Stat/MDR(2005) data

3. Players in Korea(1)

Telecommunication service providers

- **SK Telecom: Korea's first mobile operator**
  - SK Telecom is considering the strategy of combining new functions like the WLAN with the cellular in order to cope with KT's 'Onephone service',
    - However, no specific alternatives were taken against it after when KT's 'OnePhone service' had not been welcomed by the market
  - Additionally, SK Telecom cannot carry out proactive marketing for its mobile VoIP since it is deemed to encroach on the current mobile market.
- **KT group: equipped with both fixed and mobile service capability**
  - The mobile VoIP service at the KT Group level is considered from two viewpoints – it may encroach on the revenues of current mobile phone or secure mobile competitiveness.
- **LG Telecom: the third mobile operator in Korea**
  - Focusing on increasing the number of current service subscribers
  - Planning the mobile VoIP service as low price strategy

3. Players in Korea(2)

Handset manufacturer – Samsung Electronics

- Samsung Electronics already has developed the **Wi-Fi handset** and exported a large volume (including 300,000 to Italy)
- It has also been said to have developed a **dual mode handset** that combines cellular with WLAN
- It is trying to seize the initiative in the world portable Internet business, and has provided its handset for an experimental portal Internet service for the 2006 Winter Olympic Games in Italy

The policy making agency in Korea

- Seeing the VoIP service (in the fixed line communication environment) as a target of regulation
- On the other hand, the agency did not express any specific position with regards to the introduction of VoIP in mobile environment
- However, the agency is seriously reviewing the issue of market promotion and the principle of equity for incumbent mobile operators

4. Current Regulations in Korea(1)

TYPE of Telecommunication Service Providers

Telecommunication service providers in Korea : ① facilities-based telecommunication service providers, ② resale service providers, ③ and value-added service providers.

Facilities-Based Telecom. Service Provider
- Permission
- Permission change or report is required when infra service is added
- Reporting of value added comm. services is not required

Resale Service Provider
- Registration
- Registration change is needed when service is added.

Value Added Comm. Service Provider
- Report
- Report change is needed when service is added

Business Classification	Service Classification
Facilities-Based Telecom. Business - Installs telecom line facility	**Facilities-Based Telecom. Services** ① Phone service ② Leased line service ③ Service that receives frequency allocation and provides it. ④ Internet connection service (high-speed Internet, WLAN and so on) ⑤ VoIP ⑥ Other services
Resale Business - Use telecom line facility from the facilities-based telecom. service providers - Installs telecom facility inside the building	
Value Added Comm. Business - Lease telecomm line facility from the facilities-based telecom. service provider	**Value Added Comm. Services** - Telecom service besides the facilities-based telecom. Services

4. Current Regulations in Korea(2)

Service-related regulation

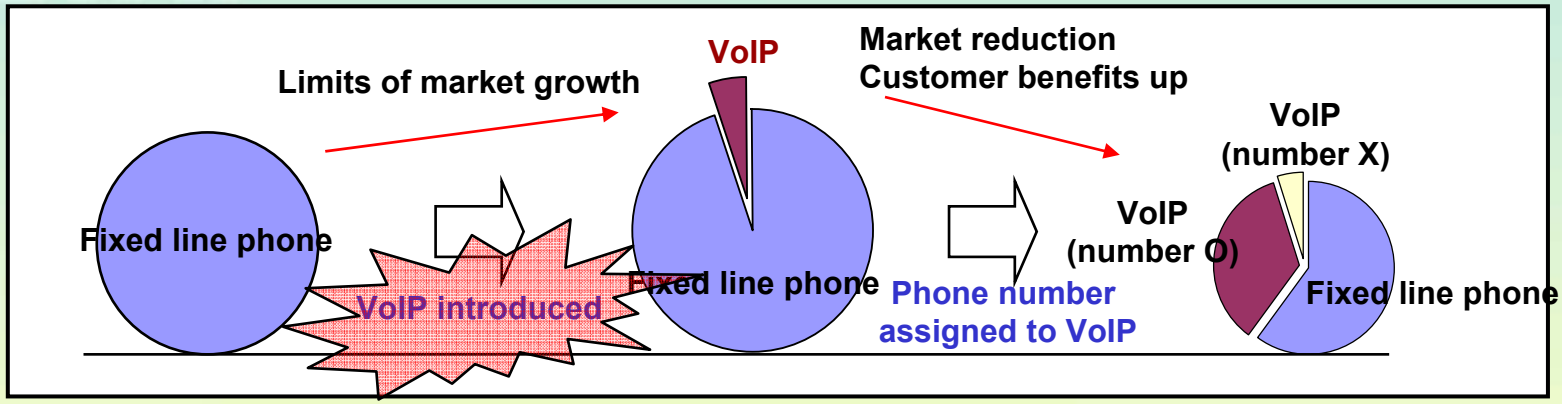
concept and regulation of major services related with the mobile VoIP

Current Service	Concept	Regulation
Fixed line phone	Local/Toll/International telecom service that sends or receives voice using telecom facility.	- Facilities-based telecom. service (phone service) - Universal service (local call)
IMT-2000	- Frequency usage: To provide mobile communication (IMT-2000) - Technology type: IMT-MC type (synchronous) or IMT-DS type (asynchronous)	- Facilities-based telecom. service (service that receives a spectrum allocation and provides it.) - Licensed spectrum (allocation with fee)
VoIP	Sending or receiving voice through Internet, regardless of the coverage area, using the telecom facility. (PC-based Voice communication within VoIP users is not included.)	- Facilities-based telecom. service (VoIP) - Sharing universal service loss - Builds up more than certain level of POI
WLAN	Providing Internet connection, using telecom facility	- Facilities-based telecom. service (Internet connection) - Unlicensed spectrum
WiBro	- Concept: providing high-speed wireless Internet outdoors. - Frequency usage: To provide the WiBro Service - Technology type: IEEE802.16-2004, IEEE 802.16e /Draft3 or later version should be complied with.	- Facilities-based telecom. service (service that receives a frequency allocation and provides it.) - Licensed spectrum (allocation with fee)

4. Regulation Scenarios of mobile VoIP Service(1)

Change of market competition and regulation environment in fixed line phone market(1)

Competition structure and prospect of fixed line phone market



Regulation environment of the fixed line phone market

	Fixed line phone	VoIP (number X)	VoIP (number O)
Competition feature	Posses telecom phone number Top voice quality, high price Business by area	No phone number Poor voice quality, free or low fare Various application services, and no area classification	Telecom phone number Moderate voice quality, low fare Various application services, and no area classification
Regulation Environment	- Hard regulation is applied to the facilities-based commu-nication service provider when licensing it. - Universal service	Excluded from regulation target	- VoIP is designated as an facilities-based communication service - May share the universal service loss - Builds up more than certain level of POI

4. Regulation Scenarios of mobile VoIP Service(2)

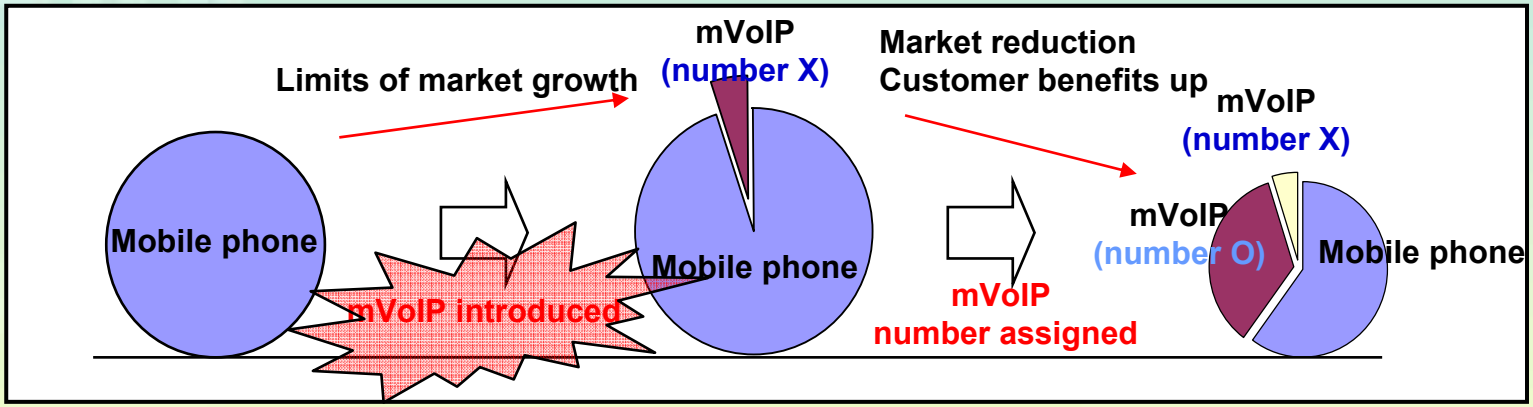
Change of market competition and regulation environment in fixed line phone market(2)

- VoIP, once a complementary goods market of the fixed line phone
  - When VoIP service was first introduced into the fixed line phone market in Korea, it could not compete with the regular fixed line phone in terms of quality and phone number assignment, and VoIP service created a complementary goods market.
- Now a replacement for the fixed line phone
  - Quality improvement and number assignment will provide VoIP service with a viable replacement for the fixed line phone, and therefore the size of the entire market becomes smaller
  - Consequently, the same level regulation applied to the fixed line phone will be applies to the VoIP service

4. Regulation Scenarios of mobile VoIP Service(3)

Change of Possible mobile phone market(1)

Competition structure and prospect of mobile phone market



Regulation environment of the mobile phone market

	Mobile phone	Mobile VoIP (number X)	Mobile VoIP (number O)
Competition Feature	Phone number is assigned Top quality, high price	Telecom phone number is not assigned, Poor quality, free or low fare Various application services	Telecom phone number is assigned Moderate voice quality, low fare Various application services
Regulation Environment	- 2G: pays a contribution after beauty contest, will be switched spectrum allocation fee - 3G business pays spectrum allocation fee - Under hard regulation of the facilities-based communication service provider when licensing it	Possibility of being excluded from regulation target	Discussing on new regulation method applicable to mobile VoIP -" Is technology evolution of current telecommunication service or a new telecommunication service?"

4. Regulation Scenarios of mobile VoIP Service(4)

Change of possible mobile phone market(2)

- Mobile VoIP was also a complementary service market of the mobile phone
  - WLAN version of VoIP service cannot compete with the regular mobile phone market in terms of quality and phone number assignment, and creates a kind of complementary service market, just like in the fixed line phone market
- However mobile VoIP could be a replacement for the mobile phone
  - It is natural that mobile VoIP replace the current mobile phone only if its quality enhances with the number assigned.
  - Consequently, new regulatory issues are arising for the mobile VoIP
  - However the mobile phone environment is different from the fixed line phone because the incumbent mobile operator paid somewhat expensive spectrum allocation fee

4. Regulation Scenarios of mobile VoIP Service(5)

Regulation scenarios

Mobile VoIP (voice over WLAN or WiBro) can be regarded as: 1) technology evolution, or 2) a new telecommunication service. Additionally, each case can be viewed with or without number assignment

	Access to technology evolution or telecom. svc (no number assignment)	Access to technology evolution (number assignment)	Access to telecom. svc (number assignment)
Entry condition	-	In the case of WiBro, it may be possible to recalculate spectrum charges	Behavioral regulation type of the bundled service, but pre price authorization needed
Number assignment	- (uses the mobile phone number) 1)	probably new number (WLAN) 010 possible (WiBro)	070 possible (WLAN, WiBro) 010 possible (WiBro)
Revenue source	WLAN revenue WiBro revenue	WLAN revenue WiBro revenue	VoIP revenue
Quality assurance level	None	Specific quality regulation will be assigned according to the number	Specific quality regulation will be assigned according to the number

* notes: 1) ( ) refers to the case of VoWLAN + Cellular or VoWiBro + Cellular

4. Regulation Scenarios of mobile VoIP Service(6)

Regulation scenarios for the Voice of WLAN

- Case of **technology evolution**
  - VoWLAN **without number** is regarded as a non-regulated service such as PC-to-PC
  - In case of VoWLAN **with number assignment**, specific quality regulation will be imposed

- case of **telecommunication service**
  - Pre price authorization and behavioral regulation type of the bundled service might be applicable,
  - and the number 070, which is currently used by VoIP service, can be possibly assigned

4. Regulation Scenarios of mobile VoIP Service(6)

Regulation scenarios for the Voice of WiBro

- Regulations for the mobile VoIP (VoWiBro) may be similar with the case of VoWLAN

- But in case of mobile VoIP, this service will compete with the mobile service in relation with the area of coverage extending and the quality improving
  - In that case, 010 number is possibly assigned for preventing customers from being confused
  - In addition, spectrum assignment charge could be recalculated in the viewpoint of the principle of equity

5. Summary & Suggestion

- It is natural to launch mobile VoIP service in telecommunication business area
  - For customers, to provide voice services with reasonable cost
  - For fixed–mobile convergence service providers, with new business opportunity
- However, the success depends on the competitiveness of service providers and adoptability from users
- Mobile VoIP (Voice over WLAN/WiBro) can be regarded as: 1) **technology evolution**, or 2) **a telecommunication service**

5. Summary & Suggestion

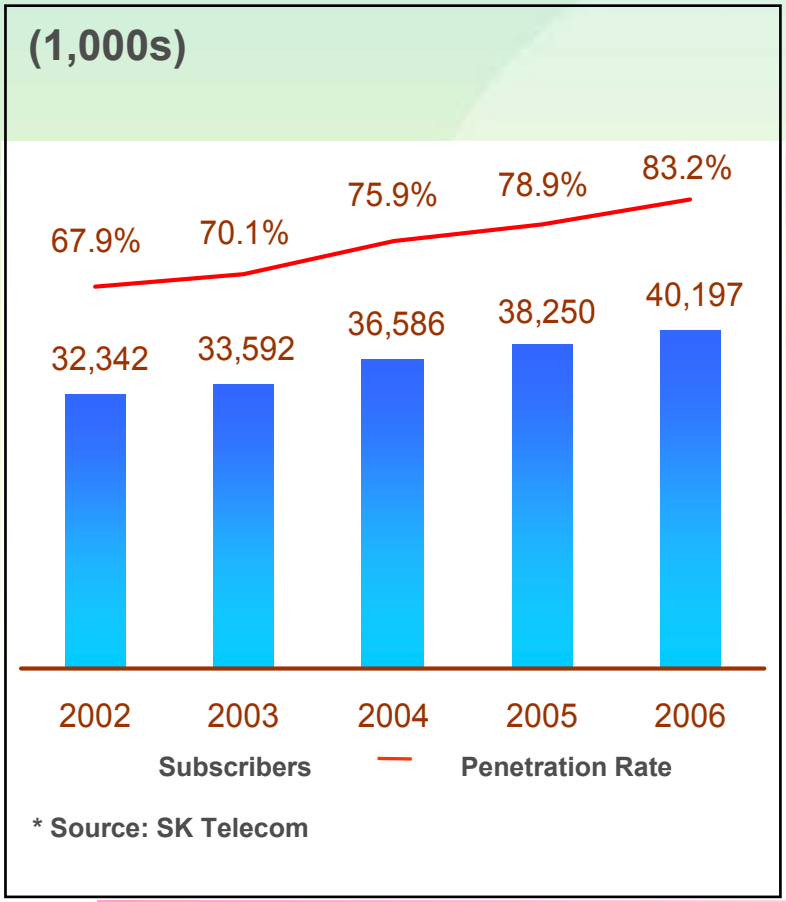
- For better market performance and safe landing of MVOIP
  - **MVoIP should be defined as a technology evolution of WLAN or WiBro**

    - Incentives to invest his network & can do his own differentiated business
  - In addition, **it is necessary to assign '010'number to mobile VoIP service** in order to increase service quality and decrease customers' confusion caused by complicated number system

Epilogue

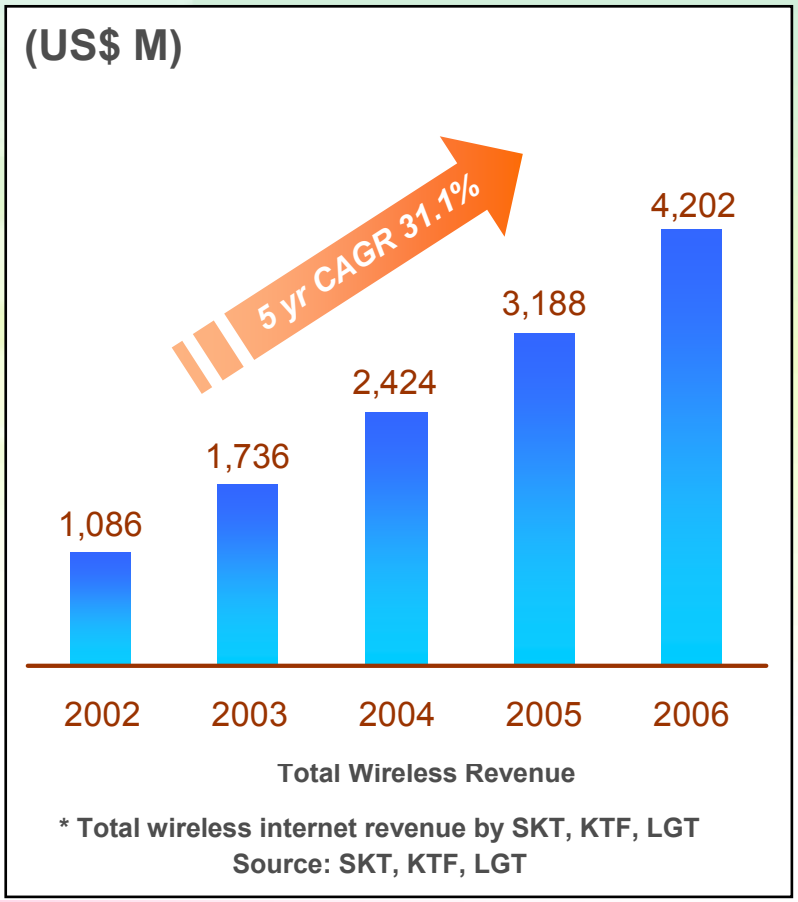
In the end of 2006, >40M people, 83.2% of Koreans are using mobile phones. Wireless internet market has also rapidly increased to US$4.2 billion.

Mobile Market Trend



* Source: SK Telecom

Wireless Internet Market Trend



* Total wireless internet revenue by SKT, KTF, LGT
Source: SKT, KTF, LGT

SK telecom onics and Telecommunications Research Institute

Thank You

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