Realizing Digital Life in Korea: Core Technology and Promotion Policy[1]

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Abstract

South Korea (hereinafter Korea) is leading the world in some forefront IT areas including high speed internet, mobile phones, PC penetration, DRAM, display equipments, internet appliances, set-top boxes, online network games and so on. Especially, with regard to broadband access to the Internet, Korea is by far the leading performer in the OECD area (OECD, 2001). In November 2002, Korea's broadband penetration passed 20 subscribers per 100 inhabitants. The government, however, has been worried about the underutilization of the superb IT network infrastructure. As a possible solution to the problem, the promotion of "digital life" is being examined thoroughly from various points of view. The digital life aims to enrich our daily lives by enabling us to remain connected with communication networks anywhere anytime in order to do anything we want to do from work to entertainment. Considering a worldwide recession in the IT sector and the underutilization of the IT capacity almost everywhere, digital life could be an effective way to promote the IT demand in the market as well as to provide individuals with more convenient and enjoyable life.

In this contribution, we will first provide the definition and reason for the introduction of digital life, and then explain the procedure for deriving core technologies that are essential to make digital life work, and finally suggest short-term and long-term policies to promote the realization of digital life in Korea. The expected impact of digital life on the economy and society will also be discussed in the last part.

Keywords ? **Technology policy, digital life, digital service, core technology, validity analysis, and promotion strategy.**

I.   Introduction

As a result of visualizing success from investing in information technology, IT industry has been recovering from its bubble collapse and regarded as a driving force of national productivity (Digital Economy 2002)[2]. This recovery accounts for IT technology diffusion to traditional industry and applied service sectors. Major concern in the field of information technology has been digitalized since 90's and shifting to high-speed, mega capacity, wide connectivity, and technology diffusion today. In the near future, digital life is expected to rapidly develop through IT technology diffusion to other service-technology sectors (Kim, 2002). Moreover, post IT revolution paradigm will be changing to the concept of "ubiquitous"[3] that means the creation and expansion of the third space through combination between cyber space and physical space (Ha, 2001).

The United States addressed that it needs to stand preeminent in the major field of cutting-edge computing and networking to sustain the world's information technology pioneer. In terms of technology transfer, it also has concentrated on applying information technology to core service areas (such as national defense, Medicare, environment, education, etc.) to satisfy social needs and to enhance the quality of life (NSTC, 2001). Moreover, Europe countries has been trying to reduce its technology gap with the United States and Japan, focusing on enhancing the quality of life through investing in applied technologies such as post-genomic applications, information society technology, nano-technologies, e-business, etc. (EC, 2001). In Japan, the social needs on technology development projects in the national strategic areas have been investigating through technology forecasting to figure out the direction to technology development every 5 year (NISTEP, 2001).

Due to government's proactive IT promotion policies and consistent industrial efforts during last a few years, Korea is now leading the world in some forefront IT areas including high speed internet, mobile phones, PC penetration, DRAM, display equipments, internet appliances, set-top boxes, online network games and so on. Especially, with regard to broadband access to the Internet, Korea is by far the leading performer in the OECD area (OECD, 2001). In November 2002, Korea's broadband penetration passed 20 subscribers per 100 inhabitants.

Despite the past glorious success, Korea's IT industry now faces new challenges. First of all, as the source of value added has been shifting to software and digital content, Korea, which has grown up on the basis of hardware products, is under pressure to change its IT industry structure. Second, the quality of network infrastructure of Korea is judge to be the best in the world, but the utilization rate of the network capacity is far

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[2] The annual average productivity in the United States surged to 2.7% in 2000 from 1.4% in 95, helped by IT diffusion to traditional industry. And also increased to 1.5% in the third quarter of 2001 in spite of economic recession.

[3] IT exists everywhere simultaneously. In other words, communication with plenty of information would be available through broadband entertainment, when "4 Any"(Anytime, Anywhere, Any device, Any network) is realized (NRI, 2002).

from being satisfactory. Third, there has been a criticism that national IT policies have not been oriented toward service users and industrial needs. The taxpayers want the government to spend money in developing technologies to be used for making people more convenient and firms and the public sector more efficient.

In the meantime, rapid expansion of digital convergence triggered by the rollout of the internet is expected to produce a wide range of new business opportunities. The number of internet users and devices connected to the internet has dramatically increased, and large-scale interactive multimedia services are now possible thanks to the rapid deployment of broadband internet. The advancement of mobile communications technology helps us overcome any kinds of geographical obstacles to be online, and fixed-mobile convergence as well as convergence of terminals has also made great progress lately. And, more and more analog content is becoming digital as the demand for information and entertainment is on a continuous increase owing to the diffusion of home networks centering on cyber-apartments. Major IT companies in the world including Intel, Microsoft and HP are trying to capitalize on these technological changes to sustain their continuous growth in the future IT market.

In response to these threats and opportunities, the Korean government determined to push forward with a digital life plan. When digital life is realized, people will be able to relish the fruit of IT development. Furthermore, since digital life will also lead to more innovative and efficient firms and public services, IT will continue to act as a core infrastructure for the advancement of the Korean economy and society.

In this contribution, we will first provide the definition and reason for the introduction of digital life, and then explain the procedure for deriving core technologies that are essential to make digital life work, and finally suggest short-term and long-term policies to promote the realization of digital life in Korea. The expected impact of digital life on the economy and society will also be discussed in the last part.
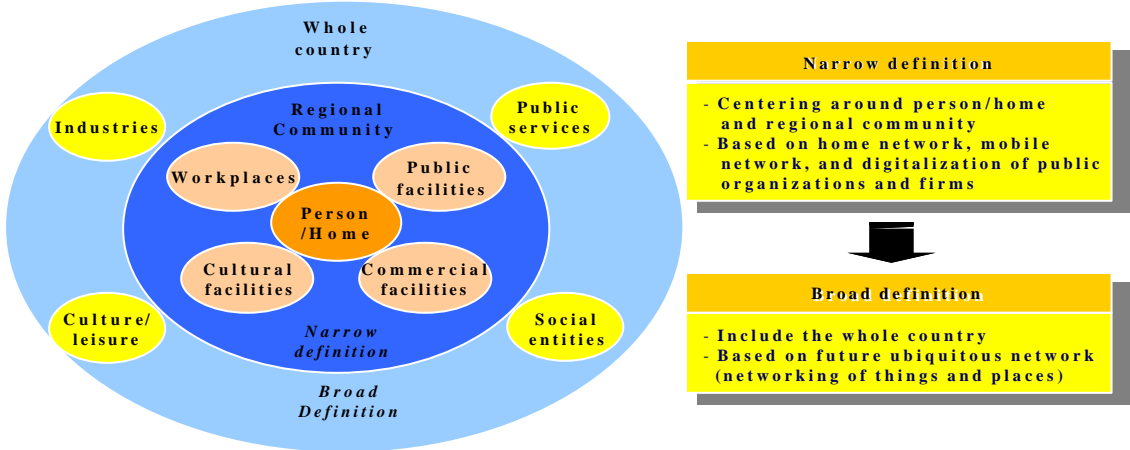
The scope of digital life

(Figure 1) The Scope of Digital Life
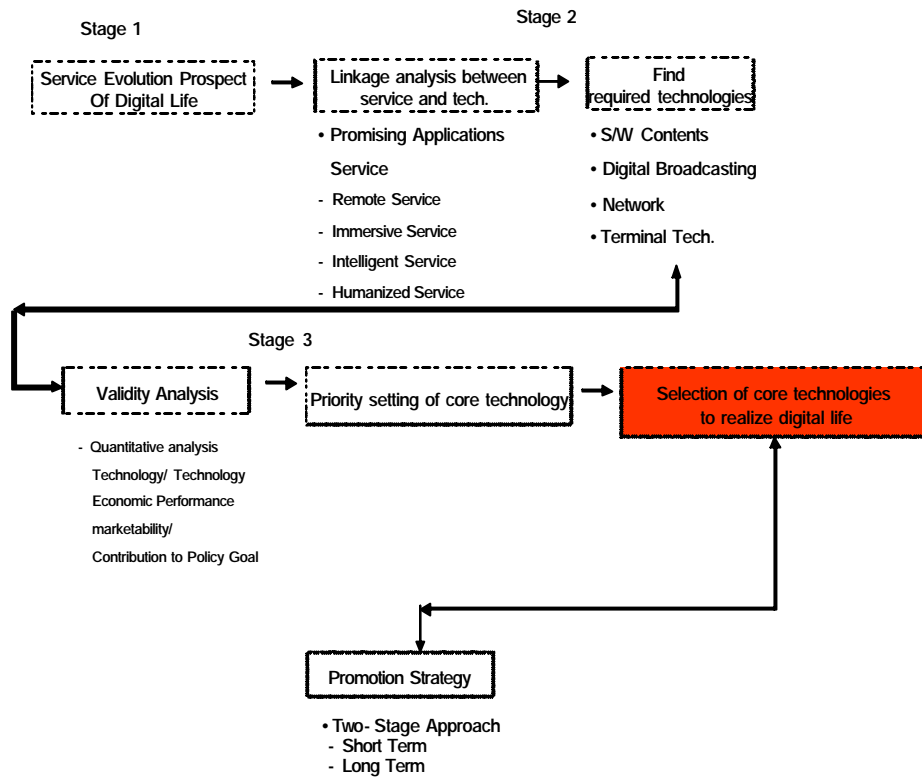
II. The Concept of Digital Life

The goal of digital life is to allow all people to enjoy more convenient, safer, happier and productive lives by enabling them to remain connected with networks anytime, anywhere and with any devices. For this purpose digital life first needs to come true centering on people and home based on home network, mobile network and digitalization of public organizations and firms in regional communities like large cities. As the reach of networks is expanded to less densely populated areas, small cities and towns and regional industrial complexes through the deployment of ubiquitous network in the future, the whole country will be connected online and then genuine digital life is going to be accomplished. At this time human being will feel ubiquitous as they can connect to anyplace to conduct any transactions regardless of where they are, at home, at work or on the move.

There may be four requirements for digital life to be seen as effective. First, it should support all kinds of people in their daily lives from children, senior citizens and housewives to people with disabilities. Second, it should involve various aspects of human life such as purchasing, entertainment, leisure, communication, learning, health care, work and mobility, to name a few. Third, to ensure that people can connect networks anytime, anywhere and with any devices, we need a broad range of technologies to provide seamless connection between different kinds of network, easy interface between human and machines and free data exchange among devices. And, fourth, to enrich everyday lives of citizens, it is necessary to improve past inconvenient life processes as well as to invent new services that people have never experienced before, for example, automation of simple repetitive housework, personalized information services and realistic home entertainments.

Digital life will require the following physical IT infrastructure: first, smart devices that can think and are connected to the internet, second, user interface to provide easy and convenient use of devices and services, third, home/office networking to connect everyday objects so they can become more convenient to use, fourth, broadband internet access, whether wired or wireless, working to bring you the World Wide Web faster and easier, and fifth, enhanced digital broadcasting combining the storytelling of television with the interactivity of the Web.

The realization of digital life will give people a lot of benefit in their everyday lives. The following are some of the examples: first, home automation and remote services will make home and social life more convenient, safer and more economical, second, resources will be used more efficiently because digital content is shared between multiple devices and one device deals with various content formats at the same time, third, we will be able to connect anyone with diverse digital devices, anywhere and anytime, fourth, digital home entertainment with large-scale interactive multimedia will lead us to a new level of excitement, and fifth, more flexible business processes will be introduced among firms with the spread of tele-working and mobile office services.

This paper consists of five chapters. The first chapter is the introduction. The second chapter describes the definition and reason for the introduction of digital life. The third chapter explains the procedure for deriving core technologies that are essential to make digital life work. The fourth chapter suggests short-term and long-term policies to promote the realization of digital life in Korea. The conclusion in Chapter 5 presents a summary of this study and the expected impact of digital life on the economy and society.

Stage 1

Service Evolution Prospect
Of Digital Life

Stage 2

Linkage analysis between
service and tech.

Find
required technologies

• Promising Applications
  Service
  - Remote Service
  - Immersive Service
  - Intelligent Service
  - Humanized Service

• S/W Contents
• Digital Broadcasting
• Network
• Terminal Tech.

Stage 3

Validity Analysis

Priority setting of core technology

Selection of core technologies
to realize digital life

- Quantitative analysis
  Technology/ Technology
  Economic Performance
  marketability/
  Contribution to Policy Goal

Promotion Strategy

• Two- Stage Approach
  - Short Term
  - Long Term

(Figure 2) Selection Process of Core Technology for Digital Life

III. Derivation of Core Technology for Digital Life

Technology development to deploy digital life makes people's life comfortable and makes people enjoy various life styles. It also provides the enhancement of productivity and efficiency to the overall sectors of industry and government. When we consider selecting core technologies to realize digital life, it is not easy to forecast various kinds of services of digital life because digital life is not tangible at this present. Moreover, the selection process has many criteria to consider. The process can be divided into 3 stages as follows:

A.   Service Evolution Outlook of Digital Life (Stage 1)
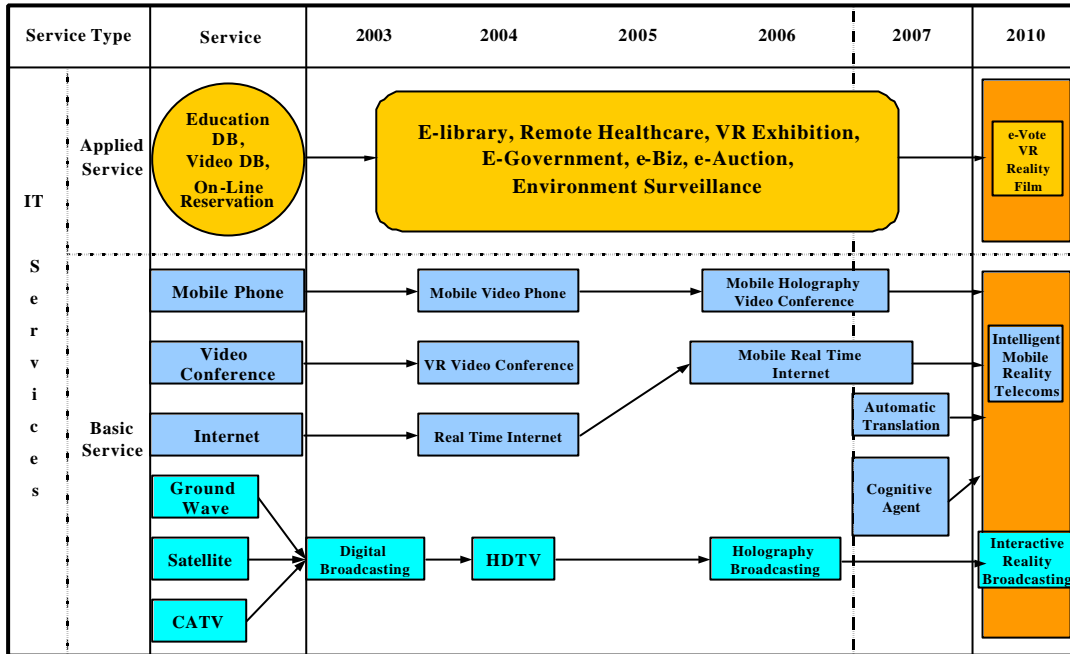
(Figure 3) Service Evolution Outlook of Digital Life

Before selecting core technologies, we need to figure out what digital life looks like in the future. In view of home digital life, people will enjoy various contents based on high quality of HD (high density) TV any time, anywhere, and with any device because home utilities (telecommunications, home appliances, broadcasting, and terminals) will be connected to wired/wireless network. Home digital service that means control management of home appliances, home edutainment, and cyber office will be available around 2010. Under any network environment, people will be open to use integrated information terminals to enjoy the high quality of contents that utilize computer graphic technology in virtual reality. Moreover, service provider will provide intelligent web services (that is available to connect to other systems) with users who have various needs.

Furthermore, digital life will make big contributions at the level of business. Company will not only maximize its productivity and transparency, but also expand market and cut its cost when business activities connect to purchase, production, and marketing through e-business. In addition, all public service will be on-line when e-government is realized by 2010.

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B.   Linkage Analysis between Services and Technology (Stage 2)

Table 1. Types and examples of digital services

Type of services	Examples of Services		
	Based on networking	Based on S/W and contents	Based on user interface
Remote Services • Overcome Time/Distance /Place • Seek Automation	- Remote Home Control - Remote Metering - Remote Collaboration - Remote Environment Monitoring - Tele- working - e- Government	- e- Learning - Tele- Medicine - Electronic Voting	
Realistic Immersive Services • Virtual Reality • Seek Realistic Entertainment	- VOD based on TV - Video Public Phone - TV Conference - 3D Telephone - Reality Video Conference	- Immersive Reality Gaming - 3D TV - Virtual Exhibition/ Library/ Zoo/ Travel - 5- sense based entertainment	- Multimedia recording telephone in absence - Multimedia terminal in shape of glasses
Intelligent Services • Customized/Personalized • Seek Information		- ITS(Intelligent Transportation System) - Personalized EC - Intelligent Office/Shopping/ Broadcasting - Intelligent Information Search - Electronic Secretary - Location based service - Automatic Translation Service - Intelligent broadcasting	- Smart home appliances Appliances - Intelligent Robot for Home
Humanized Services • Seek Simplicity/Convenience		- Translation Telephone - Bio- Authorization	- Voice/media/situation recognition - Communication using the five senses - Human- body sensing - Wearable Terminal

As a next step to get the future direction of promising applications services to realize digital life, technology committee members[4] derived remote service, immersive service, intelligent service, and humanized service in the field of networking, s/w, terminal, and user interface. By utilizing linkage analysis between service and technology required technologies were also selected under 4 major technology areas such as s/w and contents[5], network, terminal, and digital broadcasting technology.

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[4] Technology committee members consists of ten inside experts (ETRI) and ten outside experts[industry(5), universities(3), research institutes(2)] in the field of s/w contents, digital broadcasting, wireless telecommunications, and networking.

[5] includes information process tech., user interface, and platform.

<Table 2> Promising Applications Services to Realize Digital Life
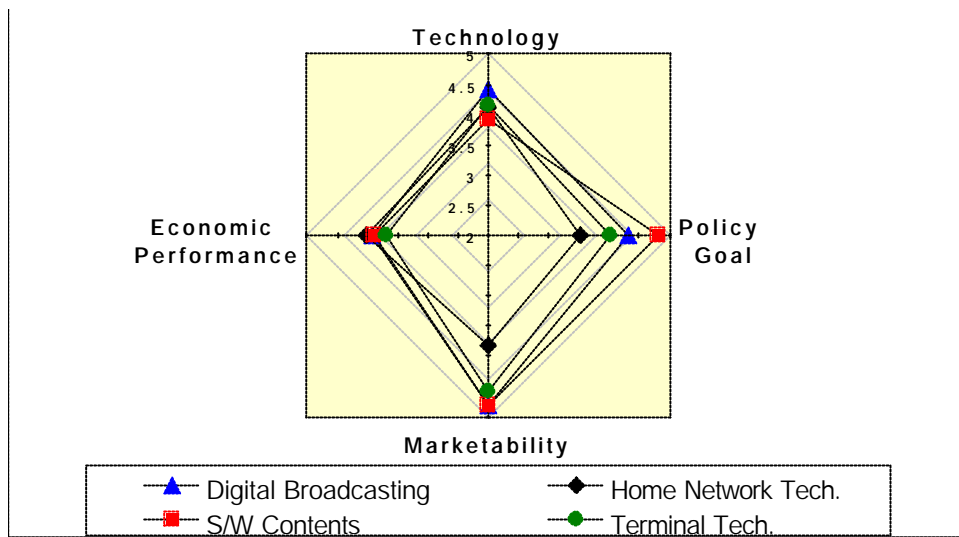
Type of Services	Required Technologies
Remote Service	- Soft Switch, NGN-OSS, DWDM, Optical packet switching, High Speed Packet Wireless Transmission, Wired/wireless LAN, Wired/Wireless Home Network, Adhoc Network Tech. IPv6 Network, Network Integration, Network QoS Tech., Mobile network system, HSDPA modem, Satellite communicat ions, Broadband, Network Security, GRID - Content production/editing/DRM/distribution.service, High-performance compression/ restoration, Real-time distributed processing, Real-time OS, Component S/W, Human-body information processing
Immersive Service	- Game Engine, Computer Graphics, Virtual Reality, Imaging Processing, Large -scale multimedia data processing, Voice Creation and Processing, Holography, Five Senses processing, Realistic Display
Intelligent Service	- Artificial intelligence, Automatic translation, Intelligent agent, Robot, Data fusion/mining, Inquiry/answer, Personalization, GPS/GIS, ITS(Intelligent Transportation System), Location/situation recognition, M -to-M interface, Control middleware - EC platform, Electronic money/payment system, Real-time security, User authentication, Smart card - Intelligent broadcasting, Mobile transceiver, Realistic broadcasting, Broadcasting content production, Real-time streaming
Humanized Service	- Natural language processing, computer vision, Virtual reality interface, Human -body information recognition - Wearable terminal, Intelligent terminal, Terminal for moving vehicle, Subminiature computer, Virtual terminal, High-density storage, High-definition display, Subminiature/long-life power source, Subminiature sensor, Communication devise for human-body information

C. *Validity Analysis and Priority Setting (Stage 3)*

Technology committee members performed validity analysis [6] to all required technologies as a quantitative method to derive core technologies to deploy digital life. To evaluate internal and external technology attributes, the total of 4 factors was considered as follows: technology, technology economic performance, marketability, and contribution to policy goal. First, evaluation criteria for technology are technology development potentiality, the degree of possession to core technology, and technology difference[7]. Second, technology economic performance pertains to adequate time and cost for technology development. Third, marketability is the degree of market growth and market size after required technology is commercialized to the market. Fourth, contribution to policy goal can be defined as the degree of contribution to technology development service visions performed by government.

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[6] For evaluation, 5 point scale method was employed. 5: extreme high, 4: high, 3: median, 2: low, 1: very low

[7] Technology committee members put more weight on technology development potentiality (0.4) than any other factors (0.3).

(Figure 4) Validity Analysis to Core Technology

Generally speaking, expert group considered marketability as the most important criterion because major goal of technology development for digital life is deeply involved in service providers who give customer high level of digital service. As for s/w contents, the values of marketability and contribution to policy goal are higher than technology and technology economic performance. This result suggests that we recognize the importance of s/w technology, but the efficiency for technology development is low because technology difference is too high. On the other hand, the values of terminal technology and home network technology are high in the sector of technology because the degree of possession to core technology is relatively high.

<Table 3> Core Technologies and Priority Setting for Digital Life

Tech. Areas	Target Tech.	Evaluation				Results	Ranking
		Tech.	Tech. Economic Performance	Marketability	Policy Goal		
Network Technology	- WLAN	4.4	4	4	4	4.1	1
	- Home PNA	4.2	4	3	3	3.6	2
	- Home RF	2.3	2	2	2	2.1	3
S/W and Contents	- Voice Cognition	4.7	5	5	5	4.9	1
	- Contents Management Tech.	4.1	5	5	5	4.8	2
	- Game Engine	4.1	4	4	5	4.5	3
	- e-biz Platform	3.5	4	5	5	4.4	4
	- Web Service	3.5	4	5	5	4.4	4
	- Computer Graphics	3.8	3	5	5	4.2	6
	- Real Time Information Security Tech.	4.4	3	4	4	3.9	7
	- Virtual Reality	3.5	3	4	4	3.6	8
	- Artificial Intelligence	3.1	3	4	4	3.5	9
Terminal Technology	- Home Server	4.52	5	5	5	4.9	1
	- Wearable Information Terminal Tech.	3.64	3.57	5	4	4.1	2
	- Embedded Software	3.93	4	4	4	4	3
	- Home Gateway	4.25	2.5	3.7	3	3.4	4
	- Hologram	2.8	2	2.6	3	2.6	5
Digital Broadcasting Technology	- Intelligent Integrated Broadcasting	4.2	3	5	5	4.3	1
	- Intelligent Broadcasting Terminal	4.28	2.6	5	4	4	2
	- Broadcasting Contents Production Tech	4.7	3	4.3	4	4	2

Interestingly, we found that s/w and contents technology area was considered more important than any other fields because it is crucial technology for digital life. Given 20 core technologies to be evaluated, we obtained

top four from each 4 technology area. The result shows that home server (4.9) and voice cognition (4.9) are the first priority. Next priority selection was made in the order of contents management technology (4.8), game engine (4.5), e-biz platform (4.4), web service (4.4), and intelligent integrated broadcasting technology (4.3). Finally, technology committee members made consensus to select 20 core technologies for digital life under 4 major technology areas.

IV.   Policies To Promote the Realization of Digital Life

There needs to be two-stage approach in implementing digital life. In the short run, it is demanded to digitalize person, home and all the social organizations and to create a market for products and services relating to digital life at the same time. In the long run, a close coordination is essential between strategies for bringing digital life to people and for deploying ubiquitous network around the country.

First, digitalization of person is achieved through portable devices and enables people to access any networks and services anytime and anywhere. For this purpose all networks are needed to be integrated and devices to be smarter, smaller and convergent. Second, home will be digitalized through home networking which connects all kinds of appliances at home including computers, consumer electronics, audio visual devices and security devices. A concerted effort is required among the government, Telcos, home appliances makers and construction companies to boost the rapid deployment of home networks. Third, all the social organizations are to be networked from governmental organizations and large firms to SMEs, SOHOs, not-for-profit organizations, regional groups and so on. This will accelerate the transition of regional communities into virtual ones. In this process, government will play a very important role through its informatization support initiatives like SOHO Networking Support program and Firm Informatization Support Program, to name two. Fourth, digitalization of public services is expected to trigger the diffusion of digital life. In the beginning public expenses are necessary to create a new market for firms involved in providing digital life equipments and software. Priority areas for digitalization among public services will be determined according to social needs and economic impacts, and some of them are security, energy, transportation, environment, learning and health care. Then, revenues from this early market will be reinvested both in the development of a diverse range of more attractive digital services and in lowering the service prices.

By the year 2010 ubiquitous network will be fully deployed to comprise things and places as well as people and social organizations. Advanced countries like the USA and Japan are also making efforts to develop peta-bit computers and optical networks which are core elements of ubiquitous network. Therefore, in preparation for the ubiquitous networking and computing age, Korean government will devote its R&D resources to developing technological capabilities in key areas like software, components, systems, sensor, system-on-a-chip, high performance computing, user interface, artificial intelligence, virtual reality and bio/nano technology.

V. CONCLUSION

This paper makes some contributions as follows: Firstly, we introduced and set up the concept of digital life. Secondly, 20 core technologies for digital life were derived in the framework of linkage analysis between service and technology. The result showed that home server (4.9) and voice cognition (4.9) were the first priority. Next priority selection was made in the order of contents management technology (4.8), game engine (4.5), e-biz platform (4.4), web service (4.4), and intelligent integrated broadcasting technology (4.3). Thirdly, policies to promote the realization of digital life are implemented by two-stage approach. In the short run, it is demanded to digitalize person, home and all the social organizations and to create a market for products and services relating to digital life at the same time. In the long run, a close coordination is essential between strategies for bringing digital life to people and for deploying ubiquitous network around the country.

The success in realizing digital life will have enormous virtuous impact on the national economy and society. At the individual and home level, people will enjoy more convenient and joyful lives than before. Remote control and services enabled by networking and digitalization will save users time and energy, allowing them expanded leisure hours and learning opportunity. This benefit is anticipated to lead to improved lifestyle, self-development and enhanced quality of life.

At the firm and industry level, digital life will increase network traffic and demand for digital content, and open a new market for digital services and products, resulting in higher utilization rate of high speed internet and plenty of new business models. It will also have significant influence on other traditional industries: first, an expansion of IT industry will induce a demand growth in other related industries, second, there will emerge new kinds of industries by combining IT with other technologies such as bio-technology, nano-technology or environmental technology, and third, IT will be used to enhance industrial productivity through business process restructuring and real-time remote collaboration.

Finally, at the national level, digital life will contribute to innovating the public sector to provide more quality services. People will be able to deal with civil affairs at home through digital government services and live in a more pleasant environment by monitoring pollution and contamination automatically. In sum, digital life will play a pivotal role in bringing about continuous growth of IT industry, heightening of quality of life, environment preservation and enhancement of competitiveness of all sectors in Korea.

REFERENCES

[1] Jungmann Lee, "A Service-oriented Mid Term R&D Planning in Korea: Mobile Telecommunications Technology Case", Proceedings of ITS 14th Biennial Conference, 2002. 8.

[2] Jungmann Lee, Changi Nam, and Gil-Hwan Oh, "Generation and selection of core technologies to realize IT everywhere and IT inside: The wireless technology case", Korea Institute of Communication Sciences, Vol. 28, Jan. 2003

[3] Kiyong Om, "Policies To Promote the Realization of Digital Life", Working Paper of ETRI, 2002.12.

[4] MIC, Mid-Long Term IT Technology Development Strategy, 2002. 10.

[5]   Nomura Research Institute, Ubiquitous Network and Market Creation, 2002.

[6]   OECD, The Development of Broadband Access in OECD Countries, Organization for Economic Cooperation and Development, 2001.

[7]   W. K. Ha, D. H. Kim and N. H. Choi, Ubiquitous IT Revolution and A Third Space, Korean Electronic Times, 2002.

[8]   http://cooltown.hp.com/

[9]   http://research.microsoft.com/easyliving/

[10] http://www.intel.com/labs/diglife/