

Case Study on Convergence Strategies of High-Technology Companies

Dong-Sung Cho* · Sang-Wuk Ku**

ABSTRACT

This paper predicts the convergence strategies of high-technology companies by analyzing current convergence strategies and business sector trends in network IT value chain.

Digital convergence and diversification (e.g., Penrose, 1959; Ansoff, 1965; Markides, 1995; Fey, 2000; Montgomery, 1994) in this paper can be defined as the strategies that high-technology companies diversify their businesses to other related business sectors (e.g., Hill and Hoskisson, 1987) in network IT value chain. Network IT value chain is composed of 6 business sectors which are core component, hardware, software, network, content, and service.

We analyze the 6 companies as cases of high-technology companies such as Intel, Sony, Nokia, Microsoft, SK Telecom, and Yahoo.

This paper is composed of 5 chapters as follows: Chapter I shows the outline of the paper. This chapter specifies research background, objectives and scope. Chapter II analyzes current convergence strategies of 6 companies. Chapter III shows the prediction of business sector trends in network IT value chain. This chapter includes major streams of business sectors and their predicted strategic pathways. Based on the implications of the analysis of current convergence strategies and the prediction of business sector trends, chapter IV predicts the convergence strategies of 6 high-technology companies. Finally, we compare the current strategic positions with the future positions in the perspective of the degree of diversification.

Key words : convergence strategy, network IT value chain, mechanism-based view

< contents >

- I . Introduction
- II . Analysis of Current Convergence Strategies

<REFERENCES>
<ABSTRACT>

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I. Introduction

1. Research Objectives

How does convergence in network IT value chain (Figure 1) matter strategically for global high-technology companies? This question is increasingly prominent throughout the holistic market and is expressed along two dimensions: first, the strategic implication of convergence across business sectors for global high-technology companies; second, the importance of convergence strategic drivers on the degree of convergence to full expansion in the network IT value chain.

We consider convergence and diversification as strategies with a wide international diffusion. Even though diversification has been studied for a long time, very few studies on convergence has been studied as a new paradigm on diversification in high-technology industry.

The aim of this study, therefore, is to show the correlation between convergence in network IT value chain and the intention of diversification of global high-technology companies. As such, this convergence study is unique in combining both diversification and technological innovation in network IT value chain.

2. Research Scope and Outline

The study was conducted in three stages. In the first stage, we analyze the current convergence strategies. In the second stage, we predict the business sector trends by analyzing their major streams to apply its implications on the next stage. The third stage, we predict the convergence strategies of high-technology companies based on the analysis of the previous analyses.

The high-technology companies as cases in this paper include Intel, SONY, Nokia, Microsoft, SK Telecom, and Yahoo. We showed the degree of diversification to full expansion of convergence in network IT value chain. Finally, we proposed future research agenda on the prediction of convergence strategic pathways. To identify the driving forces of diversification, the convergence strategic drivers would be categorized and analyzed in the mechanism-based view (Lee and Cho, 1998).

3. Terminologies

1) Digital Convergence

The pattern of changes in overall industries as well as telecommunications industry has been characterized

by the segmentation of prominent technologies, the phenomenon of technological convergence, the product convergence in high technology industry, and the industry convergence.

The convergence between information and communication technologies brings the digital electronics revolution and generated transformations in telecommunications hardware. The phenomenon of technological convergence can be characterized by four major factors such as all types of information, broadcasting signals, packet switching technology, and transmission protocol. The product convergence in high technology industry is done by three different ways such as convergence of voice, video and data applications; convergence of service providers; and convergence of customer premises equipment (Katz, 1996; Sears, 1996). As semiconductors and telecommunications are developed, the industry convergence means that traditional industry firewalls are broken due to the convergence of applied technologies and product functions and the emergence of identical customers to overall industries.

2) Network IT Value Chain

The components of the network IT value chain are the content itself, the application and middleware software that facilitate content distribution, the media outlets that aggregate the content for the consumer, the carriage that provides the medium to deliver the content and the hardware that present it to the user.

In the business sector of content, with the advent of the Internet, content was transformed. However, consumers were demonstrating that they would not pay for content with the exception of pornography.

In the business sector of software, this sector of the value chain is faced with a combination of proprietary and industry standard software. In the short term, no one company or standard will win out as the software today is still content and appliance dependent.

In the business sector of network and access, until the advent of the Internet, carriage was a minor element of the network IT value chain. There were only cable, over-the-air broadcasts and some satellite broadcasts. Telecommunications carriers had the xDSL technology available, but were restrained to come to market for fear of cannibalizing existing revenue.

In the business sector of hardware, one of the paradoxes of content convergence is that there will be convergence in the industry, but with appliances there will be an ever-increasing supply of specialized devices. Within the hardware value chain link there are the following three primary categories: computing, entertainment and communications.

In the business sector of content, content has been positively and negatively impacted by content convergence, specifically the Internet. Even with the dot-com demise there still remain a number of content

paradoxes as follow. When content has physical mass, consumers will pay for it, but in its digital format consumers are unwilling to pay. If the demise of the dot-com had any positive outcome, it was in the area of content. The dot-com crash will cause new more rational revenue models to evolve for content distribution on the Internet.

The Internet is a personalized medium and will accelerate this specialization and fragmentation. The Internet has changed that; there are no boundaries. This lack of boundaries will have the greatest impact on consumers and world cultures. The network IT value chain will be impacted by more digitization of content and the ever-increasing use of new media, carriage, and appliances.

Core Component	Microprocessor		Wireless components	Memory		Other components	
Hardware	TV/STB	Mobile terminal	PC	PDA	Game console		Home appliance
Software	Operating system		Wireless platform	Middleware		Application	
Network	xDSL		Cable & Satellite		Wireless		
Content	TV programs		Music	Movie		Games	
Service	Commerce		Access provision	Content aggregation & provision		Search	

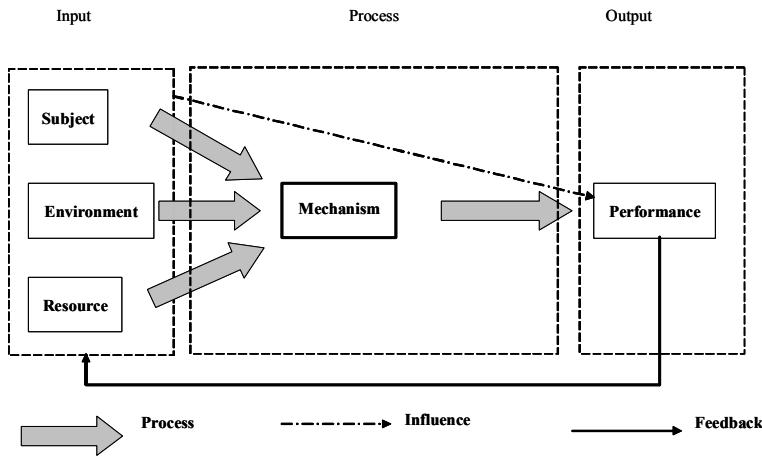
[Figure 1] Network IT Value Chain

4. Mechanism-Based View

According to figure 2, a mechanism has basic elements of subject, environment and resource. These basic elements are subject, environment, and resource.

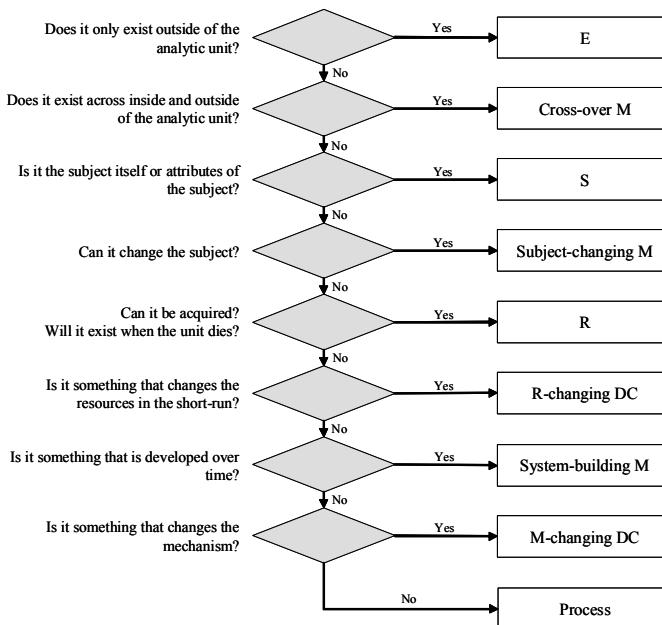
The composition elements of a mechanism can be comprised of composition of resources, sequence of resource allocation, and timing to transfer to each phase. One thing we should understand here is to understand a mechanism does not have the characteristics of rareness, imitability and non-substitutability. That is, a mechanism is a neutral element not to influence on differentiated resource value.

The central attributes of the mechanism are coordinating, learning and selecting. The coordinating mechanism is the process by which the subject utilizes resources in response to environmental changes. This coordinating mechanism is evolved through learning processes, and only the fittest is selected in the long run. The selection of a mechanism by the environment is due to the self-destructive nature inherent in the learning process.



[Figure 2] Conceptualization of MBV by Dong–Sung Cho, 2004

According to figure 3, we can classify strategic factors into subject, environment, resource, mechanism, dynamic capability (Eisenhardt and Martin, 2000; Makadok, 2001; Teece, 1997; Zollo and Winter, 2002), and process (Van de Ven, 1992; Cho, 2004) to analyze the effects of specific mechanisms on firm performance.



[Figure 3] Flow chart for distinguishing S, E, R, and M by Dong–Sung Cho, 2004

II. Analysis of Current Convergence Strategies

1. Case Studies

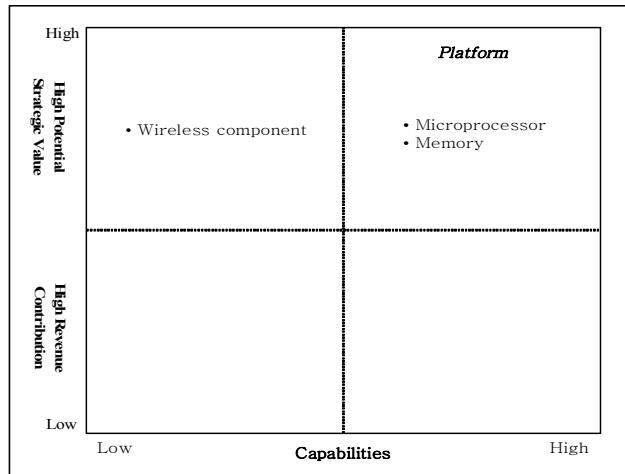
1) Intel

Intel's business platform is core component development for PCs, PDAs and mobile terminals. Intel is highly capable of delivering innovative components for PC and PDA markets, while it is trying to develop same capabilities for the wireless component market. Intel has built business platform around microprocessor¹⁾ and memory by leading processor technology. Intel has been attempting to gain market share in GSM²⁾ wireless component market. Intel holds remarkably strong position and is developing products to keep its leading position in the PC component market. Since most of Intel's customers are business corporations/enterprises, it has few content or service features. Intel has relationships with PC and PDA manufacturers to supply core components and has built partnerships for joint new product development (Dougherty, 1995; Cooper, 1993; Montoya-Weiss and Calantone, 1994; Cooper and Kleinschmidt, 1993; Song and Parry, 1997; Zirger and Maidique, 1990) efforts. Intel provides processors to most PC manufacturers. Intel Capital, a subsidiary of Intel, invests in promising technologies for potential synergies with Intel product development efforts. Intel Communication Alliances is a community of communications and embedded developers and solutions providers for convergence of computing technologies. Intel's core competencies lie in its industry standard technology, ability to bundle new components into existing package and strong customer base. Intel also participates in software business section with Compilers, VTune analyzers and performance library which are useful to maximize application performance.

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- 1) In the world of personal computers, the terms microprocessor and CPU are used interchangeably. At the heart of all personal computers and most workstations sits a microprocessor.
 - 2) GSM (Global System for Mobile Communications), is one of the leading systems. GSM uses narrowband TDMA, which allows eight simultaneous calls on the same radio frequency. GSM was first introduced in 1991. As of the end of 1997, GSM service was available in more than 100 countries and has become the de facto standard in Europe and Asia.

Core Component	Microprocessor		Wireless components	Memory		Other components
Hardware	TV/STB	Mobile terminal	PC	PDA	Game console	Home appliance
Software	Operating system		Wireless platform	Middleware		Application
Network	xDSL		Cable & Satellite		Wireless	
Content	TV programs		Music	Movie		Games
Service	Commerce		Access provision	Content aggregation & provision		Search

[Figure 4] Intel's diversification in Network IT Value Chain



[Figure 5] Intel's business platform

2) SONY

SONY participates in core component, hardware, content and service sectors in Network IT value chain. Business platforms include highly capable hardware gateways³⁾ (Wega, Vaio, Clie and PlayStation), content (music and movie) and game content aggregation & provision. SONY has businesses in semiconductor and xDSL⁴⁾ access through Sonet in Japan & Southeast Asia. JV with Ericsson to develop mobile terminals lacks

3) In a communications network, a network node equipped for interfacing with another network that uses different protocols.

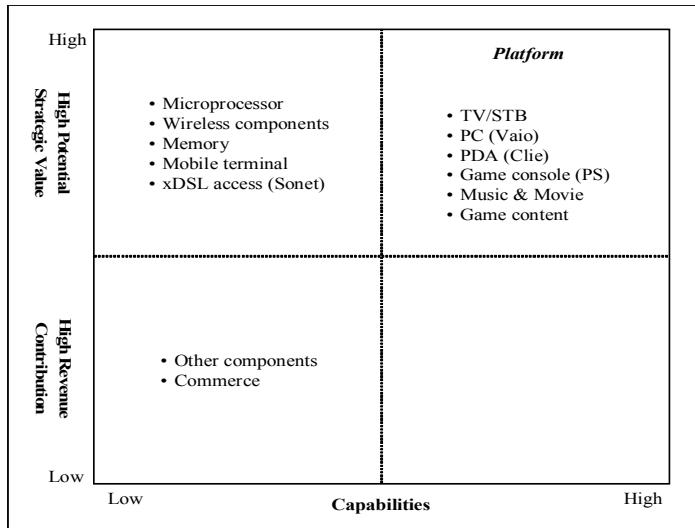
4) DSL (Digital Subscriber Line). A technology that dramatically increases the digital capacity of ordinary telephone lines (the

marketing and technological capabilities. SONY runs an on-line shopping mall for its products as well. SONY also provides financial services such as life insurance, credit card and banking in the local market.

[Figure 6] SONY's diversification in Network IT Value Chain

Core Component	Microprocessor		Wireless components	Memory		Other components
Hardware	TV/STB	Mobile terminal	PC	PDA	Game console	Home appliance
Software	Operating system		Wireless platform	Middleware		Application
Network	xDSL		Cable & Satellite	Wireless		
Content	TV programs		Music	Movie		Games
Service	Commerce		Access provision	Content aggregation & provision		Search

[Figure 6] SONY' s diversification in Network IT Value Chain



[Figure 7] SONY' s business platform

local loops) into the home or office. DSL speeds are based on the distance between the customer and telco central office. There are two main categories. Asymmetric DSL (ADSL) is for Internet access, where fast downstream is required, but slow upstream is acceptable. Symmetric DSL (SDSL, HDSL, etc;) is designed for connections that require high speed in both directions.

SONY is dominant in key products and services with high market attractiveness and is trying to hold its market leadership for attempting to stop erosion in position by investing just enough to compensate for competitive forces. Its business model is based on distribution of rich proprietary content through SONY devices to young adults. SONY classifies its global customers into five segments: affluent, CE alpha (early adopters), families (35-50), Gen Y (under 25) and young professionals-DINK (25-34). Teens and college students, sub-segments of GenY, are of critical importance to SONY's strategy to engender brand loyalty and build-off comprehensive consumer database to initiate loyalty and relationship marketing. SONY's partnership efforts are centered on new technology standardization and joint product development. SONY is participating in major industry standardization bodies to promote Linux⁵⁾-based consumer electronics and to simplify digital content sharing among consumer electronics, PCs and mobile devices. SONY leads IC⁶⁾ media recording technology called SanDisk for external storage device. SONY is collaborating with Real Network for the joint-development of distribution technology for digital content via SONY's devices. SONY and IBM are working on silicon-on insulator (SOI)⁷⁾ technology for semiconductors. SONY and Ericsson have engaged in a partnership for mobile phone manufacturing and sales. SONY sources PlayStation components from LSI⁸⁾ Logic and has extensive relationships with game developers. SONY's core competencies lie in its full capacity within the Network IT value chain, strong brand and ability to create proprietary standards.

3) Nokia

Nokia's business is centered around mobile terminal block and has expanded into wireless component, software and service sectors. Nokia is the mobile terminal leader in the world market and other businesses sectors support sales of mobile terminals. Nokia has built business blocks in component, software and application and content aggregation and provision service to help its business platform. Club Nokia is providing value-added services to increase customer loyalty as replacement handset market is growing fast. Nokia is the dominant mobile terminal manufacturer and is continuously investing in new technologies to

5) A version of the UNIX operating system.

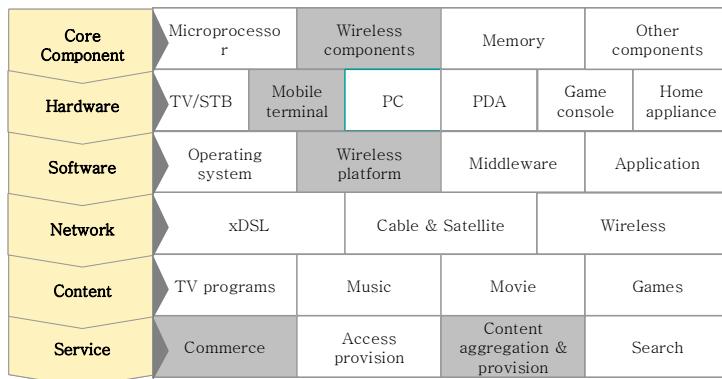
6) Integrated circuit. An electronic that consists of many individual circuit elements, such as transistors, diodes, resistors, capacitors, inductors, and other active and passive semiconductor devices, formed on a single chip of semiconducting material and mounted on a single piece of substrate material.

7) A chip architecture that increases transistor switching speed by reducing capacitance (build-up of electrical charges in the transistor's elements), and thus reducing the discharge time.

8) Large-Scale Integration. It uses integrated circuits with more than 100 logic gates. Fourth-generation computers have large-scale integration.

keep its leadership. Nokia targets to high-end mobile terminal market and is creating value proposition and switching cost through Club Nokia. High-end mobile handset users as average retail price of Nokia handsets are above industry average. Nokia has strong position in North America and Europe and is developing Asia-Pacific market. Nokia's leadership in mobile terminal market gives high bargaining power for partnerships with core component and software and application developers. Nokia has partnerships with Qualcomm and Texas Instrument(TI) to source core components. Real Network and Nokia are working on incorporating Real Network's codec⁹⁾ software for Nokia's mobile terminals. Nokia, TI and ST Microelectronics are jointly developing CDMA¹⁰⁾ semiconductor components, currently monopolized by Qualcomm. As another software product of Nokia, their integrated security product is a unified threat management solution, helping customers to simplify security deployments by consolidating proven security technologies within a single solution. It combines firewall, intrusion prevention, anti-spyware, web application firewall, and both IPSec¹¹⁾ and SSL VPN¹²⁾ in a fully integrated and easy-to-manage solution.

Nokia has close relationships with wireless carriers for handset supply and new service development. As an industry leader, Nokia has strong brand, superior product design and quality, innovative services and relationships to outpace rivals.



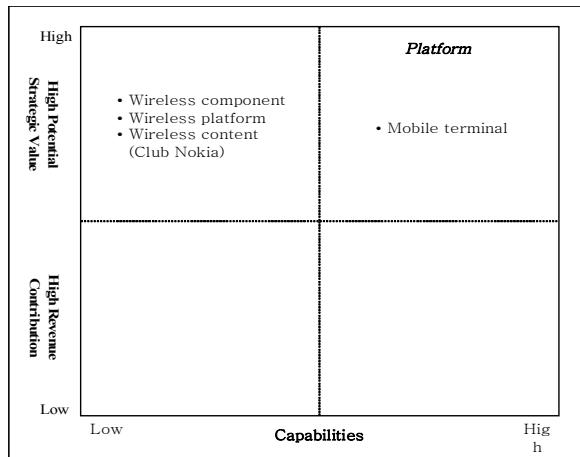
[Figure 8] Nokia's diversification in Network IT Value Chain

9) Coder-decoder. An assembly consisting of an encoder and a decoder in one piece of equipment. A circuit that converts analog signals to digital code and vice versa. An electronic device that converts analog signals, such as video and voice signals, into digital form and compresses them to conserve bandwidth on a transmission path.

10) Code-Division Multiple Access. A codec scheme, used as a modulation technique, in which multiple channels are independently coded for transmission over a single wideband channel. Modulation is the process, or result of the process, of varying a characteristic of a carrier, in accordance with an information-bearing signal. Wideband channel is a communication channel of a bandwidth equivalent to twelve or more voice grade channels.

11) IP Security Protocol

12) Virtual Private Network



[Figure 9] Nokia's business platform

4) Microsoft

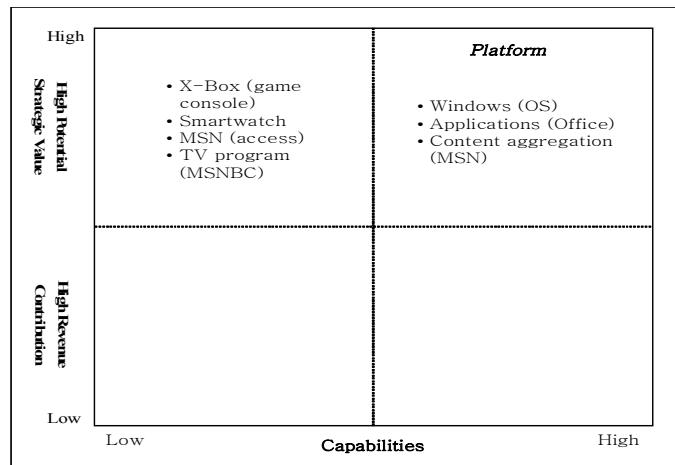
Microsoft has expanded into all Network IT business sectors except core component and network operation sectors. While Windows still remains central, application development and MSN portal also form Microsoft's business platform. Software and applications remain as the center of Microsoft's platform. Microsoft has created game platform in 2001, imitating SONY PlayStation's business model.

MSN is a leading content aggregator offering email, chat, search, BBS¹³⁾, shopping and content aggregation and provision services. MSN also offers broadband access through MSN and broadcasting service through MSNBC. Microsoft has created one of the most dominant position in the Network IT value chain and fiercely defends its position. Microsoft has created monopoly power with clear vision and set high entry barrier for potential competitors. Microsoft has developed alliance programs to support Windows Operating System (OS) and other initiatives for market expansion into the wireless market. Microsoft has extensive relationships with hardware manufacturers to embed Windows OS onto their products and application developers. Microsoft has engaged in symbiotic relationships with X-Box game developers to gain market share against SONY PlayStation. Windows Telecom Alliance and Microsoft Data Warehouse Alliance programs support members to encourage market development and facilitate co-partnerships among participants. Microsoft has been able to see the trend and develop strategies to increase customer dependency on Microsoft products.

13) A bulletin board system is a computer or an application dedicated to the sharing or exchange of messages or other files on a network. The BBS became the primary kind of online community through the 1980s and early 1990s, before the World Wide Web arrived.

Core Component	Microprocessor		Wireless components	Memory		Other components
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Network	xDSL		Cable & Satellite		Wireless	
Content	TV programs		Music	Movie		Games
Service	Commerce		Access provision	Content aggregation & provision		Search

[Figure 10] Microsoft's diversification in Network IT Value Chain



[Figure 11] Microsoft's business platform

5) SK Telecom

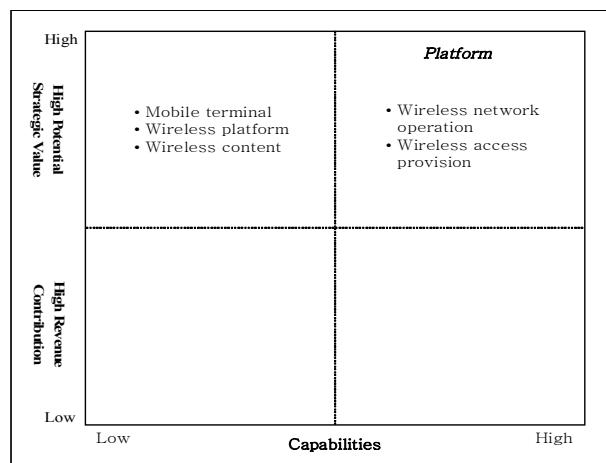
SK Telecom is a vertical integrator for the wireless telecom value chain. SK Telecom's business platforms are wireless network operation and access provision service. SK Telecom's main platform is wireless network operation and access provision with over 50% market share in Korea. Wireless platform and content aggregation & provision are strategic with increasing importance of wireless data services. While SK Telecom is the dominant wireless carrier in Korea, it needs to expand to international market for growth. SK Telecom has divided customers by target segments providing customized services to particular segments. SK Telecom has developed partnerships with mobile terminal manufacturers, wireless platform developers and content providers. SK Telecom has established relationships with wireless platform and middleware

developers to ensure quality and export platform to international wireless carriers. SK Telecom is partnering with numerous content developers, aggregators & providers for wireless data service. Particularly, it is providing the integrated hybrid services such as Melon(music portal), Cizle(movie portal), GXG(game portal), T Interactive(customized artificial intellectual service), Nate(integrated hybrid internet), and June(mobile media). Also, SK Telecom is leading ubiquitous service sector by providing services regarding telematics, digital home network, satellite DMB, Moneta(financial service), RFID(ubiquitous smart touch mobile), and LOView(online picture service).

For the success in these businesses, SK Telecom's core competencies lie in its marketing capability, brand and strong relationships with partners.

Core Component	Microprocessor		Wireless components	Memory		Other components	
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Software	Operating system		Wireless platform	Middleware		Application	
Network	xDSL		Cable & Satellite	Wireless			
Content	TV programs		Music	Movie		Games	
Service	Commerce		Access provision	Content aggregation & provision		Search	

[Figure 12] SK Telecom' s diversification in Network IT Value Chain



[Figure 13] SK Telecom' s business platform

6) Yahoo!

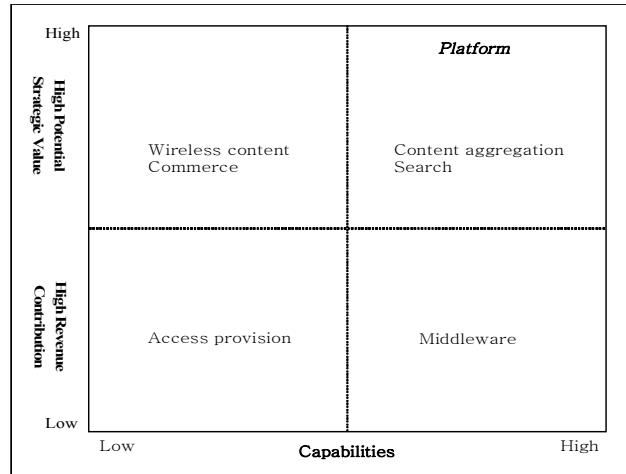
Yahoo was the leading search and content aggregation and provision service provider. Yahoo platform is content aggregation and provision and search services. Yahoo was the first provider of search and content aggregation and provision service and is building wireless content and commerce businesses.

Yahoo has completed acquisitions of Overture and Inktomi to increase search capabilities. Yahoo is the leading internet content aggregator but needs to aggressively move into new platforms like wireless terminals and digital TV. Yahoo generates revenue through marketing, premium and listing services by providing customized service through user-set preferences on MyYahoo!. Yahoo sources e-commerce and services aggregation of content through partners. Yahoo sources content from content developers in news, finance, entertainment, jobs, classified, and so on. Yahoo has developed relationships with wireless carriers to provide mobile services. Yahoo provides e-commerce services including travel packages, financial analyst reports and classifieds. Yahoo is also operating Yahoo Groups(online community), Yahoo messenger avatars, Flickr(online picture management), Yahoo Green(eco-site), and Yahoo Local(social services) as pro-bono activities.

Yahoo is the first mover and scaled fast to become the dominant content aggregator as well as search service provider.

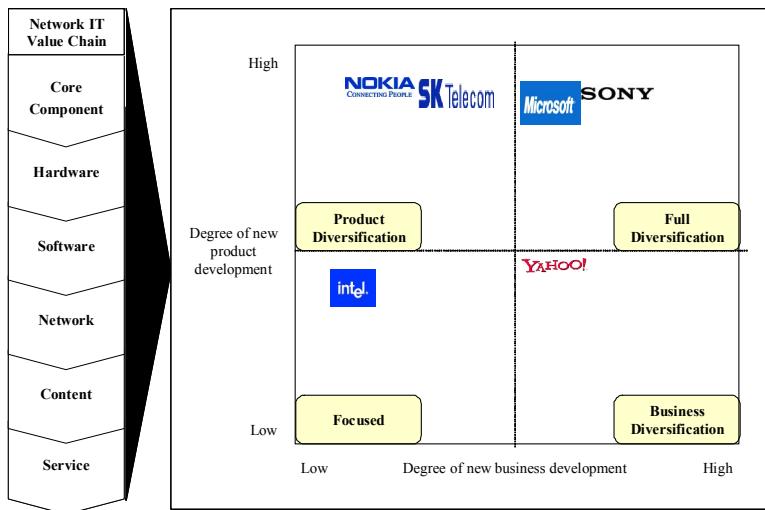
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Network	xDSL		Cable & Satellite		Wireless	
Content	TV programs		Music	Movie		Games
Service	Commerce		Access provision	Content aggregation & provision		Search

[Figure 14] Yahoo's diversification in Network IT Value Chain



[Figure 15] Yahoo's business platform

2. Convergence Strategic Positions



[Figure 16] Convergence Strategies of Global High–Technology Companies

As you can see the position map in figure , Microsoft and SONY are the most fully diversified and converging based on their competitive business platforms. They are continuously developing new products and businesses toward end consumers. We conclude this trend would be major stream the other companies

can be irresistible. Nokia and SK Telecom will get much more opportunities to interface more consumers with new contents and services through partnership or in-house development. Yahoo and Intel are currently focusing on specific target businesses. However, nobody knows they can create new business model through collaboration with the players they can utilize the assets

3. Prediction of Business Sector Trends

1) Major Streams of Business Sectors

In order to predict the strategic implications of business sectors in network IT value chain, first of all, we need to understand the major streams of business sectors, respectively. It is important to find the facts about which sub-sectors will be growing and which directions specific sub-sectors will go to.

In terms of the business sector of core component, the most remarkable issue is the growth in wireless components. Mobile phone component block is expected to grow faster than the rest of the sectors at about 10% of cumulative average growth rate (CAGR) through 2007 (Gartner, 2002).

System-on-a-chip(SOC) allows the integration of applications such as MPEG4, MP3, and security module onto the main processor for wireless devices to reduce cost, size, and power consumption.

Core component developers are unlikely to develop in products to hardware sector due to distribution channel conflict, while network, content and service sectors lack marketing and technological synergies.

Increased business diversification and SOC will stimulate partnerships to complement product development activities. SOC developers will engage in partnerships for acquisitions of intellectual properties in areas lacking expertise. Microprocessor developers may look for partnerships to expand into wireless component market. For example, Qualcomm has entered wireless platform market through BREW (binary run-time environment for wireless) while other component developers may choose to partner with wireless platform developers to integrate component and SW solutions.

In terms of the business sector of hardware, one of the most remarkable issues is the growth in digital set-top-box, mobile terminal and game console markets. They are growing faster than the rest of the sectors. Their growth presents attractive opportunities for business diversification as well. Second issue is flattening learning curve of home appliance and PC. They are mature and becoming commodities. Third issue is the convergence of PDA and mobile phone. They are converging into smartphone and mobile portable PC-type hardware. Last issue is the change in purchase market. As individual hardware penetration rates increase, new sales mostly occur for replacement use.

Case Study on Convergence Strategies of High–Technology Companies

Reasoning for improbable cases	Customer base	Customer needs	Distribution channel conflict	Product development	Overall	Analysis
Hardware	○	○	○	●	○	<ul style="list-style-type: none"> Product development synergies exist but there is strong distribution channel conflict to justify integration
Network	○	○	○	○	○	<ul style="list-style-type: none"> No integration due to lack of marketing or technological synergies
Content	○	○	○	○	○	<ul style="list-style-type: none"> No integration due to lack of marketing or technological synergies
Service	○	○	○	○	○	<ul style="list-style-type: none"> No integration due to lack of marketing or technological synergies

Note:
 - Customer base: sharing of existing customers for expansion
 - Customer needs: alignment of customer needs with existing products
 - Distribution channel conflict: lack of distribution channel conflict through expansion
 - Product development: synergies in technologies for product development



Low ○ ○ ● ● ● High
 Expansion possibility

[Figure 17] Sector Analysis of Core Component

Hardware manufacturers are unlikely to expand into network or content development sectors due to lack of marketing and technological synergies.

To expand into content aggregation and provision sector, hardware manufacturers need to establish partnerships with content developers. Hardware manufacturers will engage in partnerships with content developers to offer content aggregation and provision services like Club Nokia or Fun Club. With growing digital set-top-box and mobile terminal markets, hardware manufacturers need partners with corresponding operating system and wireless platform developers. As hardware manufacturers diversify their businesses into set-top-box and mobile terminal blocks, they need partners with component developers and network access providers.

Reasoning for improbable cases	Customer base	Customer needs	Distribution channel conflict	Product development	Overall	Analysis
Network	○	○	○	○	○	<ul style="list-style-type: none"> No integration due to lack of marketing or technological synergies
Content	○	○	●	○	○	<ul style="list-style-type: none"> There is some distribution channel synergies but marketing or technological synergies lack

Note:
 - Customer base: sharing of existing customers for expansion
 - Customer needs: alignment of customer needs with existing products
 - Distribution channel conflict: lack of distribution channel conflict through expansion
 - Product development: synergies in technologies for product development



Low ○ ○ ● ● ● High
 Expansion possibility

[Figure 18] Sector Analysis of Hardware

In terms of the business sector of software, one of the most remarkable issues is the growth in wireless operating system and platform markets. It presents attractive opportunities which are racing to become de facto standards. The attractive opportunities include the development of products such as Symbian OS (operating system), PalmOS(operatingsystem), WindowsCE, and LinuxOS(operatingsystem). Another issue is the changes in distribution channel and product features. That is bandwidth and reliability enhancements enable online downloads and interactive features of software products. The other issue is the introduction of 3G and interactive TV applications. Deployment of new network and services will require innovative applications such as location-based service(LBS) software, mobile payment, and telemetry solutions.

Software developers are unlikely to backward integrate into core components or hardware sectors and forward integrate into network access or content development. Software developers need to work with content developers and access providers to enter into service sector. Partnerships with content providers will enhance service offerings as software developers get into service sector. Emerging 3G and interactive TV application markets may require partnerships with access providers to adopt their applications onto access and content aggregation services. Relationships with hardware manufacturers are required to embed software onto hardware.

Reasoning for improbable cases	Customer base	Customer needs	Distribution channel conflict	Product development	Overall	Analysis
Core component	●	○	●	○	●	<ul style="list-style-type: none"> SW developers share similar customer base with core component developers, but there are no product development synergies.
Hardware	○	○	○	●	○	<ul style="list-style-type: none"> While some technological synergies exist with HW, SW developers are unlikely to venture into HW due to lack of marketing synergies.
Network	○	○	○	○	○	<ul style="list-style-type: none"> No integration due to lack of marketing or technological synergies
Content	○	●	○	●	●	<ul style="list-style-type: none"> Marketing and technological synergies are not compelling enough for SW developers to produce content themselves

Note:

- Customer base: sharing of existing customers for expansion
- Customer needs: alignment of customer needs with existing products
- Distribution channel conflict: lack of distribution channel conflict through expansion
- Product development: synergies in technologies for product development

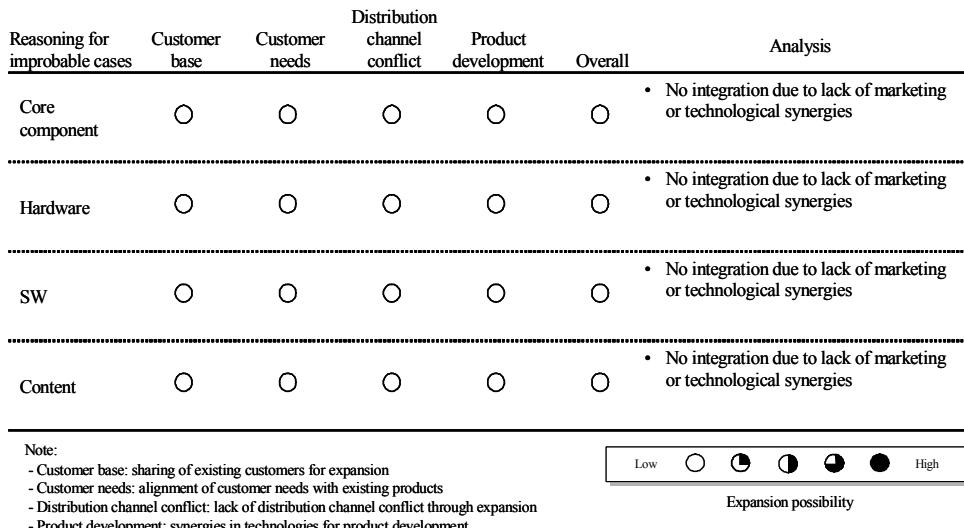


Expansion possibility

[Figure 19] Sector Analysis of Software

Most network operators are developing products with access service and may expand to offer ubiquitous access with content aggregation and provision services. Specifically, operators aim to provide ubiquitous access through any device. Network operators are generally vertically integrated providing network and access provision services. They have no marketing or technological synergies with sectors other than service sector.

Network operators and access providers are highly complementary. For niche markets, leasing lines to specialized access service providers may result an inexpensive way to generate new revenue and increase market presence. Network operators use middleware to provide network operation.



[Figure 20] Sector Analysis of Network

In terms of the business sector of content, the remarkable issues are the introductions of interactive TV content, interactive games, and 3G content. The initial content for interactive TV includes sports, shopping and VOD content. With interactive features of game consoles, subscription-based game market will grow fast. PC game developers often run their own servers for interactive games, while game console developers provide the service for proprietary titles. Development of 3G content for location-based services(LBS), entertainment, m-commerce, and information will flourish.

Content developers have little need or compelling synergies to backward integrate. For this, they will keep relationships with access service providers and content aggregators. Content developers will continue

supplying content to access service providers and content aggregators. As content developers enter into service sector, they need partners with middleware developers.

Reasoning for improbable cases	Customer base	Customer needs	Distribution channel conflict		Product development	Overall	Analysis
			Conflict	No conflict			
Core component	○	○	○	○	○	○	<ul style="list-style-type: none"> • No integration due to lack of marketing or technological synergies
Hardware	○	○	○	○	○	○	<ul style="list-style-type: none"> • No integration due to lack of marketing or technological synergies
SW	○	○	○	●	○	○	<ul style="list-style-type: none"> • Some synergies with product development exist but not enough to justify expansion
Network	○	○	○	○	○	○	<ul style="list-style-type: none"> • No integration due to lack of marketing or technological synergies

Note:
 - Customer base: sharing of existing customers for expansion
 - Customer needs: alignment of customer needs with existing products
 - Distribution channel conflict: lack of distribution channel conflict through expansion
 - Product development: synergies in technologies for product development

Low ○ ● ● ● ● High
 Expansion possibility

[Figure 21] Sector Analysis of Content

Close customer relationships give service providers options to expand horizontally or vertically. The options are one stop-service, access specialization, and key content or technology sourcing. Adding new services for existing customers is easy and attractive for one-stop service. Mobile virtual network operators and public WLAN access providers lease lines from network operators to offer access services with specific brands. Sourcing of content or technology is a key to service providers. Some access or content aggregation providers are developing their own content, while Yahoo acquired Overture & Inktomi to source software technologies.

Service providers are unlikely to backward integrate beyond software sector due to lack of need and capabilities. For this, brand and customer relationships may provide opportunities for service providers to offer access service or hardware sales. Given strong brand and customer base, service providers may partner with network operators, software developers or hardware manufacturers through OEM or distribution arrangements. Service providers need to source competitive middleware to run their service business.

Reasoning for improbable cases	Customer base	Customer needs	Distribution channel conflict	Product development	Overall	Analysis
	Core component	○	○	○	○	
Hardware	○	○	○	○	○	• No integration due to lack of marketing or technological synergies
						• No integration due to lack of marketing or technological synergies

Note:

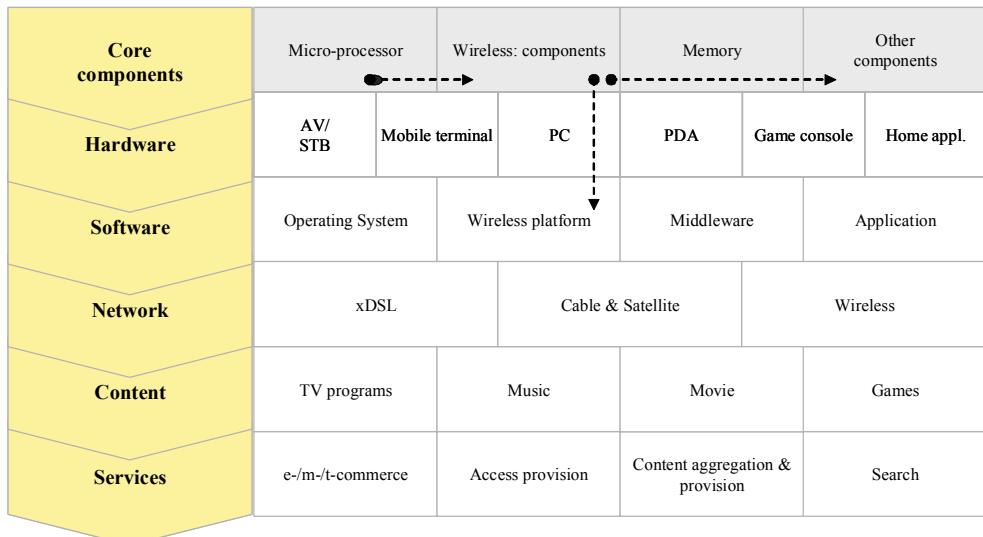
- Customer base: sharing of existing customers for expansion
- Customer needs: alignment of customer needs with existing products
- Distribution channel conflict: lack of distribution channel conflict through expansion
- Product development: synergies in technologies for product development

Low ○ ● ● ● ● High
 Expansion possibility

[Figure 22] Sector Analysis of Service

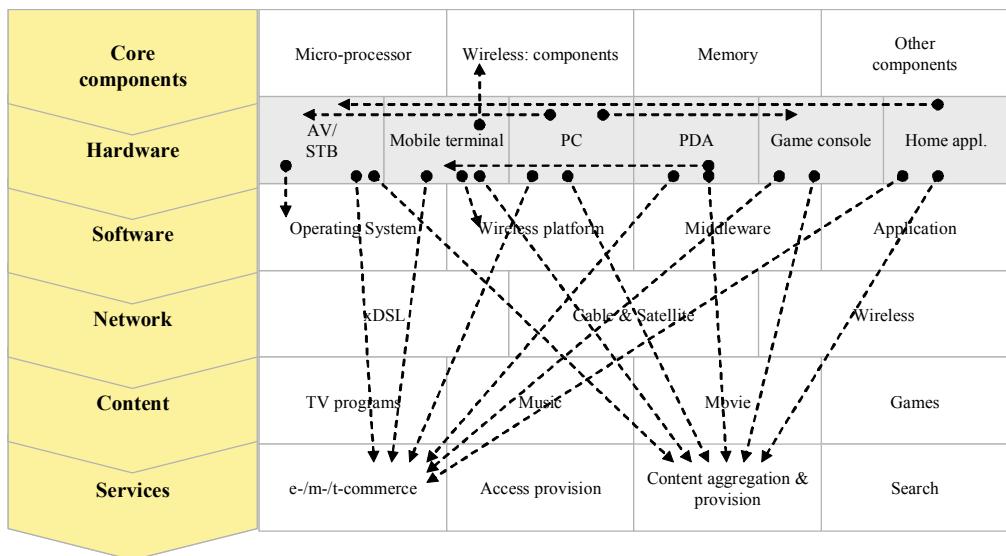
2. Prediction of Business Sectors

The sector prediction of core component is divided into three things. First, growing wireless component market will attract expansion of microprocessor developers. Second, as SOC developers can not possess expertise in all areas, increased business diversification and partnership activities will occur. Third, integrated SOC and software will enhance bargaining power of component manufacturers.



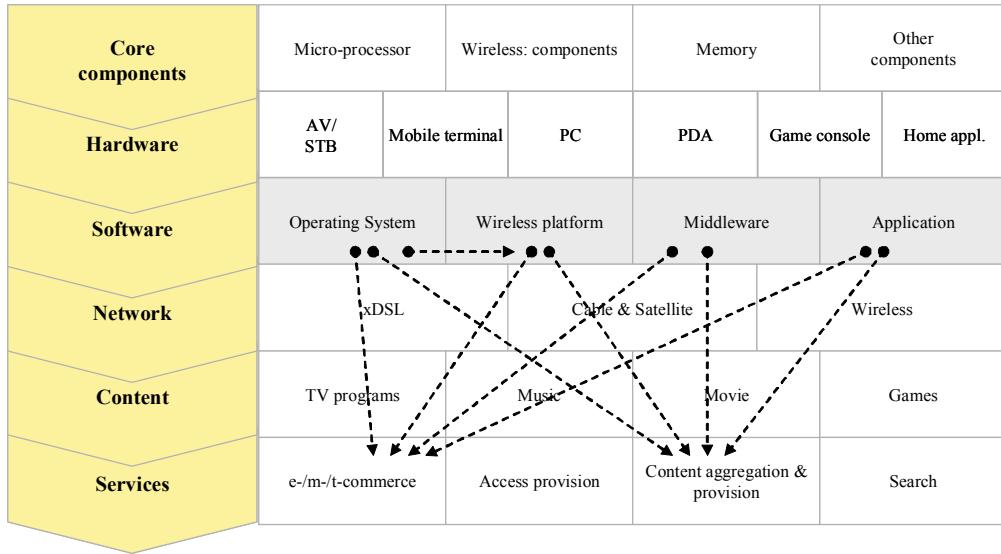
[Figure 23] Sector Prediction of Core Component

The sector prediction of hardware is divided into four things. First, hardware manufacturers with slow growth may try to expand into faster growing hardware products. Second, convergence of PDAs and mobile phone leads PDA manufacturers to expand into mobile terminal market. Third, as learning curve flattens, early producers develop new products and differentiate with proprietary component and software. Fourth, growing importance of repurchase market lead hardware manufacturers to forward integrate into service for closer customer interface and build customer loyalty.



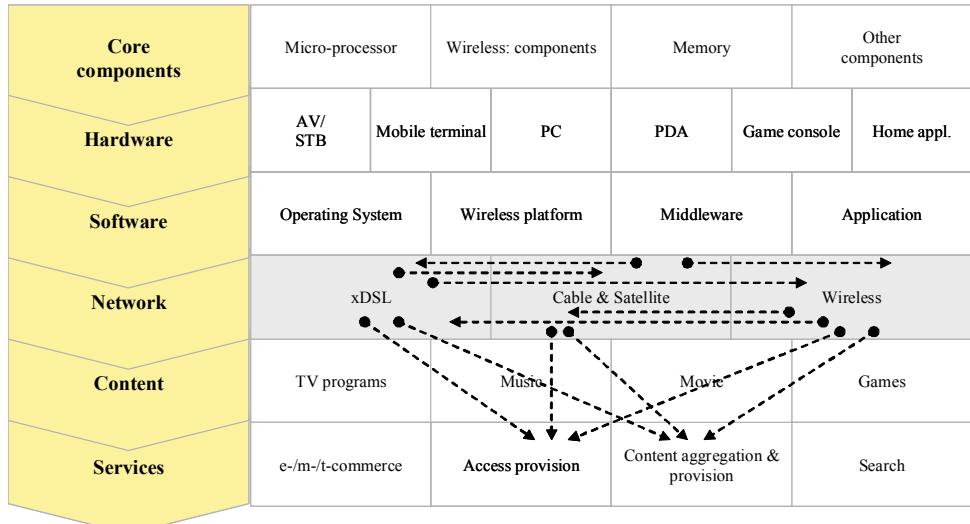
[Figure 24] Sector Prediction of Hardware

The sector prediction of software is divided into two things. First, operating system developers may use marketing and technical synergies to enter attractive wireless market. Second, online distribution of software and enhanced interactive features will enable software developers to offer commerce and content aggregation and provision services to gain direct customer interface.



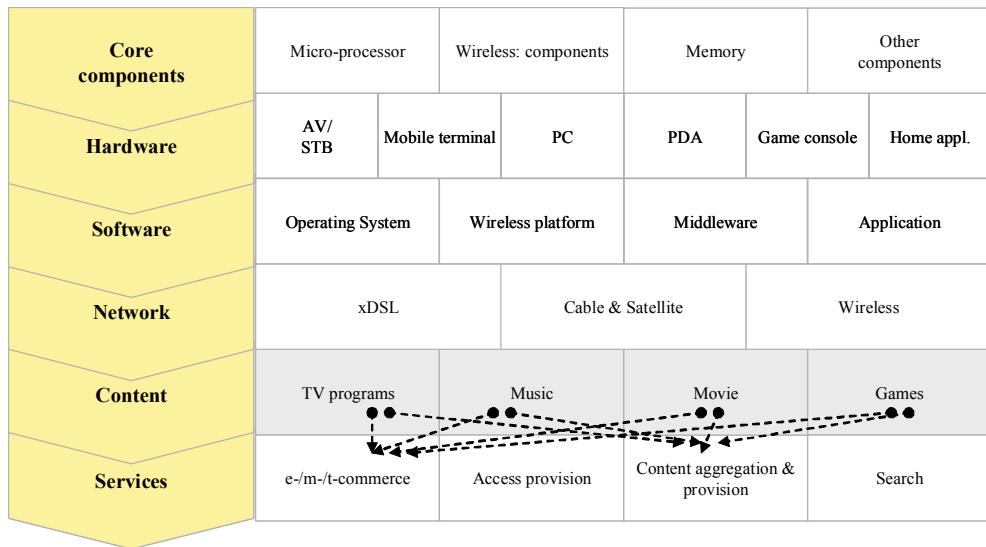
[Figure 25] Sector Prediction of Software

The sector prediction of network is divided into two things. First, ubiquitous access trend will induce business diversification of network operators. Second, most network operators are developing products by access services and content aggregation and provision.



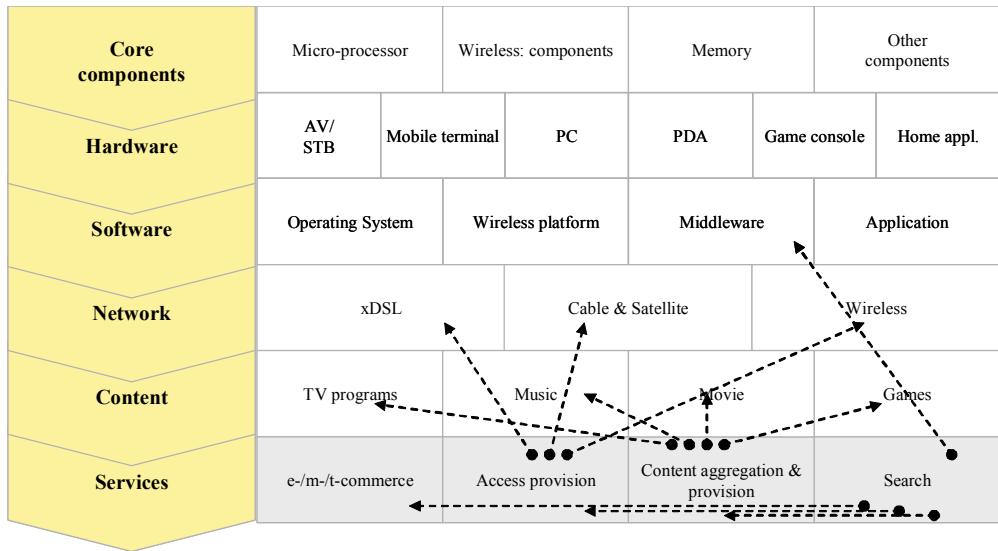
[Figure 26] Sector Prediction of Network

In terms of the sector prediction of content, content developers may expand into commerce and content aggregation and provision blocks as product diversification presents low entry barrier and high marketing and technological synergies for closer customer interface.



[Figure 27] Sector Prediction of Content

The sector prediction of service is divided into four things. First, service providers will continue adding new services with strong brand and customer relationships. Second, access specialists may acquire networks to become independent from current network operator. Third, access providers and content aggregators may develop their own content to be distributed to their customers. Fourth, backward integration may occur to acquire key technologies to sustain bargaining power.

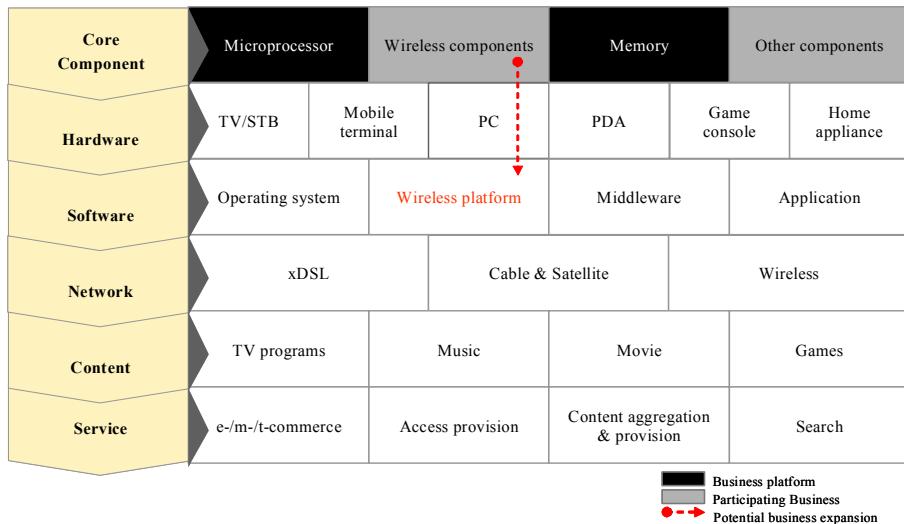


[Figure 28] Sector Prediction of Service

4. Prediction of Convergence Strategies of High–Technology Companies

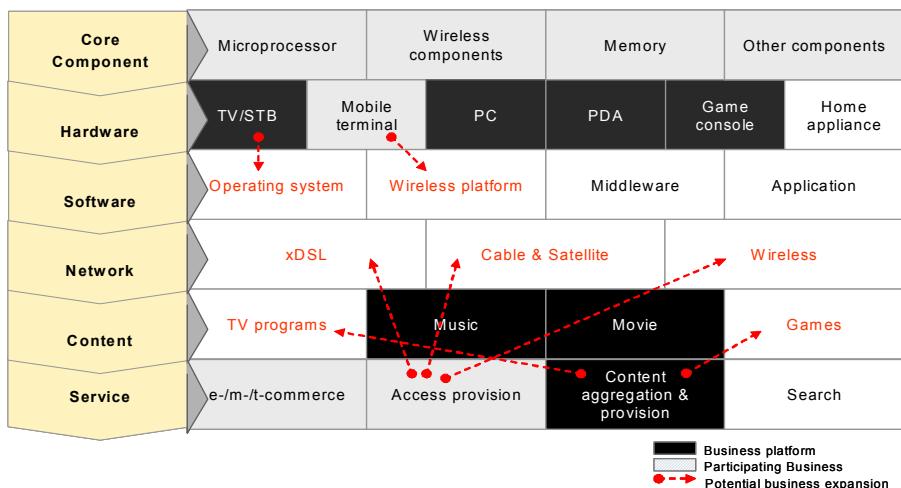
Based on the analysis of convergence strategies of high-technology companies and the prediction of their business sectors, we can predict their convergence strategies.

Intel might jump into wireless platform block if Intel's entry into wireless component is successful. From this, Intel is expected to diversify their core component business into software business based on the core competences such as industry standard technology, ability to bundle new components into existing package, and strong customer base.



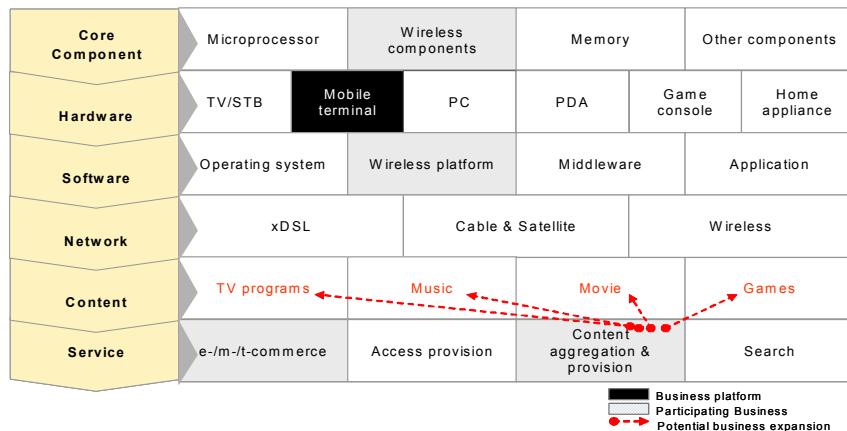
[Figure 29] Prediction of Convergence Strategy of Intel

Currently, software and network operation are the only missing pieces for Sony to achieve full network IT value chain diversification. Sony will put its competences to strengthen the competitive positions in four core hardware gateways such as TV/STB(set-top-box), PC, PDA, and game console and entertainment contents and services. Sony will diversify its mobile terminal business to wireless platform. And also, it will diversify content and service businesses to network businesses relating to xDSL, cable and satellite, and wireless.



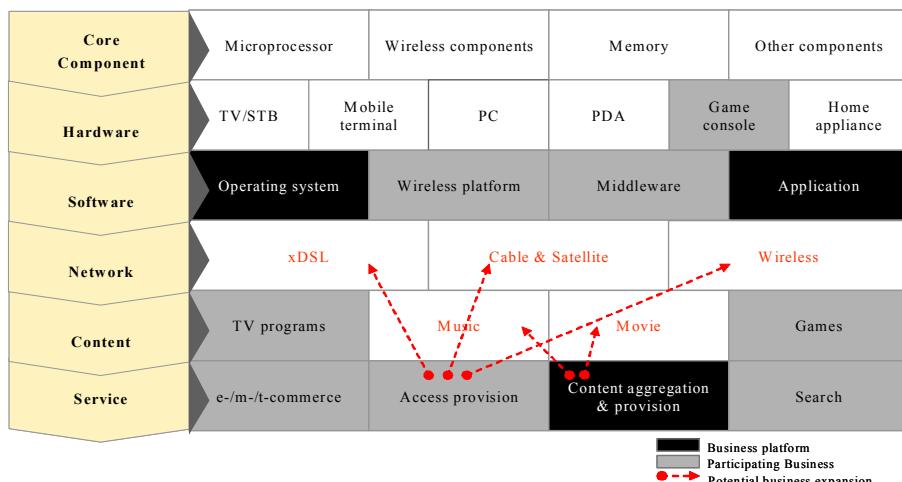
[Figure 30] Prediction of Convergence Strategy of SONY

Nokia with the platform of mobile terminal might expand into proprietary content development. By utilizing Club Nokia's marketing capabilities, Nokia might develop various kinds of contents to expand interfaces with end users who want to get value-added services.



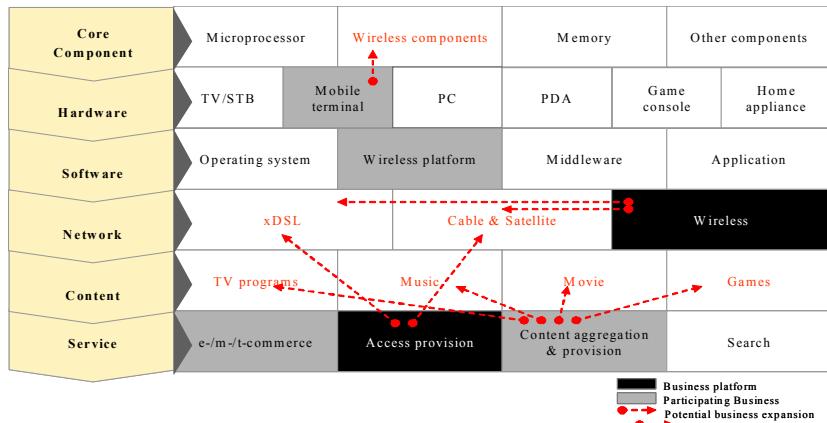
[Figure 31] Prediction of Convergence Strategy of Nokia

Microsoft achieve full network IT value chain diversification except core component by getting into network operation. Microsoft might continue to retain and develop more alliance programs to support Windows OS and expand into the wireless market.



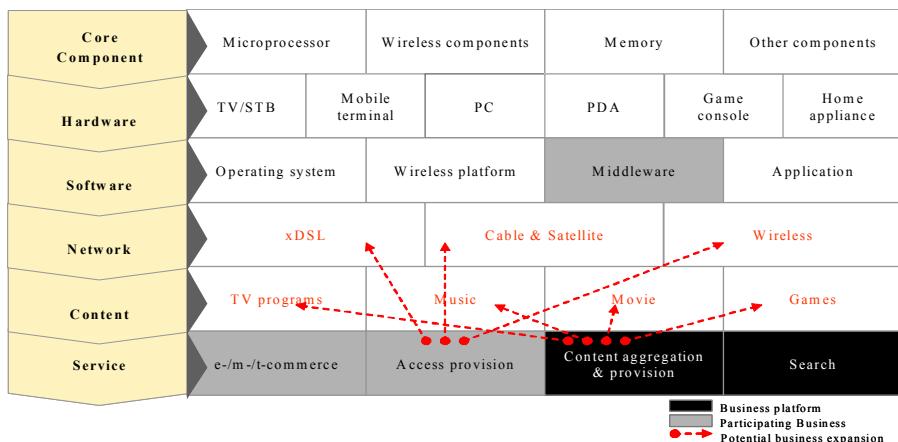
[Figure 32] Prediction of Convergence Strategy of Microsoft

SK Telecom may expand into other network operation blocks, build content development business and enter into wireless component block based on the core competences such as marketing capabilities, brand and strong relationships with partners. SK Telecom might strengthen more partnerships with numerous content developers, aggregators, and providers for wireless data service.



[Figure 33] Prediction of Convergence Strategy of SK Telecom

Yahoo may backward integrate to have greater control over content and network sourcing. Yahoo is expected to develop various content developing businesses based on the capabilities of content aggregation and provision services. Network sourcing businesses are also expected to be developed based on the capabilities of access provision service.

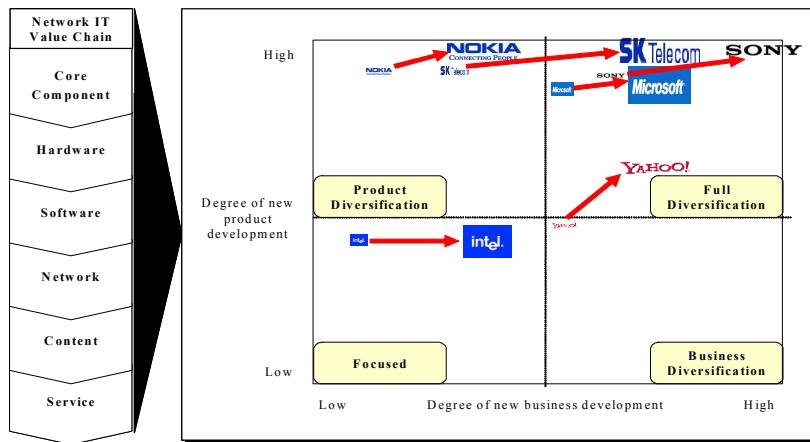


[Figure 34] Prediction of Convergence Strategy of Yahoo

4. Discussion and Conclusion

As you can see the predicted strategic positions in figure , compared to current situation, most companies are expected to tend to go toward the position of full diversification. Microsoft and Sony might be still fully diversified and continuously new sophisticated products and businesses toward en users. SK Telecom might be positioned in full diversification by strengthening network business as its genuine business and developing content and core component businesses as new horizontally integrated businesses. Yahoo is expected to enter the new territory, content business sector for strengthening its diversification strategic position.

Nokia might move toward more diversified position in the business diversification perspective. By utilizing the capabilities of Club Nokia business, it might be able to build the required capabilities for content businesses. Intel is also expected to strengthen the business diversification tendency by entering software business sector with new products related to wireless platform.



[Figure 35] Prediction of Convergence Strategic Positions of Global High–Technology Companies

As high-technology companies go toward full diversification to meet diverse customer needs, they might develop more digitally converged new products and businesses. We should study what factors drive them to strengthen the degree of diversification.

We would like to express these factors as mechanisms in the mechanism-based view (Cho and Lee, 1998; Cho, 2004).

We considered the mechanisms regarding diversification such as CEO's propensity to diversification, degree of customer diversification, variety of consumer needs, customer geographic range, degree of relevant

technology innovation, length of product life cycle, degree of related and unrelated diversification.

Applying the flow chart as we mentioned before, we can break driving factors into each of subject, environment, resource, and mechanisms as follows.

〈Table 1〉 Examples of Analysis of Mechanisms based on the Mechanism-Based View Flow Chart

Strategic drivers	S	E	R	Mc	Ms	Msb	DCr	DCm	P
CEO's propensity to diversification	O								
Degree of customer diversification		O							
Variety of consumer needs		O							
Customer geographic range		O							
Degree of relevant technology innovation			O						
Length of product life cycle				O					
Partnership							O		
Degree of related diversification in the same business sectors in network IT value chain						O			
Degree of unrelated diversification to the different business sectors in network IT value chain							O		

S: Subject, E: Environment, R: Resource, Mc: cross-over Mechanism, Ms: subject-changing Mechanism, Msb: system-building Mechanism, DCr: R-changing Dynamic Capability, DCm: Mechanism-changing Dynamic Capability,

P: Process

We will develop empirical research model to analyze the effects of specific mechanisms on firm performance in the future. For this, we should develop the research model to identify the mediating effects of mechanisms compare to those of other strategic factors such as subject, environment, resource, and corporate strategies which are influenced by three advanced mentioned factors.

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