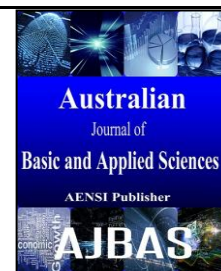




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The evolution of Mobile Internet as a Technology and Business model : Case Study Approach

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ABSTRACT

Many companies and business have been born based on mobile Internet. It is worthwhile to check the evolution and direction of mobile Internet in view of technology and business model. We decomposed Mobile Internet into understandable components and analyzed Mobile Internet business cases in terms of 1st and 2nd generation. In 1st Mobile Internet generation, we introduced Korea three operators' completion and impediment. In 2nd generation, we offered LTE Advanced, HTML 5 technology as a new technology and analyzed Internet of Things, O2O business and Instant messenger monetization as a new business model.

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INTRODUCTION

Mobile Internet has become an essential infrastructure for daily life through mobile services and with mobile devices. Consumer's experiences have expanded from device experiences to that of mobile services (Ramirez-Correa, Rondan-Cataluña *et al.* 2015).

Mobile Internet is defined as a wireless access or data service which connects to cellular network's data service or broadband network contents by mobile device. (Lee, 2009; Vlachos, Giaglis, Lee, & Vrechopoulos, 2011). Mobile Internet includes wired similar experience and unique wireless experience. In the first level of it, there is a using of data on cellular network by mobile device. In the next level, there is a using of data on broadband network by mobile devices. At the third level, there is a creating unique service which is not provided by wired internet, such as location based service, mash up service which mash up location and other service (Farzana and Ramyadevi 2015). The <figure 1> describes the flow to the 3rd level service from the 1st level.

Mobile Internet has been full-fledged since i-Phone launched in 2007. Many companies and business have been born based on mobile Internet (Portnoff 2014, Farzana and Ramyadevi 2015, Indrawati and Marhaeni 2015). It is worthwhile to check the evolution of mobile Internet in view of technology and business model.

Mobile Internet Components:

First, we decompose Mobile Internet into essential components and identify characteristics that could be used to forecast direction of mobile Internet evolution.

1. Technology :

For implementing mobile internet, the necessary technologies are browser and network. In this chapter, browser and network technology are described.

Browser:

Browser technology is evolved to W3C standard from OMA standard. OMA standard, WAP 1.0 and WAP2.0 is based on XHTML. OMA standard is based on the text or simply graphic interface. W3C standard, full browsing Mobile Web 1.0 and full browsing Mobile Web 2.0 is based on the HTML 4.01 and JAVA script 1.5. W3C standard support full browsing and make possibility for participation, sharing and distribution of information. Now, Mobile Internet evolved to environment for Mobile Web2.0 service and become more similar with PC(West and Mace 2010). Thus supporting interlocking Flash / Media Player / Emailer / word file viewer becomes more important. Browser also can be distinguished by contents reconstruction method. Proxy-based method is that reconstructed contents and display on server, and transmit to client in user device. This method uses a part of HTML 4.01, a part of

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JavaScript 1.5, CSS Level 1 and basic functions. Proxy-based browser supports only rendering mode and UI for brief browsing. And this method needs installation, can't use plug-in, needs maintenance on both server/client and not support WAP. Client-based method is that transmit the data to user's device directly, similar with PC browser. This method is

based on HTML 4.01, JavaScript 1.5, CSS Level 1/2/3, Ajax and etc. Client-based browser can support PC view, rendering mode, tabbed browsing, zoom, doc view, etc. And this method browser installed in device can use plug-in, need maintenance only on Client and Support WAP so that Client-based method is more suitable to mobile internet.

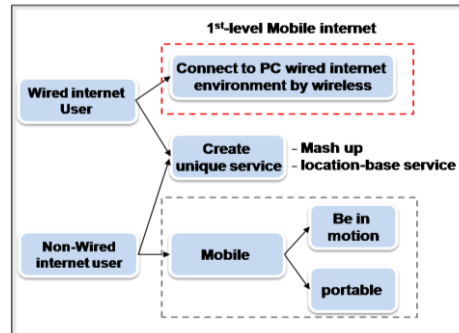


Fig. 1: Mobile Internet definition level.

Tencent, China famous mobile messenger company, recently developed and launched QQ Mobile Browser HTML5 innovation, pushing developers on HTML5-based web app creation.

Network:

In the initial stage, network technologies can be distinguished as two types; CDMA, and GSM/WCDMA created by QUALCOMM and commercialized in Korea. GSM is created by Global System for Mobile communication and commercialized in Europe. These technology standards make network speed get faster and faster. Each stage has different speed. So they support different core services.

In the 2G stage, core services are text based simple service that service portal which have non-diversified contents. And main contents are SMS, simple email, news searching, and Bell/Ring tone/game download.

In the 2.5G stage, core services are graphic based service, WAP2.0, and limited wired portal access. So in the stage, MMS, push email, MP3 download become main contents.

In the 3G stage, network becomes fast enough to use full browsing. So in this stage, video clip download and Google, Yahoo service becomes main contents.

In the 3.5G stage, full browsing has become a main trend, networks will be 100% opened and wired portal connect will be activated. For this service, Web2.0, such as RSS, Ajax, will introduce and Flash and ActiveX will be supported (Funk 2009). In the HSPA stage (HSPA: High Speed Pack Access), it improved on WCDMA with much capacity in the downlink (5 times) and in the uplink (2 times). HSPA realized this by using MIMO technology.

Recently, network has evolved to LTE as an end-goal technology (Mukhopadhyay, Navyashree *et al.* 2015). It was helped along by standardization called the 3GPP (Ousta, Yusoff *et al.* 2014). There are essential technology advancements that separate LTE from preceding access technologies. Orthogonal Frequency Division Multiplexing (OFDM) and Multiple input multiple output (MIMO) systems were leveraged by LTE.

2. Market and Consumer:

Demand of mobile internet can be calculated by number of device which can access to mobile Internet. The devices comprise smartphone and tablet. The second method to predict market demand is counting full web browser users. Third method is to counting network bases which can connect to mobile Internet easily.

Mobile phone users are 5.2B in 2014 and penetration is ramping to 73% and driving increased innovation. The proportion of mobile Internet is more than 50% of the total Internet usage.

Describing users' characters, there is a comparison between needs for wireless and wired Internet service. Also the uncomfortable factors in each service could give lessons to understand consumers. In wired Internet, user felt uncomfortable at limitation of mobility and consuming time for booting PC. It is need to recover to use simply searching internet and check email.

On the other hands, mobile Internet users can solve the problem of mobility and booting lag, however there are another problem to use. First, speed on the network is the matter. Mobile Internet could make speed as wired internet on the network over HSDPA or CDMA EVDO. Now days, LTE brings a fundamental shift in value creation for generation networks and satisfies consumer needs for

network speed. Second, there are many uncomfortable factors to bother the consumer to use Internet as wired environment. The problems are small screen size of cell phone (Mair 2009), uncomfortable input system, battery shortage (Cho, Woo *et al.* 2014) and difficulty accessing menu. Third, there are not many contents to use. Especially Korean site usually use Active-X or plug-in application so that it is difficult to implement all contents in mobile Internet. Forth, mobile operator would not offer appropriate price to use Internet as using wired Internet. It is need to make an offer lower using fee for activation of mobile Internet. Limitless price system could make mobile Internet demand high.

Consumers do not have interest to technology, and they only have concern to how to use which service and function.

3. Industry value chain:

Some elements are needed to embody the mobile Internet. The first element is network provider (wired/wireless). The second element is platform

provider. Portal operators such as Yahoo and Google are able to be a platform provider and mobile telecom operators such as Nate (SKT) and fimm (KT) are also able to be a platform provider. The third element is contents provider who work on platform and network. And last element is device vendor such as Samsung and LG who provide wired/wireless terminal. In the past, some strategic movement exists on the industry value chain. The first movement is to merge between wireless and wired operators. (Merge between KT and KTF is a typical movement) The second movement is strategic alliance among platform, network, and terminal player (ex. Google-Orange-HTC). The third movement is competition between Google and mobile operator to take a leadership in platform providing. The last movement is device vendor's movement for creating and managing the part of services on the mobile Internet. Device vendors embody the plan to get the leadership in the field of E-mail, SNS and 3screen service which will be told as a future opportunity and the business model based on cooperation with operator in that filed.

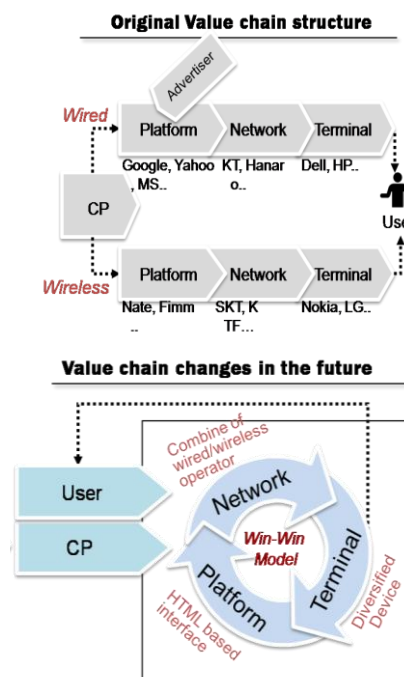


Fig. 2: Mobile Internet Value Chain Changes.

Mobile Internet 1st Generation Cases:

1. Korea Mobile Operators' competition:

In Korea, three operators competed with each other. Three operators also concentrated on full browsing. SK telecom, the first runner in the mobile telephone market; provided the Auction Mobile and T-Interactive. T-Interactive contains services such as registering the path which accessed to information that primarily used mobile phone customers and favorite locations in wireless internet on mobile phone display. Moreover they focused on not only

WAP service-oriented Internet, but also provided full browsing which included web based service to increase the value of device and create new demand such as linked with additional service like e-mail or file viewer. KT, the 2nd runner in the mobile telephone market, had its brand "SHOW". SHOW provided services that contained Korea first data free mobile auction service, Pop-up SVC and mobile instant message. Pop-up SVC was information service that was waiting on the screen appears immediately when the customers needed to get

information such as major portal, weather, traffic and stock service. LG, the 3rd runner in the mobile telephone market and had aggressive strategy on mobile Internet. They had their brand "OZ". OZ concentrated on customized strategy for each generation. So OZ provided personalized initial screen and most preferred and frequently used menu by 3 separated age.

Currently, mobile Internet has become a complement of broadband service. Faster and efficient mobile Internet has displaced some part of wired Internet service. But in Korea, it may perform

different situation. In Korean market, Big 3 servicers, SK telecom, KT and LG, have whole package of telecommunication such as IPTV, broadband service, mobile phone service, VoIP. So they don't compete based on wired and wireless business because they have both resources. Moreover they already make bundle set of all different services. SK provides T band set, KT provide Qook and SHOW set, LG provide LG bundle set. Now they concentrate on improving their brand. They competes each other by strategies based on the brand name of whole package, not the network type; wired or wireless.




company	Main promotion service
	<ul style="list-style-type: none"> - Auction Mobile : Wired-Wireless SVC service that interlock existing Auction - T-Interactive - New communications link wireless internet to customer, mobile phones to me. - Register the path which access to information that primarily used mobile phone customers and favorite locations in wireless internet on mobile phone display - Full Browser - Not only WAP service-oriented Internet, but also provide full browsing which include Web service. This can increase value of device and create new demand. - linked with additional service like E-mail or File Viewer.
	<ul style="list-style-type: none"> - SHOW Internet - Mobile Auction : Korea first data free mobile auction service. - Pop-up SVC : Information service waiting on the screen that appears immediately to the customer need to. For instance major portal, weather, traffic and stock service - free for update on screen - Mobile IM - Full Browser
	<ul style="list-style-type: none"> - SVC mobile Internet strategy by Communication Theme with mobile world - provide personalized initial screen by customers' age - to use Wireless internet service easier and more convenient, provide most preferred and frequently used menu by 3 separated age - Full Browser

Fig. 3: Korea mobile operator mobile Internet service strategy .

• Impediment:

Regulation:

In Korea, there are several regulations for mobile Internet. In 2007~2009, the issues about i-Phone have changed the several regulations. The main issues of i-Phone are Law of private information and WIPI (Lee and Oh 2008). I-Phone offers maps including compass service which offers users' location information using GPS location and base station location through Wi-Fi service. It is illegal to use private information as any purpose without giver's permission. It is the problem that Korea Communication Commission Agency regards the location information as private one. If i-Phone offers the service, Apple corp. has to get the permission from all users. Also KCC warns Apple to take responsible for the problem, not mobile operators (KT, LGT, SKT). There are no countries that Apple offered i-Phone without this information service. Also there were WIPI problem. WIPI (wireless internet platform for interoperability) is Korean standard platform which is developed for solve the problem that all telecommunication company use all different mobile platforms. It made contents provider develop all different contents and program. It was going to be problem because WIPI is only for Korea so contents provider could not offer globally their products. Also users had constraint to use global various platforms. Because of users and makers demand, it was deregulated since April 2009. Finally there are still unsolved problem of contents. KCC have adult contents certificate keyword 718. It applies both mobile and fixed Internet. If you enter

those key words in Internet window, there will be certificate alerts to everyone. It is not a problem for wired internet environments, because certificate system is simple. However mobile environments are much more complex and time consuming, thus it is needed to be changed. Also in keywords 718, many regular words are included so that it makes contents providers uncomfortable to offer exact information.

Tariff:

Tariff is also impediment to activation of mobile Internet. Korea mobile Internet market had unique price structure, double pricing to using mobile Internet. For example, when consumer download 1 mp3 from web store, they pay only contents fee 500won in the wired environment. However, in wireless environment, they have to pay contents fee and data charge, 500won and 10,547 won (figure 4). It was heavy burden for wireless Internet users. Usually mobile Internet operator wanted to raise the using fee, company wanted higher price and governments gave pressure to down price. Mobile Internet using price. Excluding LGT, SKT and KT did not provide any appropriate price level. Actually, this price system makes users do not use mobile Internet.

LGT changed this problem (Table1). It provided appropriate price system for users. They charged only 6,000won for Internet 2000-4000 pages (1GB). They supported full browsing service and low price both. It was possible to implement because they had lower the network loading using different line voice (CDMA 1x EVDO) and data (revision A). This

service attracted consumer more than 900,000 LGT OZ service users.

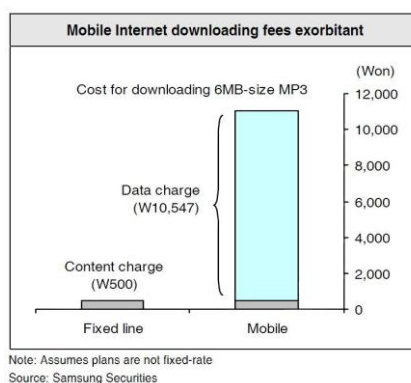


Fig. 4: Double pricing (Korea market in 2009)

Table 1: Tariff.

Company	Fee	Benefit
SKT	Data Perfect 10,000/month	100,000 worth
KT	Absolute free zone 10,000/month	30 kinds of data free in free zone
LG	OZ price 60,000/month	2000-4000 pages (almost 1,000,000 won worth)

Mobile Internet 2nd Generation Cases:

1. Network evolution and Telco's response:

Advancement of network makes mobile services diversity. Consumers want network to have high speeds and enough capacity to use the mobile services with ease. LTE Advanced is a technology that enables operators to at least double 4G network speeds and capacity. LTE Advanced network enables operators to aggregate different spectrum bands (700-900MHz, 1.8GHz, and 2.6GHz). Consumers can use a single network and handset with different spectrum. It is particularly useful as operators seek to re-farm old 2G/3G spectrum for 4G use. Having

started in South Korea, LTE-Advanced networks have been rolled out globally.

In 2015, South Korea LTE already has saturated and mobile operators' sales growth is slowing. Korea LTE's penetration is about 65% while smartphone penetration rate is about 72%. This implies LTE market remaining potential is 7%. KT (Korea Telecom Company) unveiled new tariff plans that offer unlimited free voice calls to subscribers using 300MB or more of LTE data. This benefit was originally given only to subscribers using 5GB of LTE data or more. This strategy is effort to mitigate saturation in LTE market.

Table 2. KT New Tariff in 2015.

(KRW)	Calls	Data
29,900	Unlimited (wireless)	300MB
34,900		1GB
39,900		2GB
44,900		3GB
49,900	Unlimited (Fixed line + wireless)	6GB
54,900		8GB
59,900		10GB+2GB /day

2. Future opportunity business model(II) :

Mobile Internet potential profit areas must have power to change consumer life style. First, Internet of Things including connected devices is likely to change people's life style. The IOT (Internet of Things) has been highlighted at the censor developers, connected device company and semiconductor players.

Intel made CPU and some chips designed for Internet of Things and wearable devices such as Quark, the ATOM processor E3800 low power ship. Qualcomm made QCA 4002/4004 as a low power

Wi-Fi chip. This solution helps consumers to use Wi-Fi to any product. Internet of Things uses mobile Internet, censor network, and near field communication technology. It embodies integrated mobile Internet business. Second, smartphone games will increase competition. Third, mobile Instant messaging services have increased paid membership and sticker revenue in Korea and China. Fourth, transaction based business model such as online reserving, e commerce, O2O business based on LBS is rapidly increasing.



Fig. 5: Korea Mobile Internet business players.

In Korea, leading venture companies are led by mobile business player categorized mobile messenger, social shopping, mobile game, and offline/online connection, so called O2O business. Industry has been reshaped based on mobile Internet business.

Kakao has about 10 trillion won in corporate value based on total estimate after merger with Daum. The second largest shareholder of Kakato-Talk is TenCent, a Chinese company, which shows international economic exchange and cooperation is increasing. Kakao's business models include game broadcasting, advertising, and stickers. Game broadcasting is a business model allowing a portion of payments for items on the mobile game platform. Advertising is to charge for accounts and solutions that are marketable through group text messaging to companies. Kakao has Plus Friend (brand) and business profiles (on-site store owners) and stickers generate revenues from familiar text message emoticons.

The world Internet market is reshuffled as Facebook and WhatsApp (USA), Line (Japan, Southeast Asia), TenCent (China), Kakao (Korea) from the mobile Internet. In China, there are fierce competition among Baidu, TenCent, and Alibaba.

From the technology view, HTML 5 on mobile enables mobile web-based services and device to device technology enlarges more efficient connectivity environment.

Discussion And Conclusion:

There are a few things to consider in predicting evolution of Mobile Internet. First, we have to distinguish from developed countries mobile Internet environment and that of developing countries in view of consumer experience. In developed countries, consumers have experienced fixed Internet before mobile Internet. However, in developing countries, consumers have experienced mobile Internet first. Mobile Internet is first and sole experiences. Facebook has spread Internet to developing countries through "Internet. Org Project". Consumers in developing countries do not have the target compared to Mobile Internet.

In this case, mobile Internet demands may increase without complaint. Second, we should consider interest of third party developer around

mobile Internet ecosystem. Future service is expected to be offered as web-mobile convergence. Service and device will be developed as implementing mobile web 2.0. Also 3rd developers will make related technology in Open API environment. Widget or sync technology development is going to be improved for contents from web to mobile and from mobile to web. The third party developer will expect plenty profit in mobile Internet ecosystem. Ecosystem should be made to the structure to ensure profitability(Gorgan, Bacu *et al.* 2012). Third, we should analyze competition between online video consumption and smart TV(Portnoff 2014). Related firms have competed fiercely for hegemony in the video and TV market. Mobile advertising business has started to transition(Izquierdo-Yusta, Olarte-Pascual *et al.* 2015). In the past, the competition was the center of the portal. In the future, we need to approach comprehensively considering trend of user traffic, mobile access, individual apps, integrated platform player, store distribution and O2O business channel.

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