

Browsing as the killer app: Explaining the rapid success of Apple's iPhone

Joel West
San José State University
Joel.West@sjsu.edu
<http://www.JoelWest.org>

Michael Mace
Rubicon Consulting, Inc.
Mike@RubiconConsulting.com
<http://mobileopportunity.blogspot.com>

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Abstract: Since the mid-1990s, the mobile phone industry has sought widespread adoption of mobile data services, envisioning a new “mobile Internet” with its own complex value network delivered through smartphone terminals. With its iPhone, Apple rapidly gained smartphone market share while spurring widespread adoption of mobile data services in the United States.

Here we argue that the success of the iPhone was based on Apple's conception of the mobile Internet as being another modality of the existing wired Internet, and its leveraging of existing systems competencies. We demonstrate how a promise to deliver the “real Internet” was a core part of Apple's original strategy, and that iPhone users quickly showed an interest in web browsing disproportionate to any other mobile phone in the US or Europe. From this, we suggest implications for the development of the mobile Internet in other countries, as well as for future value creation and capture in mobile phone value networks.

Keywords: mobile Internet; value networks; handsets; industry structure; digital convergence

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1. Introduction

After network operators in developed countries achieved high penetration rates for mobile voice services, their major hope for revenue growth became increasing the use of mobile data services. These services were used to justify the development of 3rd generation (IMT-2000) mobile telephone standards, as well the billions of euros spent in Europe on spectrum and updated network infrastructure.

Much of the effort in the past decade to create a mobile Internet has focused on constructing a brand new value network designed from the beginning for mobile phones. This was driven in part by a desire to establish market control and power: the sponsors wanted to create a new value network that they control rather than join an existing network they did not control. Examples would include DoCoMo's dominance of Japanese telecommunications, the walled gardens of Western operators, and Nokia's efforts to create enterprise services and spawn Finnish m-commerce startups.

But there was also a belief that a new version of the Internet was needed before mobile data could succeed. The argument was that the wired Internet, built for large screens and keyboards, was not appropriate for use on mobile phones with small screens and no keyboards.

However, the rapid success of the iPhone in the United States and Europe suggests these approaches have been misleading and incomplete. Rather than trying to recreate the Internet, Apple focused on re-creating the mobile phone to make it a good client to the already-mature ecosystems of the wired web, while at the same leveraging its existing iTunes content ecosystem and other elements of its systems integration competencies.

This article uses the success of the iPhone to consider broader questions of how value is

created for mobile Internet users, and which firms will capture the returns from such users. It examines direct and indirect impacts of the iPhone on both the market for converged mobile devices and the conception of value creation for mobile devices and data services. It focuses on the two markets (in the US and Europe) where the iPhone was introduced in 2007, and considers both Apple's strategies and the responses by its competitors.¹ The paper concludes by discussing future adoption patterns for the mobile Internet, the role of new devices in establishing new communications services, and the future control of value capture in mobile phone value networks.

2. Value Creation in Mobile Networks

2.1 Creating and Capturing Value in the Value Chain

The delivery of goods and services to mobile phone subscribers has been conceptualized as a sequential value chain, or as a complex value network with third party suppliers of complementary goods and services (Maitland et al, 2006; Sabat, 2006; Tilson and Lyytinen, 2006). Some elements of such a chain (or network) — such as hardware and software components and network infrastructure — have only an indirect relationship to subscribers. Key elements visible to subscribers include the provision of mobile devices and network access services. More recently, with the rise of mobile data services, the value-creating elements have increasingly included a broad category labeled “content,” which includes pre-recorded entertainment, live entertainment, news, sports and other information, as well as applications

¹ The Asian market for mobile data and convergence devices — notably in Japan and Korea — is significantly different from North America and Europe, to a degree that would be impractical to cover fully in this article. Funk (2003, 2007) provides detailed coverage of the Japanese market for mobile data services.

(such as games) that add functionality to the device.²

As with any industry, pricing power (and thus firm profit) for a given structural position within an industry value chain is influenced by the number of competitors; firms generally compete by creating differentiated offerings or by providing undifferentiated offerings at the lowest possible cost. A successful business model requires that a firm not only be able to create value, but also be able to sustain value capture in the face of competition from rivals and substitutes, as well as resist cost and pricing pressures from upstream and downstream members of the value chain (Porter, 1985; Chesbrough and Rosenbloom, 2002).

In some cases, the delivery of value is through a linear chain controlled by the network operator's distribution channel and its relationship with the subscriber. An example of this is when a consumer buys a handset directly from an operator and uses content provided by its "walled garden." In these cases, the subscriber's choice of operator also constrains the choice of device and content.

Competition was initially scarce between and within mobile phone value chains, which began as extensions of the existing wireline telephone systems organized as a natural monopoly. However, in the 30 years since the first cellular phone systems were launched, competition has increased for both operators and equipment suppliers — both by the increase in the number of direct competitors, and through competition

² Consistent with earlier papers on mobile data services (e.g. Tilson & Lyytinen, 2006), when we use "content" without qualification, we refer to all of these various categories; in other contexts "content" has been used to refer to a subset of these categories. We also do not draw a distinction between information goods (e.g. a pre-recorded movie) and customized services (mapping, e-commerce).

between operators and manufacturers for capturing the returns from mobile phone equipment and services.

Prior to the 1980s, most large wireline network operators relied on captive equipment suppliers. The rate of technological change was slow, allowing the predictable amortization of capital investment over a period of decades. The operators thus functioned as utilities, delivering a standardized commodity service (voice calls) for a set price with ubiquitous distribution, while suppliers enjoyed a predictable source of business for decades.

Both technological and regulatory changes began to erode the control and increase the competition faced by the fixed operators in the 1970s and 1980s, including the growth of mobile phone networks and liberalization that brought multiple competing operators. In the face of these changes, the efforts of most operators have been focused on defending and expanding their user control and their ability to extract most of the profit from phone customers. Meanwhile, suppliers of other parts of the telephony value chain, especially mobile handset vendors, have been trying to reduce the operators' control and secure a larger percentage of the profits for themselves.

Still, during the 1990s mobile phone industry structure and demand conditions were favorable for both Western network operators and handset makers. Mobile phone adoption was growing rapidly, thus allowing operators to increase revenues by participating in the overall industry growth; in many countries including the US, operators also controlled the subscriber relationship and thus the allocation of returns in an end-to-end-value chain. Leading mobile phone vendors such as Nokia, Motorola and Ericsson both enjoyed this growth, and appeared protected by high entry barriers of radio

expertise, scale economies and global distribution channels.

By the time the iPhone was introduced in 2007, the profitability of mobile voice services had declined dramatically. Operators in developed markets faced saturated markets for commoditized services, and thus fought a zero-sum battle for market share. Meanwhile, vendors used to competing on innovation-driven differentiation were increasingly forced to compete on price, both with new entrants (especially from Korea and China) and also serving more price sensitive customers in developing countries.

Operators, handset vendors and other firms in the new mobile value network were thus vying to capture value against direct competitors, suppliers or customers. For example, operators such as Vodafone openly expressed a desire to further commoditize handsets. Even with increasingly complex mobile devices, standardization has the prospect of enabling such commoditization. Market entry has been aided by fueled by the emergence of component-based hardware suppliers (e.g. Qualcomm and TI) as well as open source software alternatives (notably the Linux operating system and WebKit web browser engine).³

For both operators and handset vendors, the best hope for growing revenues lay with mobile data services. However, such services would require a more complex value network than for voice services. The major difference was the third-party provision of content, whether provided to subscribers via a distribution channel provided by the operator or other aggregator, or through a

direct relationship from the content creator to the subscriber that bypasses the operator.

2.2 Initial Efforts to Create a Mobile Internet

In Europe and the United States widespread adoption of mobile data services was predicated upon (and justified) multibillion dollar investments in new 3rd generation mobile phone networks that would deliver DSL-caliber bandwidth to mobile phones in cafes, cars and trains (Bekkers, 2001; Ure, 2003). In the late 1990s, telecommunications vendors and operators in Europe, Japan and the United States promulgated ITU-endorsed standards for 3G wireless networks, and various countries either assigned or auctioned off new radio spectrum to enable such networks to be deployed (Bekkers and West, 2009; Anderson et al, 2005).

In conceptualizing, planning and implementing the mobile Internet, telecommunications companies — manufacturers of handsets and infrastructure, operators of mobile data networks, and providers of online services and content — faced two alternatives: they could leverage the existing applications, content and value networks of the wired Internet, or they could build their own. Differences between different markets — specifically Japan, Korea, U.S. and within Europe — suggest that there was considerable path dependence in which mobile data strategies were successful in each market.

During the period 1997-2007, nearly all of the emphasis was on new mobile-specific solutions for two reasons: limited mobile data speeds and control of the value network. First generation mobile data networks such as CDPD were limited to only 19.2 kbps. Beginning in 2000, operators began rollout of 2.5G services such as GPRS, which still provided only dialup-caliber throughput at a time when residential broadband

³ In the PC industry, systems assembly had low barriers to entry, thus becoming a commodity with nearly all of the profits accruing to the operating system and CPU suppliers (Kraemer & Dedrick, 1998).

service had become widely available in developed countries.

A number of mobile data solutions were developed that used both simplified content and low-speed data transmission. The WAP Forum was created in 1997 to develop and promote the Wireless Application Protocol, a simplified version of the protocols used on the wired Internet. However, WAP promised a mobile Internet experience that it could not deliver (cf. Sigurdson, 2001; Palomäki, 2004). Meanwhile, messaging and information service experiments were created using mobile data services such as ARDIS, CDPD and Mobitex, with top transmission speeds of 5-10 kbps (vs. 50 kbps for landline dial-up and 128-256 kbps for DSL). But such speeds proved inadequate for supporting richer media formats such as web pages with photographs. Finally, the Parlay Group (formed in 1998) created protocols in which operators would become retailers of third-party value-added services (Iversen & Tee, 2005).

Meanwhile, rather than wait for high speed 3G networks, beginning in 1999 Japan's NTT DoCoMo introduced its i-mode system which achieved ubiquitous adoption despite slow data speeds. By the end of 2002, there were approximately 70 million Japanese subscribers to such limited mobile Internet services, and another 35 million using similar services in Korea (Funk, 2004: 7-8).

Based on his studies of early mobile data services, Funk (2001: 56-57) concluded that DoCoMo and other Japanese operators successfully sought to achieve reach (widespread adoption) with limited richness, while Western operators sought to replicate the richness (bandwidth-intensive multimedia) of the Internet for a small niche of price-insensitive customers. He argued that any effort to spur adoption of mobile data and content services

should emphasize reach over richness, and that US and European firms were over-emphasizing replication of the multimedia-rich wired Internet in their mobile Internet strategies.

Meanwhile, efforts (successful and not) to build mobile-specific Internet content assumed development of a new value network to supply this content. The success of DoCoMo (and its Japanese imitators) rested on three pillars: new i-mode specific content, a rapidly growing user base (attracting even more content), and its willingness to take a 9% commission on all transactions rather than demanding a much larger cut (Funk, 2001).⁴

Cognizant of DoCoMo's success, US and especially European wireless operators sought to create their own value networks to spur adoption of 3G data services and also to garner additional revenues by controlling mobile commerce transactions. In many cases, the operators tried to provide the services themselves, sharing revenue as necessary with wholesale suppliers but controlling all aspects of the transactions through creation of a "walled garden." In other cases, third parties were allowed to interact directly with end-users without operator involvement — particularly for services that were a mobile extension of the existing Internet (Maitland et al, 2002; Tilson and Lyytinen, 2006). The recent dramatic explosion in user-generated content — particularly real-time information sharing such as blogging and Twitter — has increased the value of mobility for web-based Internet services.

⁴ By building both customers and content, DoCoMo and its Japanese rivals were able to overcome the "chicken and egg" problem of priming the network effects needed for adoption network industries (Funk, 2007). In an (ultimately unsuccessful) effort to replicate this i-mode success in other countries, from 2000-2002 DoCoMo made more than \$15 billion in strategic investments in carriers in the US, Europe and Asia (Cullen 2002).

Today, the additional value-added services and products can be clustered into these categories:

- *Additional communications features*: more advanced forms of communications that supplement or replace voice calling — such as SMS, text messaging, e-mail, videoconferencing — requiring both extensions to the device and ongoing access to the network.
- *Additional computing features*: add-on software packages (such as business productivity or games) similar to those found a PC or PDA, typically from third-party software vendors.
- *Commercial content*: news (text, pictures, video), information services, movies, music, ringtones and other professionally-generated content — often depending on major media companies such as Bertelsman, Disney or Sony.
- *User-generated content*: the most recently developed category, it includes photo sharing, video sharing, blogging, wikis, and social networking (such as Facebook and Twitter).
- *E-commerce*: conducting transactions online, whether through dedicated client software or through a browser.

The eventual revenue models for many of these services are undetermined, with the three major possibilities being subscription fee, fee per use (or per product), and ad-supported. Users' experience with the wired Internet created an expectation of large amounts of free information, whether models based on targeted ads (such as Google's), advertorial content with embedded ads or product placement (such as movie previews), or user-generated content including blogs. Operators hoped to obtain

revenues by leveraging the unique mobility and location-aware possibilities of mobile phones — such as through location-based ads — but such business models remain unproven.

The increase of free (or indirectly-supported) Internet content diminished expectations that US operators could control all access to the content and charge a fee as a middleman, as NTT DoCoMo successfully did with its i-mode service. The apparent end of such hopes for walled gardens could be seen in late 2007, when the two largest US operators announced that they would provide (unspecified) open access to their respective networks, while the CEO of the world's largest mobile operator, Vodafone, admitted that it would eventually lose control of its own network (Sharma and Searcey, 2007; Ray, 2007).

If they did not control the online transactions, operators at least assumed they could sell access to the network, whether per-usage or via a flat monthly subscription fee. However, digital convergence has also brought operators competition for higher wireless speed data access. This includes both paid Wi-Fi or WiMax services, as well as free Wi-Fi access at work, at home, or even from restaurants that provide the commoditized service to attract customers. Operators thus faced considerable uncertainty in picking a revenue model to pay the cost of creating and running mobile data networks.

Even DoCoMo began to feel pressure to offer more open access to its network. In the summer of 2005, it released 3G phones with full Internet browsing capability using third party browsers from Access of Tokyo and Opera Software of Oslo. Three years later, after the release of the initial iPhone and Android models, a DoCoMo exec emphasized global open standards that allow the same handsets and applications used on DoCoMo and other networks (Benjamin, 2008).

2.3 Market Experiments in Mobile Devices

With the emergence of the Internet and the rise of faster mobile data networks, the concept of an Internet-enabled mobile device has provided a realization of the decades-old vision of digital convergence between communications and computing that was first proposed in a 1977 speech by NEC chairman Koji Kobayashi (cf. Kobayashi, 1986). During the 1980s and early 1990s, key aspects of the convergence idea were developed and popularized by futurist Nicholas Negroponte and Apple CEO John Sculley (Sculley, 1987; “From Idiot Box to Information Appliance,” 1994; Gordon, 2003).

Based on the evolution of the communications and computing industry, a vision of mobile convergence devices emerged in the 1990s that provided voice and data communications in a mobile computing-enabled device. These devices arose from the confluence of mobile phone and personal digital assistant (PDA) design paths, and today the category is normally referred to as the “smartphone” segment of the mobile phone market (Table 1). In the face of saturated demand and falling prices for voice services, since 1997 operators have attempted to sell devices to create revenue growth: selling new data services provided the operators’ best hope of increasing average revenue per user (ARPU). Similarly, the commoditization of voice telephones meant that most handset vendor profits were made from high-priced, high-margin products incorporating sophisticated computer capabilities.

Originally such devices were limited by the available hardware — including LCD screens, microprocessor speed, battery life, data bandwidth — as well as an incomplete understanding of the product category by both producers and users. What is widely considered to be the first convergence phone came in 1997, when Nokia introduced the Nokia 9000, a mobile phone with built-in QWERTY keyboard

marketed in Europe as a replacement for a small laptop. However, the 9000 weighed 397 grams and was not a major sales success. The first US “PDA phone” was Qualcomm’s 1998 pdQ based on the Palm OS, but like the Nokia 9000 it was too large and heavy (285 grams) for a cellphone, and found only a small audience.

In 1998, Nokia, Psion, Motorola, and Ericsson banded together to create the Symbian joint venture to produce a mobile phone OS. The first Symbian smartphone (the Ericsson R380) shipped the following year.

By 2001, both the device size and the design choices began to more closely match what customers wanted. These include the Handspring Treo 180 (2001) and RIM BlackBerry 5810 (2002) in North America,⁵ and the Ericsson p800 (2002) in Europe. Also released at this time were mobile phones based on Microsoft’s Windows, but phone makers’ concern about Microsoft’s supplier power forced Microsoft to partner with second-tier Asian manufacturers eager to gain market entry using Microsoft’s brand and access to key enterprise buyers.

In its first five years selling smartphones, RIM surpassed Palm OS and Windows for dominance in North America; elsewhere in the world it had little impact, garnering only 8% of 2006 global smartphone shipments. The leading smartphone vendor in 2006 was Nokia, with 50.2% of the world market, while Symbian OS was the leading smartphone OS, with 67% share of an estimated 77 million phones sold (Canalys 2007). Since its initial Nokia 9000 smartphone, Nokia developed 10 subsequent models in its Communicator family, but most of its smartphone sales come either from phones in

⁵ Previous BlackBerry models were e-mail centric devices similar to two-way pagers, while the 5810 was the first BlackBerry that also supported voice calls.

more traditional form factors or those (such as the E61, E62 and E71) that resemble the RIM BlackBerry.

When the iPhone was announced in 2007, the most successful converged phones in terms of actual data usage in the US and Europe were the business-oriented e-mail devices, led by the RIM BlackBerry. The BlackBerry's basic screen and keyboard layout has been copied by a wide range of competitors, including the Palm Treo, Nokia E-series, Motorola Q, and Samsung Blackjack.

Efforts to create a converged entertainment device were much less successful. The Nokia N-Gage gaming phone, launched in 2003, was a spectacular failure,⁶ as was (on a much smaller scale) the TapWave Zodiac, a converged PDA and game device. The Danger Hiptop youth communicator was a minor success in the US and several other countries, but was offered by only a single operator and shows no signs of rapid growth. In 2009, Sony was rumored to be planning yet another product in this category, by creating a converged phone based on its PSP mobile gaming device (Takenaka 2009).

At the time of iPhone's introduction, the most successful entertainment phones in the West were the SonyEricsson Walkman phones — popular in Europe although not widely available in the US. In 2005, Motorola launched the Rokr with iPod capabilities licensed from Apple, but the phone was not a hit. Critics at the time argued that the phone's music capabilities — with a limit of 100 songs — were deliberately

⁶ “The N-Gage was not as commercially popular as Nokia [predicted], having sold, by the end of 2005, less than half of the minimum six million units that had been Nokia's target.” (“N-Gage”, 2007). One problem Nokia faced was attracting video games to a new gaming platform in competition with three major consoles and one (soon to be two) portable game platforms from console makers.

crippled by Apple to avoid cannibalizing iPod sales.

3. Apple's iPhone Strategy

In 2007, the most prominent new entrant to the mobile phone market was Apple Inc. (née Apple Computer). As a device, the initial iPhone differed from traditional mobile phones in having a large touchscreen for viewing video and the Web, a browser based on personal computer standards rather than rewritten for mobile, a custom user interface with intuitive panning and zooming designed specifically for that touchscreen, and no physical keyboard or keypad. Unlike most other smartphones, it also required purchase of a mobile data service plan. Apple's value proposition for the iPhone built upon the iTunes music and video service that it had already developed for its market-leading iPod music players (West and Mace, 2007).⁷

Thus the iPhone was designed as an integrated component in two existing value systems, rather than as a standalone handset. This trend toward integrated systems design has roots in Apple's personal computing strategy, and continues a long-term tech industry debate between “closed” and “open” innovation (cf. Chesbrough, 2006).

After shipping its first iPhone in June 2007, Apple extended its initial iPhone strategy in two different ways. First, it released the iPod Touch, which offered the iPhone operating system, its PDA features and ecosystem without the phone capabilities. Secondly, it followed the initial iPhone with annual releases of updated models and operating system software. If the initial iPhone provided an easy to use phone with superior web browsing capabilities, the 2008

⁷ Data on the iPhone product and its strategies were taken from the Apple website, its 10-K and 10-Q filings, analyst estimates and news articles. The history of Apple and its product strategies is given by several book-length histories (e.g. Malone, 1999).

update brought better web browsing (through a UMTS radio interface) and a revolutionary application development platform and delivery channel. The 2009 update improved the phone hardware to offer parity with many competitors, while adding an improved delivery channel for third party software and services.

3.1 Apple's Historic Competencies

Beginning with its Apple II in 1977, Apple used software skills to distinguish its personal computers from competitors. In the 1980s, it led the industry in ease of use with its Macintosh graphical user interface. And in the 1990s, first with its PowerBook laptops and later with its iMac and iPod product lines, it made industrial design a source of advantage.

Throughout its first three decades Apple was consistent in using end-to-end systems design to both create value and capture that value. Apple operated as a vertically-integrated supplier of operating system software and hardware, but encouraging third-party application supply. This strategy was consistent with other successful computer systems such as those from IBM and Digital Equipment. The only major exception to this integrated pattern came with the “Wintel” duopoly, in which Microsoft and Intel were the dominant PC suppliers as unintended beneficiaries of IBM’s longstanding market power (Moschella, 1997; Bresnahan and Greenstein, 1999).

A number of mobile phone platforms — including Palm OS, Symbian and Windows Mobile — have sought to replicate the Wintel model, separating the supply of key components from hardware sales. The iPhone challenged this assumption by offering a more integrated and closed system including OS, hardware, built-applications, and online services.

The iPhone thus reflected Apple’s systems approach — control of music content, hardware,

software and distribution — rather than a mere point product (Figure 1). The ties that such a systems approach creates between the user and handset vendor are a direct challenge to operator control, potentially relegating an operator as a mere service provider supporting the phone, rather than the central player in the customer relationship.

3.2 iPhone Product Design

When Apple introduced the first iPhone in January 2007, it attracted thousands of articles of favorable (if not fawning) publicity. Apple predicted it would sell 10 million iPhones worldwide in 2008, about 1% of the global market.

The iPhone contained the features standard to other phones — including voice connectivity, calendaring, and address book and e-mail — but had major differences:

- Instead of a physical keyboard or keypad, the phone used a touchscreen with a software-defined virtual keyboard for numeric and text input.
- As with Apple’s iPods — but unlike most competing smartphones — it lacked a user-changeable battery or memory card.
- It functioned as a high-end model of Apple’s best-selling iPod music and video player line, with the 480x320 screen offering a larger image than any other model. With this, the iPhone was fully integrated into Apple’s market-leading iTunes Store for downloading audio and video entertainment content.
- It contained a version of the Safari web browser, adapted from the browser Apple had developed for its personal computers, and enhanced with touch-driven interface

features that made it easier to manage web browsing on a small screen.

By using the standard browser, the larger screen and a touchscreen replacing a mouse, Apple hoped to provide a mobile Internet experience closer to a PC than any previous mobile phone. With this improved browsing experience, Apple believed its iPhone would help operators spur mobile data adoption. As Apple CEO Steve Jobs said three weeks before the initial iPhone release:

They [Cingular] have spent and are spending a fortune to build these 3G networks, and so far there ain't a lot to do with them. People haven't voted with their pocketbooks to sign up for video on their phones. These phones aren't capable of taking advantage of it. You've used the Internet on your phone, it's terrible! You get the baby Internet, or the mobile Internet — people want the *real* Internet on their phone. We are going to deliver that. We're going to take advantage of some of these investments in bandwidth. (Block, 2007).

A major limitation was that the initial iPhone did not have the 3G support customary in Japanese and European smartphones, but instead used the slower EDGE 2.5G network; Apple claimed this was because GSM-derived 3G was not yet broadly deployed in the US and because existing 3G components would not allow five hours of battery life. The browser mainly relied on Wi-Fi access, which was common in European phones at the time but was disabled in most phones sold by U.S. network operators; music downloads relied at first on a PC connection and later Wi-Fi.

3.3 iPhone 1.0 Business Model

With its introduction, Apple announced it had negotiated a multi-year US exclusive agreement with Cingular (which later became AT&T).⁸ When Apple began development in 2005, it started a bidding war between the two largest US operators, Cingular and Verizon Wireless (Sharma et al, 2007). While the exact terms were not disclosed, various reports suggested that Apple used its brand name and iPod market position to win significant concessions. Apple also used the threat of starting its own MVNO (Mobile Virtual Network Operator) for negotiating leverage (Vogelstein, 2008).

The most controversial concession was Apple's demand for a share of ongoing subscriber revenues. Various analysts estimated that Apple initially earned between \$3 and \$18 a month in revenue sharing, or from 5-40% of the gross monthly service charge — as well as assuming support obligations normally assumed by the operator. Apple's revenue demands were seen as a major reason why it had difficulty getting other operators to distribute its initial iPhone.⁹

Apple also insisted on control over the user experience. The phone would be only available from retail and online locations owned by Apple or Cingular, but initially not thousands of third party Cingular resellers such as Best Buy and Radio Shack. Support (including activation and repair) would be provided by Apple. Cingular employees underwent special training on the phone prior to its June release.

⁸ Cingular Wireless was founded in 2000 as a joint venture of two former AT&T subsidiaries, SBC and BellSouth. SBC bought AT&T in 2005 and BellSouth in 2006, with the combination adopting the AT&T name. In 2007, the Cingular mobile phone service was also renamed AT&T.

⁹ While many saw Apple's revenue sharing model as unprecedented, others noted that Research in Motion earned both an initial bonus for new customers and an ongoing revenue share for its BlackBerry products (Sorensen, 2007).

In return, Cingular hoped to gain new and more profitable (higher ARPU) customers. It reportedly negotiated a five-year US exclusive to the iPhone. With this promise, Apple foreclosed the pattern of other mobile phone makers in the US and Europe, which would grant one operator an exclusive for 60 or 90 days, and then proliferate popular models across all operators.¹⁰ This reflected a calculated gamble by Apple (and Cingular) that loyalty to Apple and the iPhone was greater than loyalty to any specific operator.

Also, Apple's system required that all iPhone buyers activate Cingular phone service and subscribe to mobile data services. Thus, a \$599 (later \$399) phone would require a minimum two-year service contract costing \$1,400 (with most users taking plans from \$1,900-\$2,400). This approach not only guaranteed revenue to AT&T, but also meant that every iPhone user had available a prepaid mobile data plan, thus encouraging causal mobile Internet usage.

This revenue sharing arrangement was enforced by "locking" the phone so it could not be used on other phone networks. Since the mid-1990s, similar locking had been used by US operators to recover up front subsidies to reduce the initial purchase price of new handsets, supplemented by multiyear contracts. Both the technical and legal measures constituted an intentional switching cost to recoup customer acquisition costs, as predicted by Shapiro and Varian (1999).

Instead of subsidizing the initial purchase price of the phone, Cingular would earn a small profit

¹⁰ In Japan, manufacturers had long provided exclusive phone designs to NTT DoCoMo, which used these designs to gain competitive advantage (Funk, 2003). But such exclusives are far less risky with a operator that (as DoCoMo has) controls a majority of the market, than in the US market where no single operator has captured even 30% share for the past decade.

on the units sold through its stores (Vogelstein, 2008). The new business model both upended the financial value of the handset sale, but also changed the handset from a commodity bundled with service to a crucial part of the customer value proposition. The high gross margins for the iPhone — estimated at 33%, including distribution channel margin, consistent with other smartphones — also provide an added incentive for manufacturers to invest in innovation to improve profits.

3.4 Initial Adoption

Apple concentrated its initial 2007 marketing and rollout in its home market, where its brand, iPod and iTunes penetration were strongest. It also faced the weakest smartphone competition at home, where the BlackBerry dominated business-oriented convergence devices but Palm was fading in the consumer segment. By comparison, Nokia and Sony Ericsson sold numerous Symbian-based smartphones in Europe, while market expectations (and operator market power) made Japan and Korea an even more daunting prospect.

Apple's advertising and tens of millions of dollars of free publicity built interest to a frenzy comparable to a new videogame console rollout, with consumers lining up the night before the June 29 release. Apple sold 270,000 iPhones in the first 30 hours it was available. However, after the earliest adopters purchased iPhones, sales lagged until Apple announced a \$200 price cut on Sept. 5, quickly bringing sales to 1 million.¹¹ Comparing the summer and fall sales figures suggests that the 33% price cut tripled the demand for the phone.

¹¹ Apple initially introduced a phone with 4 gigabyte of memory for \$499 and a 8 gb phone for \$599, but the 4 gb model accounted for less than 10% of the phones sold and was discontinued with the Sept. 5 price cut.

For the European launch, there was initial speculation that the iPhone would be distributed by Vodafone, the largest mobile phone operator in Europe and part owner of Verizon Wireless. However, like Verizon Wireless, Vodafone sought to build its own music store and control access to content on its network, as part of efforts to increase loyalty and commoditize handsets.

Instead, Apple partnered with operators that eagerly sought to improve their image through association with the stylish iPhone. “These are not negotiations among equals. Apple clearly had the upper hand,” one analyst told the *Financial Times* (Maier and Müller, 2007). While Apple negotiated an undisclosed share of monthly revenues, with only 14 retail stores in Europe it was forced to relax control over distribution. The phones were thus sold by the operators, Apple’s 13 UK stores, and major resellers such as Carphone Warehouse in the U.K.

In November 2007, Apple rolled out the iPhone in the three largest European countries using the mobile phone franchises of the former national monopolies:

- **United Kingdom.** The phone was released in Nov. 9 by O2, the former BT Cellnet owned by Spain’s Telefónica since 2001. The *Financial Times* reported that 190,000 phones were sold in the first two months.
- **Germany.** Also on Nov. 9, the iPhone was released by T-Mobile, the mobile subsidiary of former PTT Deutsche Telekom, where it sold only 70,000 phones in the first 11 weeks.
- **France.** Beginning on Nov. 29, the iPhone was sold by Orange, the subsidiary of France Telecom, with 70,000 phones sold in the first month.

Apple announced global sales of 1.1 million and 2.3 million iPhones in the 3rd and 4th quarter of 2007. Of the latter, about 310,000 were estimated to be via European channels. For the 4th quarter, Canalys (2008) estimated that the iPhone had already vaulted into the number two position in the market, behind market-leader Research in Motion with 41%. Apple was second with 28%, all Windows Mobile devices were at 21% and Palm was at 9%.

For the operators, the crucial measure of success for the iPhone was winning new customers; the main reason operators agreed to share revenues with Apple was in return for incremental revenues. An existing AT&T customer switching to an iPhone would at best add a data plan to their existing bill. But a customer switching from another operator added both the data plan and the voice plan, creating a much larger increase in revenue. Among the iPhone subscribers, the proportion of new subscribers (almost all switching from other operators) ranged from 40% in the US to 75% in the UK.

After the European launch, speculation was rampant that Apple would announce exclusive operator agreements for major markets such as China and Japan. However, it never added an Asian operator for its initial iPhone model, which observers attributed to its revenue sharing demands and the failure of the initial iPhone to support high-speed UMTS networks.

3.5 Competitor Responses

While the iPhone won praise for its product design and ease of use, it also faced a number of criticisms. Several of the earliest criticisms accurately predicted major barriers to adoption, including the \$600 price (later reduced to \$400) and the slow data speed without a 3G network. The locking of the phone to a single operator, and to prevent third-party applications, were both taken as technical challenges by the

“hacker” community, which created a gray market for “unlocked” iPhones.

Unlike smartphones enabled by Symbian, Palm, and Microsoft, the initial iPhone did not allow development of native third party applications, although Apple encouraged the development of web-based applications similar to those that were being promoted by Google for the wired Internet. But the iPhone browser was unable to run many standard web applications because it lacked Flash middleware, a requirement that Jobs had discounted at the initial product introduction time.

In response to the demand for third-party applications — and successful efforts by third parties to install software without Apple’s cooperation — in October 2007 Apple announced it would allow third party development in 2008. Among the most significant missing applications were instant messenger clients, an e-book reader, and support for location-based services.

Thus, both the strengths and weaknesses of the iPhone gave competing hardware companies a benchmark to target, while Apple’s exclusive distribution deal gave competitors — particularly Verizon Wireless in the US and Vodafone in Europe — a strong incentive to promote competing convergence devices from LG, Nokia and other vendors.

With its product, end-to-end system and exclusive distribution, Apple created competitors at all levels. Many of these competitors were among the most powerful and capable participants in the mobile phone value networks.

On the hardware side, the iPhone brought no initial product response from the largest European makers, which continued to sell Symbian smartphones: Nokia with phones incorporating a standard phone keypad, thumb

keyboards or miniature keyboards, and Sony Ericsson shipped pen-based smartphones. While Nokia’s smartphone sales continued to grow, it had limited market presence in the rapidly growing North American market and its global market share slipped. In October 2007, Nokia unveiled a prototype of an iPhone-like touch screen interface, although it did not ship a commercial product until the Nokia 5800 in late 2008.

The most immediate hardware response in the US came from Asian manufacturers that had already begun touchscreen phone development, particularly the two largest Asian manufacturers, Samsung and LG. Some of the competing phones (such as the LG Voyager sold by Verizon or HTC G1 from T-Mobile) included both a touchscreen and a retracting physical keyboard. Also responding was Research in Motion, which continued to gain market share with its trademark BlackBerry keyboard devices, and released its first touchscreen device to great anticipation in Fall 2008. These iPhone rivals were heavily promoted by operators shut out by the iPhone exclusive, particular for the half of the US market that used CDMA technology (led by Verizon and Sprint) and thus lacked access to the GSM-only Apple, Nokia or Sony Ericsson smartphones. For the most differentiated phones, rival operators also matched the iPhone’s mandatory data plan.

Nokia’s more direct response to Apple came in August 2007, when it pre-announced its own content distribution website that both competed with and attempted to surpass the iTunes Store, using its control over the handset interface to drive customers to the site. Nokia’s Ovi (Finnish for “door”) portal planned to include licensed music, games, and user-generated content. But when it was actually launched in 2009, the Ovi store was not well received by many reviewers, who criticized its user experience.

Meanwhile, Vodafone, Verizon and others continued to promote their own operator-specific music stores. Despite the success of Cyworld (owned by Korean operator SK Telecom), most other operator stores had proven unsuccessful in the US and Europe. For example, during 2008, Apple's cumulative (worldwide) reported iTunes downloads were equivalent to about 6.3 million songs and about 300,000 videos downloaded every day, as compared to 450,000 songs and videos downloaded from Verizon's VCast, the largest operator-specific store in the US.

Operators also found their content pricing power limited by consumer expectations set by Apple's music store, with the most successful iTunes competitors forced to match or beat Apple's pricing. It was also difficult for operators to duplicate the ease of use of the iTunes / iPhone system, because (by relying on outside handset vendors) they lacked both the control of the end-to-end systems architecture, and the experience in building such systems.

3.6 Mobile Internet finds its killer app

For years, analysts have wondered what would prove the "killer app" that would spur widespread adoption of mobile data services. For example, in a pre-3G era of low speed data services, Kivimäki and Fomin (2001) concluded that short message services and DoCoMo's i-mode were respectively the killer app for European and Japanese users. Other predictions have included mobile banking, other mobile commerce, location-enabled retail directories, or mapping services.

In the end, the iPhone proved that for the US (and perhaps Europe), the killer app for the mobile Internet was the same as for the wired Internet: a web browser.¹² By emphasizing the

¹² The iPhone used the same WebKit open source HTML rendering software as Apple's browser for its personal computers; the same WebKit was also

web browsing user experience, the iPhone leveraged the same value network of an estimated 1 trillion non-commercial, ad-supported and fee-supported web pages that were already familiar to existing users of the wired Internet.

In September 2007, Apple released a reduced capability iPhone that it called the iPod Touch. It lacked the camera and GSM phone capabilities of the iPhone; without the AT&T contract, its initial price was actually higher than the AT&T-subsidized iPhone. However, it featured the same touch screen and nearly all the software features of the iPhone, including web browser, email and iTunes download capabilities. Apple positioned the devices as the high end of its iPod line, but some termed the Wi-Fi only mobile Internet device an "iPhone Lite."¹³ Anecdotal evidence suggested that the PDA served users who wanted the iPhone features, but would not or could not sign up a two-year AT&T contract.

Early signs showed the iPhone was being widely used for casual web browsing, whether via the 2.5G (later 3G) network or via Wi-Fi hotspots. On Christmas Day 2007, Google reported that the iPhone was the most common mobile browser on its website (Helft, 2008). Two

adopted by Nokia (for its Symbian S60 phones) and Google's Android. However, Apple's patented "gestures" improved the ease of use for scrolling and zooming on the small laptop screen. sponsored by Apple. In June 2005, Nokia announced it would adopt WebKit as the basis for a browser for its S60-based smartphones, and it began shipping the new browser with S60 3rd Edition.

¹³ A PDA phone without the phone capabilities, the iPod Touch was Apple's first PDA since its 1998 discontinuation of the Newton, which attracted a fiercely loyal but tiny market share (Muñiz & Schau, 2005). The original iPod Touch shipped with headphones but no speaker, microphone or Bluetooth capabilities. However, with its Sept. 2008 model, the iPod Touch added a limited speaker, and could be used to make VoIP calls with an external microphone and the standard headset.

months later, Google said that the iPhone had fifty times as many Internet searches as any other mobile handset. A Google manager said “We thought it was a mistake and made our engineers check the logs again” (Palmer and Taylor, 2008).

By recent estimates, the iPhone accounted for 48% (Dec. 2008) to 66% (Feb. 2009) of all US mobile web browsing (Chartier, 2009; Malley, 2009). Such statistics — influenced by the high web surfing propensity of iPhone users — measure the iPhone’s share of web pages viewed rather than its share of handsets or web browsers. At the end of 2009, the iPhone and its cousin the iPod Touch together accounted for 49-70% of all mobile web browsing in the US, UK, Germany, and France (Figure 2).

In a 2009 interview, AT&T’s CEO admitted that it had not been ready for the level of mobile data traffic that the iPhone produced. After 2008, the company paid an upfront handset subsidy to acquire new customers, because the iPhone subscribers also brought 60% higher monthly revenue than users of other devices (Ramsay, 2009). For the 12 months from July 2008-June 2009, AT&T reported that 40% (later one-third) of the newly activated iPhones brought new subscribers, which (by our calculations) accounted for 48% of its net new subscriptions during this period.

3.7 iPhone 2.0 and 3.0 strategies

In 2008, Apple delivered both an updated product and key refinements to its initial strategy. In June 2008, it announced a new model that had full 3G support, as well as other smaller enhancements such as a built-in GPS receiver (common in other phones) to enable location-based services.

At the same time, Apple dropped its monthly revenue sharing business model (widely resisted by operators outside the US and Europe) in

favor of a more conventional operator-subsidized sale of the handset in the US and elsewhere; to pay for the subsidy, AT&T increased the minimum cost of the required data plan from \$240 to \$360/year. Together, these two changes allowed Apple to launch the iPhone 3G on July 11 in 22 countries, and expand distribution to 70 countries by the end of 2008.

As in Europe, its offer to bring new customers and revenues (in exchange for control of downloaded content) was most attractive to trailing operators. In Japan, it was rejected by the dominant operator DoCoMo (50% share) which already branded its own Symbian- and Linux-derived smartphones; the UMTS iPhone was incompatible with the cdma2000 operator KDDI (29%), and so Apple distributed the iPhone through #3 Softbank (18%). After two years of negotiation, in China it was unable to reach agreement with the dominant carrier China Mobile (72%) — reportedly over control of iTunes/App Store revenues — and so launched its service in October 2009 with the #2 carrier China Unicom (21%). While the iPhone suffered from poor initial sales in China, it met with a more enthusiastic reception with its November 2009 launch in Korea with #2 KT.

The day before releasing the iPhone 3G, Apple also opened an online marketplace called the “iPhone App Store.” The store included about 500 free and commercial native applications, based on the software development kit that it released on March 6. Apple also released a software update that allowed existing iPhone and iPod Touch users to have access to the new features, including the App Store.

Unlike the prior operator-centric download stores, Apple’s App Store (as with its iTunes Store) provided a common distribution mechanism across all operators and Apple devices. This eventually provided Apple unprecedented economies of scope and a large

unified market for its developers. In the first six months, the store attracted more than 15,000 applications and 500 million downloads, and three months later (April 2009) those figures had doubled to 30,000 and 1 billion, respectively;¹⁴ in November 2009, the figures reached 100,000 and 2 billion. Among the most popular applications were iPhone-customized interfaces for leading websites (such as eBay or MySpace), other web enabled services (such as location-enabled restaurant reviews) as well as stand-alone applications (especially games) ported to or written for the new platform.

The new SDK and new app store also brought a new policy towards previously-banned applications. At its opening, the app store featured a free native client for the most popular US instant messaging service, AOL Instant Messenger. In March 2009, Skype released a native client for its VoIP and instant messaging service, which Apple allowed only if it used Wi-Fi rather than 3G data networks. However, controversy remained over Apple's non-transparent discretionary approval process for third party vendors seeking app store distribution.

In response to the success of the iPhone App Store, rivals Google and Research in Motion introduced their own application downloading services. Google announced its Android Market in August 2008 and opened it for paid applications in February 2009. Also in August, Microsoft unveiled Windows Marketplace for Mobile (supporting one platform but multiple handset makers) while Nokia and Samsung released stores supporting their own handsets but multiple platforms. Finally, in April 2009 RIM launched its BlackBerry App World. However, none of the competing application

¹⁴ The 1 billion figure was potentially misleading, since it was believed to include updates to already-purchased applications.

stores matched the variety or popularity of Apple's stores.

Despite its US-centric approach, in only 18 months Apple increased its global smartphone market share from 0% to 8% (Table 2). In 2008, it surpassed its goal of selling 10 million iPhones, with 13.7 million phones sold (60% of them the newer iPhone 3G). It also sold about 11 million iPod Touch models¹⁵ in 2007-2008, as compared to 17.4 million iPhones during that same period (Table 3).

Two years after the original iPhone release, in June 2009 Apple unveiled its third model, the "iPhone 3G S" with incremental hardware improvements such as a better camera, video recording, a digital compass, faster processor and support for faster UMTS networks. One feature increased operator network traffic while another reduced it. Through a process called tethering the new iPhone could serve as a laptop computer modem — as with other phones, only where permitted by the operator. On the other hand, to reduce congestion on UMTS networks, the iPhone included new software that made it easier to switch to paid or free Wi-Fi hotspots.

At the same time, Apple announced significant upgrades to its software and its App Store distribution channel,¹⁶ which would be made available to what it announced was an installed base of 40 million "iPhone OS" devices.

¹⁵ In its quarterly earnings, Apple did not break out the iPod Touch from its other iPod models. Beginning in 2009, the company began declaring the combined number of devices potentially compatible with its iPhone App Store (i.e., iPhone or iPod Touch). The first such estimate of 30 million total units by March 2009 suggested that a total of 13 million iPod Touch models had been sold by that date (McLean, 2009).

¹⁶ The major change to the App Store was that it not only allowed the sale of applications, but also provided a convenient channel for sale of add-on information goods and services, such as songs in a music program or new scenarios in a video game.

Previous reports suggested that about 60% of these devices were iPhone models and 40% of these were the less expensive (and operator-independent) iPod Touch Internet PDA.

4. Discussion

With its iPhone, Apple created a successful product family that enabled its entry into the crowded mobile phone market. At the same time, it changed the conception of the mobile Internet, demonstrated the importance of mobile devices in driving demand for new mobile services, and highlighted the increasing competition for capturing the returns from the value created by such services.

4.1 Creating Value for Mobile Internet Users

The delayed adoption of the mobile Internet once puzzled many industry leaders, analysts and academics, who developed elaborate theories of how to construct a new value network to supply content specific to mobile phone users.

Much of that theorizing was colored by attempts to generalize from the earliest successes of the mobile Internet, when Japanese and Korean operators provided limited Internet content using the existing low-speed data networks. In arguing that reach (ubiquity) was more important than richness (multimedia content), Funk (2001: 60) concluded that efforts by US and European firms were failing because they were “attempting to modify popular business fixed-line content for the mobile phone.”

While US and other Western carriers worked to build out 3G networks over the next five years, adoption of those services remained limited to high-end business customers. Compared to Japan and Korea, only a small fraction of users browsed Internet content over mobile devices, with mobile data demand (beyond SMS) primarily focused on reading email with devices

such as the BlackBerry. As late as 2006, Lindmark et al (2006) predicted that “consumer applications of mobile Internet ... [are] unlikely to fully cover ... the 3G investments.”

Three weeks before the release of the first iPhone, Steve Jobs predicted, “people want the *real* Internet on their phone” (Block, 2007). Jobs was eventually proven correct: when given web browsing that was substantially similar to the browsing experience on a PC, mobile web usage went up dramatically. The success of the iPhone demonstrated that what was holding back demand for mobile data services in the US was not the creation of new mobile-specific value networks, but the delivery of devices and networks that were capable of delivering a convincing approximation of the familiar wired Internet.

Other evidence suggests that similar patterns are likely in other countries. Data from the Nielsen Company in late 2008 from both the US and UK demonstrated a heavy overlap between the most popular wired and mobile Internet sites, containing search, webmail, news, sports and weather (cf. Ferguson, 2008). The product strategies for Nokia, Google, RIM and other smartphone manufacturers and suppliers now also emphasize the ability to deliver a compelling standard Internet experience over 3G mobile networks — as demonstrated by increased web traffic during 2009 from their respective browsers.

In short, efforts to create a second Internet for Western mobile users (whether delivered via WAP or via i-mode) were doomed to fail: the existing Internet framed user expectations to such a degree that the mobile substitutes paled by comparison. While Funk (2001) focused on the richness of the wired Internet, the nature of the website use suggests that for mobile users, richness was not a goal in itself: the iPhone actually delivered a less rich experience than

those smartphones (such as the Nokia N-series or those using Google's Android) that supported websites including Flash animations.

However, the iPhone (and its large-screen imitators) otherwise offered access to the same websites as wired terminals. Just as network effects allowed the World Wide Web to supplant the premium content of AOL and other proprietary providers, so, too, they supplanted efforts to build mobile-specific content in countries and languages where the WWW was already well established. These indirect network effects have been augmented by the direct network effects from increasingly popular social networking applications, in which subscribers access a single network of friends whether from a PC or a mobile phone client.

The success of the iPhone in (both directly and indirectly) spurring adoption of the mobile Internet in the US and Europe built upon the large supply of web content, which in turn could be traced to adoption of personal computers and consumer broadband during the period that mobile operators experimented with limited mobile bandwidth solutions. This led to high marketshare and customer loyalty for a wide range of national and multinational content sites, whether Google or NYTimes.com in the US or BBC.co.uk or Spiegel.de in Europe.

The Western consumers who came to expect the "real Internet" on their mobile phone eventually got it with the iPhone, setting a new dominant design for mobile data services in the United States.¹⁷ We predict that over the next few years, all smartphones in the US and Europe will be

¹⁷ A dominant design standardizes certain design choices, shifting product competition from design choices to product cost or performance (Suárez and Utterback, 1995). The dominant design for US smartphones clearly included a device suited for web browsing and other popular Internet applications, but other issues such as keyboard type appear to be open to further experimentation.

expected to match the display, input and browser expectations set by the iPhone, while another fast growing category will be mobile Internet devices (such as so-called "netbooks") that offer a larger screen or other improvements on the mobile Internet experience.

Finally, the success of the iPhone supports the findings of López-Nicolás et al (2008) regarding the crucial role that social factors play in the adoption of 3G mobile services: such adoption depends on not only on technical utility, but also upon the direct and indirect diffusion effects long-identified by Rogers (1962). In this regard, the iPhone clearly benefited (particularly in the US) both from unprecedented publicity and also strong word-of-mouth recommendation from satisfied enthusiasts.

However, the picture appears quite different in those countries (such as Japan and Korea) where the PC was not as heavily integrated into the culture, and mobile users adopted an Internet of limited richness before the fixed-line Internet experience was as deeply fixed in users' minds. With the widespread deployment of 3G networks — and more capable terminals — these same operators are seeking to extend their portals and business models to include richer multimedia content, to forestall entry by global content firms of the wired Internet. However, Japan and Korea are unusual as two countries which are the sole users of their respective languages — and have lower English fluency than most European markets — and thus not linked to other markets providing a natural supply of content.

The future of the mobile Internet in developing and less developed countries remains to be seen: some aspects of them parallel the developed Western countries, while others parallel Japan and Korea. Prior research has demonstrated that large media markets provided network effects for both producers and consumers, engendering

a large supply of domestic content unavailable in smaller countries (Waterman, 1988; Wildman and Swiek, 1988). Both China and India have large markets and strong domestic media industries with online content, although China (like Japan but unlike most of the West) has a dominant mobile phone operator that is attempting to control its own content value network.

Still, the value of the Internet has been the linkages, serendipity and consequential network effects accruing from having a single interdependent Internet.¹⁸ Whether demand-side economies of scale from shared complementary assets (as predicted by Katz and Shapiro, 1986) or the more prosaic supply-side economies of scale and scope available to large Internet content providers such as Google and Microsoft, the assets created for and used by the wired Internet clearly have at least indirect value in fueling developing country adoption of the mobile Internet.

As a small residual benefit of their respective colonial legacies, many countries in South Asia, Africa and Latin America have high literacy in one of the European languages. As with existing media markets, this makes directly available some content from Europe (or North America) and makes easier adaptation of other content. Meanwhile, popularity measures of social networking tools suggest that each country has its own distinct social network, and in most cases the leading tools provide both PC- and mobile-based clients (Denton, 2007).

In the end, advocates of the mobile Internet — like the authors of the convergence visions of

the 15-20 years ago — expect that all consumer access to content will be through ubiquitous mobile devices that combine computing and communications capabilities. The ultimate structure of that single Internet content industry would appear to depend on path-dependent national choices of the past decade, just as the national industry structure for today's wireless operators depends on the path-dependent origins of the wired telecommunications industry a century earlier.

4.2 Allocating Value Capture from the Mobile Internet

While firms in the mobile telecommunications industry worked together to create enough value to spur adoption of mobile data services, in response to increasing industry commoditization they also engaged in zero-sum competition to capture the returns from this adoption. Such competition for profits occurred not only between traditional rivals among vendors, operators and content suppliers, but also between these complementary roles within the value network.

There were two keys to Apple's successful entry into mobile telecommunications. First, it gained market entry by redefining the mobile phone to create the new dominant design for mobile Internet devices. Secondly, it leveraged its systems capability to establish a permanent position of value capture in mobile phone industry.

The success of the iPhone (and its imitators) in driving mobile data use points to the importance of new devices in fueling demand for new wireless services, at least during the early years of those services when the dominant design for the access device is as yet unknown. The creation of hand-portable and later pocket-sized handsets by companies like Motorola and Mobira helped drive the adoption of analog mobile phone services. In North America, the

¹⁸ Network effects have also been shown to be important in the adoption of mobile voice services; (Rouvinen, 2006) showed that the effects due to market size and number of prior adopters for developing countries were both positive and comparable to those in developed countries.

1999 introduction of the first BlackBerry device from Research in Motion enshrined the “thumb” keyboard as the norm for millions of business email users, while the 2007 iPhone set the standard for mobile web surfing.

As with other technological industries, the competitive advantage gained by creating such new and differentiated products may only last during the early phases of a product category (cf. Suarez, 2004). In later phases, imitative handset vendors have sought market share from market-creating innovative products — whether the pocket handset of Motorola, the thumb keyboard BlackBerry, or the large touch-screen iPhone — by copying those innovative features and also leveraging other competencies such as miniaturization, manufacturing and cost-reduction. In this regard, the smartphone market five years from now will contain a wider range of devices and manufacturers, in which Apple seeks to protect its premium-priced differentiated iPhone offerings as it has with its iPod music players.

Apple’s second (and likely more durable) source of advantage came from its integrated approach that leveraged its decades-long systems competencies in hardware, software, and system design. For the iPhone, the company built upon both these general competencies and the specific parts of the value proposition it developed for the iPod and iPhone.

In this regard, Apple’s systems approach to the mobile phone industry was most similar to that of RIM with its BlackBerry devices and e-mail services. Rather than merely provide devices to operators or other distributors, both firms sought to control key value-creating assets and thus assuring ongoing value capture and associated profits.

The two firms differed, however, in the reaction of operators. As the creator of “push” e-mail

RIM, offered operators a unique new source of data revenues. In contrast, Apple had to use the consumer brand loyalty from its popular iPod and iTunes Store to provide the bargaining power necessary to supplant the operators’ existing (but largely unsuccessful) “walled garden” content systems. Apple’s success creating value with consumers has changed the traditional allocation of returns between vendor and operator, a pattern that operators hope to stem and that other handset vendors (particularly Nokia) hope to copy.

Longer term, the success of the iTunes Store and the iPhone App Store — as well as the proliferation of imitators — raises questions about the source of applications and other Internet content for mobile devices. The source might be a network operator, handset manufacturer, the platform sponsor, or an independent supplier such as Amazon or the BBC; the latter includes many firms that established strong market position (and value capture) in the wired Internet. In the near term, continuing fragmentation appears likely.¹⁹

It is too soon to tell whether in the long term the ability of a platform sponsor to control application distribution (as do Apple, Google and Microsoft) or entertainment (as with the iTunes Store) will replace both independent content and operator “walled gardens,” or co-exist alongside them. Nor can we conclude that the device-centric model of mobile service provision will remain dominant across the industry, or if the eventual pattern will reflect one of three other models identified by Balloon & Walravens (2008): operator-centric, portal

¹⁹ Maitland et al (2006) note the importance of billing as part of the ability of DoCoMo to capture value from the i-mode ecosystem. In that regard, this could help explain the common success of DoCoMo and Apple in controlling their ecosystems, despite differing positions in the value network.

(third party aggregator)-centric or decentralized service-centric business models.

In the future, additional value in convergence devices is likely to be provided by access to commercially generated content, such as music, movies, news and video. The structure of the value network for delivering such content is still indeterminate. In some cases, the content may be provided directly by the creator (particularly TV networks such as NBC, ESPN or BBC), but in many cases the content may be distributed by an aggregator that combines content from multiple sources. As observed by Balloon & Walravens, that aggregator might be the operator (something most large operators have tried), the handset maker (Apple or Nokia), or a third party (Amazon, Google, or Yahoo). To date, Apple has been the most successful at charging for access to content with its company-run iTunes store.

For operators seeking to extend their market power, particularly challenging is the role of the open Internet in providing both commercial and user-generated content. Such content is inherently available without restriction to competitors and substitutes. Efforts to vertically integrate to provide mobile content will probably fail, just as they eventually failed in the fixed Internet for Internet service providers such as America Online.²⁰ As with other mass media, the distribution channel that delivers the largest audience allows the largest budget for acquiring premium content, whether professionally produced entertainment or popular sporting events.

²⁰ One of the few cases that would reward operator distribution of content would be where there is a technical basis for improved quality or efficiency, such as the use of DVB-H, FLO, or T-DMB for multicast distribution of popular video channels or live sporting events.

The US and European operators are likely to be caught between handset companies that integrate hardware and services functionality in ways that the operators can't match, and user demand for unhindered access to a broad range of content (such as that from the wired Internet) that the operators can't control. If operators fail to provide access to such content, customers will defect to competitors; if they do deliver such content, their business may increasingly shift towards providing data delivery as a commoditized service while being unable to share in the value capture from third party content.

4.3 Future Research

The early success of the iPhone in promoting mobile data adoption suggests several avenues for future research.

The iPhone was able to leverage existing wired Internet content. However, over the long term, will the most popular content on the mobile Internet be that from the existing wired Internet, adapted from existing content, or new content specific to mobile devices? Will the users of mobile devices most like personal computers (in terms of screen size or input mode) be more likely to use the same content as PC owners? Outside Western countries, will the type of mobile content usage be driven by established content relationships (such as i-mode) or established usage patterns for Internet access devices (PCs vs. laptops vs. netbooks vs. smartphones vs. "feature" phones)?

Similarly, the examples of the BlackBerry and iPhone suggest conditions under which manufacturers makers can command premium prices for handsets, but a high selling price is no guarantee of high margins. Linden et al (2009) estimated how iPod returns are allocated between Apple and its various component suppliers, but a similar analysis of the iPhone would be complicated by the (undisclosed)

division of product sale revenues between vendor and operator.

Even such analysis risk oversimplifying the value capture from 3G mobile phones. Margins will vary across the various handset segments, and (we predict) between the early and later phases of a product category. In addition, the value capture of a BlackBerry or iPhone sales is not limited to the initial purchase price, but must also include the total profit stream from the device and associated services during its period of use.

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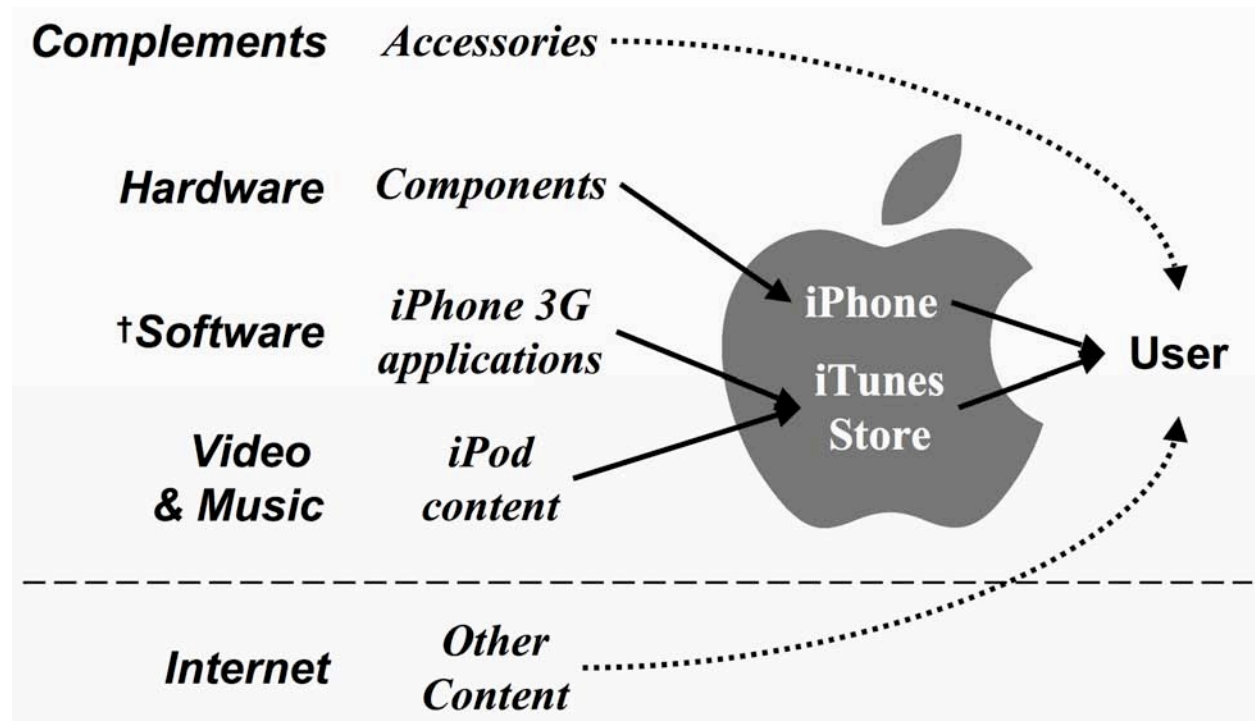
7. Figures and Tables

Table 1: Key smartphone product milestones, 1997-2009

Date†	Company	Smartphone	Platform	Browser	Screen	Input
1997	Nokia	Nokia Communicator 9000	GeOS	Proprietary (xHTML)	640x200 gray	Compact keyboard
Sept. 1998	Qualcomm	pdQ	Palm-OS	Proprietary	160x160 B&W	Stylus
March 1999	Ericsson	Ericsson R380	Symbian OS	WAP only	360x120 B&W	Stylus
2000	Nokia	Nokia Communicator 9210	Symbian Series 80	HitchHiker	640x200 color	Compact keyboard
Oct. 2001	Handspring	Treo 180	Palm OS	Blazer	160x160 B&W	Stylus and thumb keyboard
March 2002	Research in Motion	BlackBerry 5810	BlackBerry OS	WAP only	160x160 B&W	Thumb keyboard
May 2002	Audiovox	Thera	Pocket PC	Pocket Internet Explorer	240x320 color	Stylus
Dec. 2002	Sony Ericsson	p800	Symbian UIQ	Opera	208x320 color	Stylus
Aug 2006	Nokia	E61	Symbian S60	WebKit (S60)	320x240 color	Thumb keyboard
March 2007	Nokia	N95	Symbian S60	WebKit (S60)	240x320 color	Numeric pad
June 2007	Apple	iPhone	iPhone	WebKit (Safari)	480x320 color	Touchscreen
July 2008	Apple	iPhone 3G	iPhone	WebKit (Safari)	480x320 color	Touchscreen
Oct. 2008	HTC	G1 (Dream)	Android	WebKit	480x320 color	Slide keyboard
Oct. 2008	Research in Motion	BlackBerry 9530 “Storm”	BlackBerry OS	Proprietary	480x360 color	Touchscreen
Nov. 2008	Nokia	5800	Symbian S60	WebKit (S60)	640x360 color	Stylus and touchscreen
April 2009	HTC	Magic	Android	WebKit	480x320 color	Touchscreen
June 2009	Palm	Pre	webOS	WebKit	480x320 color	Touchscreen and thumb keyboard
June 2009	Apple	iPhone 3G S	iPhone	WebKit (Safari)	480x320 color	Touchscreen
Nov. 2009	Motorola	Droid	Android	WebKit	854x480 color	Touchscreen and slide keyboard

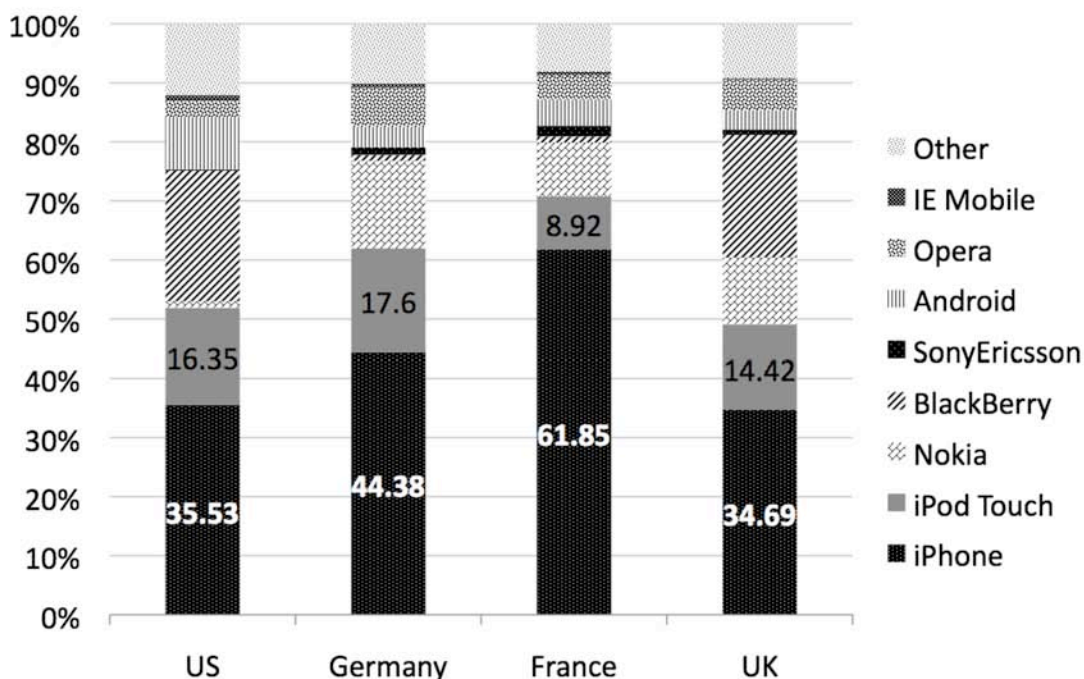
† Date of first customer release where available; otherwise, date of public announcement.

Figure 1: Ecosystem for Apple iPhone and iPod Touch



† Third party software available from iPhone App Store beginning in July 2008.

Figure 2: Mobile browser market share, December 2009



Share of mobile browsing page views, December 2009, as reported by StatCounter.²¹

Table 2: Global smartphone market share, 2006-2008

Platform	Vendor	2006	2007	2008
Symbian	Nokia, Sony Ericsson, <i>others</i>	67%	63.5%	52.4%
BlackBerry	Research in Motion	7%	9.6%	16.6%
Windows	HTC, <i>others</i>	14%	12.2%	11.8%
iPhone	Apple	-	2.7%	8.2%
Linux†	Motorola, <i>others</i>	6%	9.6%	8.1%
Palm OS	Palm	5%	1.4%	1.8%
<i>other</i>		1%	1.0%	1.1%
Total		100%	100%	100%
Annual total		64.1 million	122.3 million	139.3 million

²¹ StatCounter is a free software tool that allows website owners to track visitors to their sites. Because the base version of the product is free, it is broadly popular among bloggers and small site owners. StatCounter aggregates and publishes statistics based on the traffic monitored by its software. Because StatCounter is used primarily by smaller websites, it is most sensitive to the browsing activity people who go beyond one or two major portal sites. It is, therefore, an especially good measure of the browsing activity of the most enthusiastic mobile Internet users.

† Includes Android

Sources: Adapted from Canalys (2007) and Gartner (2009)

Table 3: iPhone and iPod Touch models, 2007-2009

Model	Announced	Features*	First Sold	US Price	Countries	Worldwide Unit sales
iPhone	9 Jan 2007	EDGE	29 June 2007	\$499-599†	1	6.1 million
			5 Sep 2007	\$399†	1->6	
iPhone 3G	9 June 2008	UMTS, GPS	11 July 2008	\$199-299†	22->80	15 million¶
			8 June 2009	\$99	80+	n.r.
iPhone 3G S	8 June 2009	UMTS, GPS, video camera	19 June 2009	\$199-299†	8->80+	1 million‡
iPod Touch	5 Sep 2007	No GSM or camera	13 Sep 2007	\$299-399	n.r.	13 million§
	9 Sep 2008	No GSM or camera	9 Sep 2008	\$229-399	n.r.	

n.r.: not reported

* Except as noted, all models feature GSM-enabled voice calls, 240x320 touch screen, still camera and Wi-Fi

† Price with operator handset subsidy and two-year contract; more expensive models have more RAM

¶ First 9 months, through March 28, 2009

‡ Sales in eight countries during initial 3 days of availability

§ Estimate of sales for all models of iPod Touch from Sept. 2007-March 2009