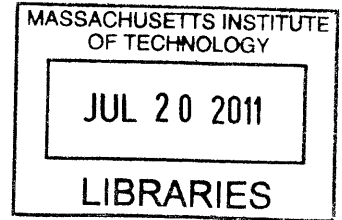# Emerging Trends in Mobile OS Platforms

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ABSTRACT

Smartphones with a market penetration of over 31% in US among mobile users have become a mass-market product within a short 4-year period since the launch of iPhone. Tablets are showing similar trajectory in terms of adoption. Currently iPhone and Android own the majority market share in the consumer space and RIM is yet to find any real success.

In this thesis work, historical and current landscape for the mobile market industry has been studied. Leading Smartphone operating system vendors and their strategies for managing multi-sided platform were studied and relevant impact on market share was analyzed. Google with a fragmented eco-system and Apple with integrated architecture took a very different approach to market leadership and these approaches were studied in detail.

Apart from the above, this thesis sought to answer the following questions: 1) How can the Smartphone OS platform vendors sustain their dominance in the mobile eco-system as other players in the value chain look to increase their share of value-capture? And 2) what kind of pacts can they make in the long run among themselves to retain their market power?

Thesis Supervisor: Michael A. Cusumano

Title: Sloan Management Review Distinguished Professor of Management

ACKNOWLEDGEMENTS

Contents

1 History of Smartphones and Recent Trends

1.1 A Brief History of Smartphones[1]

1.1.1 The Experimental Era

iPhone reinvented the Smartphone market and accelerated the adoption of smartphones in the consumer market. But the history of smartphones goes back to the time when IBM came up with Simon in 1992 (Wikipedia: IBM Simon, 2011). Simon could do what a lot of current generation smartphones provide as a basic set of functionalities, such as: address book, calendar, world clock, calculator, email, FAX, and notepad. Simon was remarkable, keeping in the mind the premature technologies of early 1990s. Also, it had its own touch screen, which was used to dial numbers to make a call. But this innovation came with a high cost of around $899, and since the hardware technologies were not well developed at the time, the device was huge and heavy. It came as no surprise that Simon was not well received in the consumer market.

Nokia was quick to enter the Smartphone market, when it collaborated with Hewlett Packard to introduce Nokia Communicator in 1996. To this day, through its continued innovation, Nokia remains one of the strongest OEMs (Original Equipment Manufacturers) worldwide. Like its counterparts at that time, Nokia Communicator was huge, heavy, and expensive. It came with a flip keyboard, a design that modern phones like the Motorola Droid have adopted. It was also the first phone that ran on an Open Source Operating System (Robers, 2009). But the lack of web browsing ability was a

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[1] Source for this section: http://en.wikipedia.org/wiki/Smartphone

setback. The next significant development in Smartphone history was the release of the concept phone GS88 by Ericsson in 1997. It was the first device to be labeled as a "Smartphone" (Wikipedia: Smartphone, 2011).

Although these devices were the pre-cursor to the Smartphone industry, Research in Motion was the company that was able to break through the consumer market with the introduction of Blackberry. Model 5810, introduced in 2002, came with the ability to email and surf the web. But the downside was that the users had to plug in a headset to talk on the phone. This limitation was gone with the introduction of the Blackberry model 6210 in 2004 (Robers, 2009). Although smartphones reached wider audiences with Blackberry, it was still limited to business executives, who used it to get ubiquitous access to email and the web during the day.

In 2003, Palm released the Treo 600 in collaboration with Handspring (after Palm acquired it). Treo 600 was designed to run on its own OS and came with support for both CDMA (Code division multiple access) and GSM (Global System for Mobile Communications) (Robers, 2009). This model had a full keyboard and it brought in features like wireless web browsing, calendar, email and a contact organizer. But the most important feature was its ability to download and sync third party applications with the computer. It was the first device that could sync with the computer (Wikipedia: Smartphone, 2011).

1.1.2   The Onset of the iPhone

On September 7, 2005, Apple and Motorola released ROKR E1, the first mobile phone to use iTunes (Cohen, 2005). A year later, in September 2006, due to a lack of control over the design, Steve Jobs (Apple CEO) decided to discontinue support for ROKR (Wikipedia: iPhone History, 2011). At this time, he started working on Apple's own

version of a Smartphone, which in the later years came to be known as the iPhone. The iPhone revolutionized the adoption of smartphones in the consumer market.

On January 9, 2007, Apple announced the iPhone at the World Wide Developers Conference. It was later released on June 29, 2007, along with its own Operating System called iOS (Appendix: Figure 48). Though, initially, Apple did not provide the ability to officially download and run third party applications, it brought in a much superior UI (User Interface) experience and a phone that was mostly controlled through its touch screen and multi-touch interface. The web browser it offered was far more superior then any of its competitors. A process called 'jail break' soon emerged within a month (Wikipedia : Jailbreaking, 2011), which allowed third party applications to run on the device. It looked quite similar to the Newton MessagePad, Apple's previous touch-screen portable device developed in 1993 (Appendix: Figure 47), but was much sleeker, elegant, and cleaner (Wikipedia: iPhone History, 2011). It initially did not have 3G support, due to a lack of 3G wireless network coverage in the U.S., which came later. On June 11, 2007, Apple announced that the iPhone would support third-party web applications using the Safari engine on the device (Wikipedia: iPhone History, 2011). It later released an SDK (Software Developer Kit, a set of tools that helps developers create applications for a certain platform) on March 6, 2008, to allow developers to develop native applications for the iPhone. The Application Store was released on July 11, 2008 (Wikipedia : iPhone, 2011). As of April 2011, the latest version of the iPhone is the 4th generation.

1.1.3   Android and the Rise of Smartphones

Open Handset Alliance, backed by Google was seen as a formidable competitor to Apple's dominance. This alliance consists of eighty firms developing open standards for mobile devices (Wikipedia: OHA, 2011).   Android, based on the Linux operating

system, is the alliance's flagship software. Since Android's launch on 21 October 2008, its rise has been remarkable. The Android grew from less than five percent in the fourth quarter of 2009 to over thirty-three percent in the fourth quarter of 2010 (Canalys, 2011). According to comScore, in January 2011 Android surpassed RIM as the leading Smartphone OS platform in the U.S. with a market share of 31.2% (comScore Data Mine, 2011). Unlike iOS, which runs exclusively on the iPhone, Android is licensed out to OEMs and is an open source platform. This is partly responsible for why it was so quickly adopted worldwide. OEMs threatened by Apple's fast growth in the Smartphone segment were quick to adopt Android, which provided as good an experience as iPhone, in terms of the operating system and developer support. A major contributor to Android's success is Motorola's Droid phone, which ran on the Verizon network and had one million units sold in the first seventy-four days after its launch on October 28, 2009 (Wikipedia: Motorola Droid, 2011). During this time, since the iPhone was exclusively launched for AT&T, Verizon marketed the Droid as an alternative to iPhone (Wikipedia: Motorola Droid, 2011).

Although iOS and Android remain the two strong operating systems to look for in future, the Operating System with the highest install base currently in the world is Symbian. Nokia initially backed Symbian. It still has the second largest market share of Smartphone sales worldwide, as reported for the fourth quarter of 2010, but it is on a sharp decline (Canalys, 2011). Figure 1 shows the major operating systems market share by Smartphone sales. Apple and RIM remain the third and fourth largest Smartphone OS providers worldwide.

Symbian's predecessor was a company called Psion, which released the world's first organizer in 1984 (Wikipedia: Psion, 2011). One of the significant products from Psion was the Epoc Mobile Operating System, which eventually led to the development of Symbian the OS (Wikipedia : Symbian, 2011). When Psion was losing its market share to the Windows CE platform and Palm Pilot, it joined hands with Nokia, Motorola, and

Ericsson and formed 'Symbian Ltd.' in 1998 (Wikipedia: Symbian Ltd).

	Q2 2008	Q3 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009	Q1 2010	Q2 2010	Q3 2010	Q4 2010
Android	0.0	0.0	1.6	2.8	3.5	8.8	9.6	17.1	24.7	32.9
Symbian	58.3	46.6	48.8	50.3	46.2	44.5	44.3	43.4	33.9	30.6
Apple	2.1	17.3	10.5	13.7	17.8	16.2	15.4	13.5	17.0	16.0
RIM	16.7	15.2	20.6	20.9	20.6	19.9	19.4	18.1	15.0	14.4
Microsoft	14.3	13.6	12.3	9.0	8.8	7.3	6.6	4.9	3.0	3.1
Others	8.6	7.3	6.1	3.3	3.2	3.4	4.6	3.0	6.4	3.0
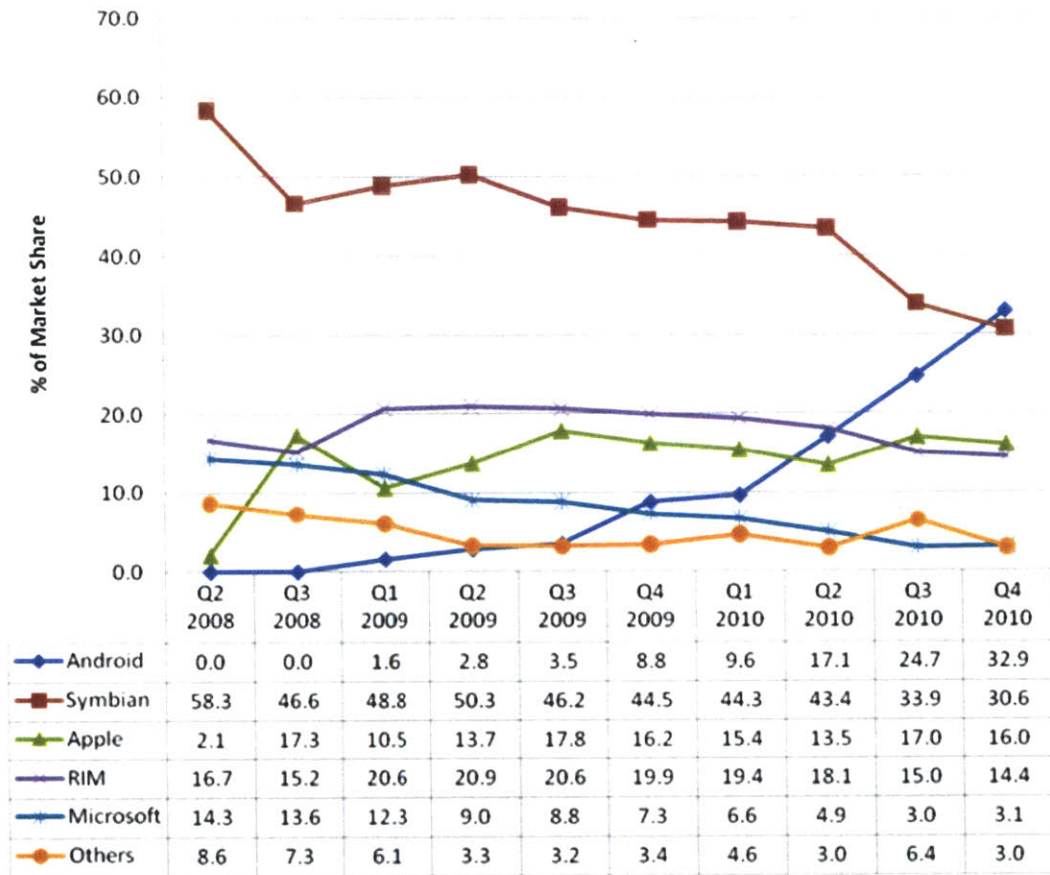
Figure 1 - Worldwide market share by Smartphone sales

Source: Canalys report on Smartphone analysis, Quarterly shipment data for market sales. (Canalys, 2011; Canalys, 2010; Mobile Phone Development , 2009; Canalys, 2009)

Symbian Ltd. created Symbian OS and the first Symbian phone was released by Nokia in June 2001, called the Nokia 9210 Communicator (nPwap, 2009-2011). After this, Nokia used the Symbian OS on almost all of their smartphones. Symbian Foundation was launched in April 2009, to transition the Symbian platform to an open source. In a major event, which happened in Feb 2010, Symbian was transformed to an open source library and was made available through Eclipse Public License (Wikipedia : Symbian, 2011). But in November 2010, Symbian Foundation announced that, due to

lack of funds, they would convert to a licensing-only firm (Wikipedia : Symbian, 2011).

A year later, to counter the declining market share to Android/iOS (iPhone), on 11 of February 2011, Nokia announced a strategic partnership with Microsoft's Windows Mobile to create a new mobile ecosystem (Supersite for Windows, 2011). This throws Symbian into an uncertain future, where it's very survival is being questioned.

2010 also saw EVO, the Smartphone from Sprint, which currently boasts of having the fastest wireless network available commercially in the U.S. EVO 4G is based on the Android and has a 4.3 inch, 800x400 pixel resolution display (Home of Android, 2009).

1.2 Recent Trends

1.2.1 Smartphone Penetration – United States

Smartphone adoption accelerated in the U.S. in 2010, but Smartphone users are still less than one-third of all mobile users. eMarketer reports that U.S. Smartphone users grew forty-nine percent in 2010, reaching 19.4% of the total population and thirty-one percent of all mobile users (Elkin, 2011). It also predicts that the growth percentage will slow down, but will still keep rising at a steady rate, reaching 109.5 million users by 2015 (33.6% of the U.S. population) (Elkin, 2011).

Nielsen research reveals more about the recent acquirers of smartphones. In the third quarter of 2010, forty-one percent of new subscribers who purchased a handset opted for a Smartphone, up from thirty-five percent in the second quarter of 2010 (Elkin, 2011). In terms of total percentage of mobile users, this penetration grew from twenty-one percent in the fourth quarter of 2009, to thirty-one percent in the fourth

quarter of 2010 (Elkin, 2011). Figure 2 illustrates the continuously rising penetration of smartphones in the U.S., as a percentage of all mobile subscribers.
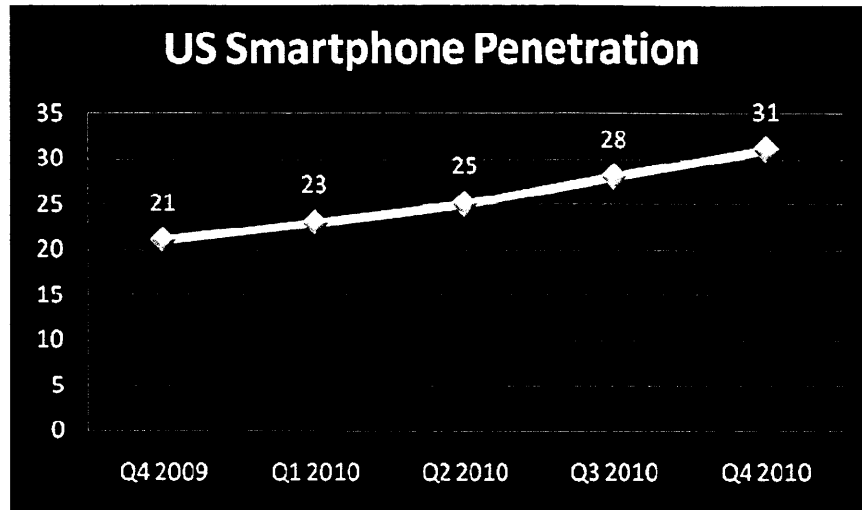
Figure 2 - US Smartphone Penetration % of recent phone acquirers

Source: Nielsen wire and eMarketer (Elkin, 2011; Kellogg, 2011)

1.2.2 Smartphone Penetration – Worldwide

Canalys reported that there were 101.2 million Smartphone shipments worldwide during the fourth quarter of 2010. That is an astonishing growth of eighty-nine percent, year on year. The final tally for the whole year of 2010 was just below 300 million units, an eighty percent growth over 2009 (Canalys, 2011). Figure 3 shows this growth. As the chart points out, the most significant growth happened in the fourth quarter of 2010. In the later chapters, we will dig deep into this growth and will analyze major contributors.

Wordwide Smartphone Market

	Q3 2008	Q3 2009	Q4 2009	Q2 2010	Q4 2010
Wordwide Smartphone Market	39.83	41.37	53.7	63.02	101.2

(y-axis: in millions, 0 to 120)
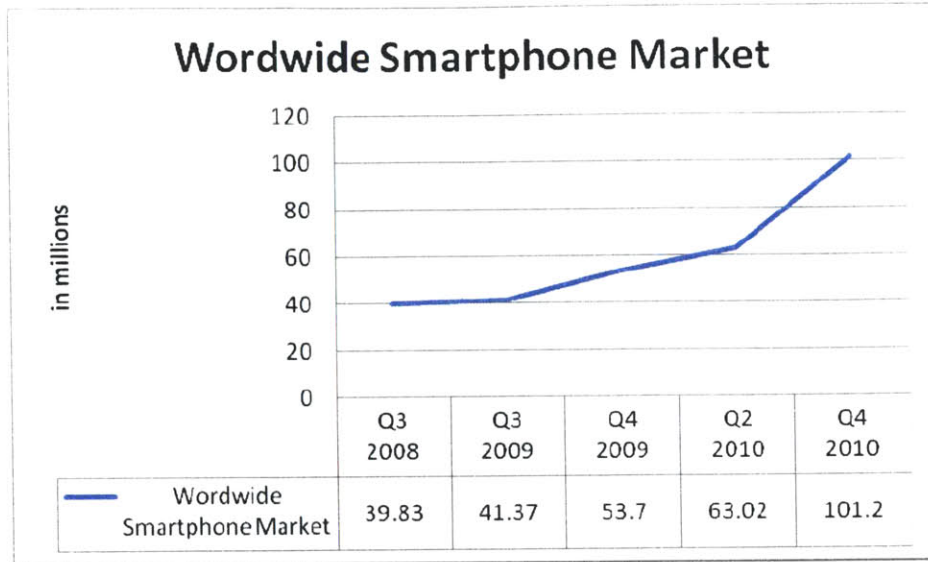
Figure 3 - Worldwide Smartphone penetration

Source: Canalys report on Smartphone analysis, Quarterly shipment data (Canalys, 2011)

1.2.3 Breakdown by Region

The U.S. remains the largest single country in terms of Smartphone shipments in the 2010 (Canalys, 2011). For region-wise distribution, comScore data indicates that smartphones have achieved higher penetration in Italy, Spain and the UK. Asia-pacific and Europe have higher numbers in terms of Smartphone penetration region-wise (Elkin, 2011). This is obvious given the larger populations in Asian countries. Credit Suisse predicts a growth of 263% in the Asia Pacific region (excluding Japan) by 2015, compared to that of 2010, and 158% in Western Europe for the same period. North America and Japan are predicted to have a growth of 144% and 27.4%, respectively. These numbers are derived from the total mobile subscriber's prediction given by Credit Suisse (Appendix: Figure 50). Even though smartphones represent less than one-third of mobile users currently, there is a strong growth in terms of new users acquiring smartphones and it is expected to reach 64.6% worldwide by 2015 (Elkin, 2011).

1.2.4 US Consumer Engagement Patterns

According to eMarketer, U.S. consumers spent 50 minutes on average per day on mobile devices in 2010, up fifty percent from 2008. It constituted 7.5% of total time spent consuming media. Mobile devices are predicted to get more share of media time per day and this growth is predicted to continue over the years (Elkin, 2011).

%change in average time spent with various media by US consumers

	Mobile	Internet	TV and video	Radio	Magazine	Newspaper	Other
■2009	21.9%	6.6%	5.1%	-3.9%	-12.0%	-13.2%	-4.2%
■2010	28.2%	6.2%	-1.1%	-2.0%	-9.1%	-9.1%	0.0%

■ 2009 ■ 2010
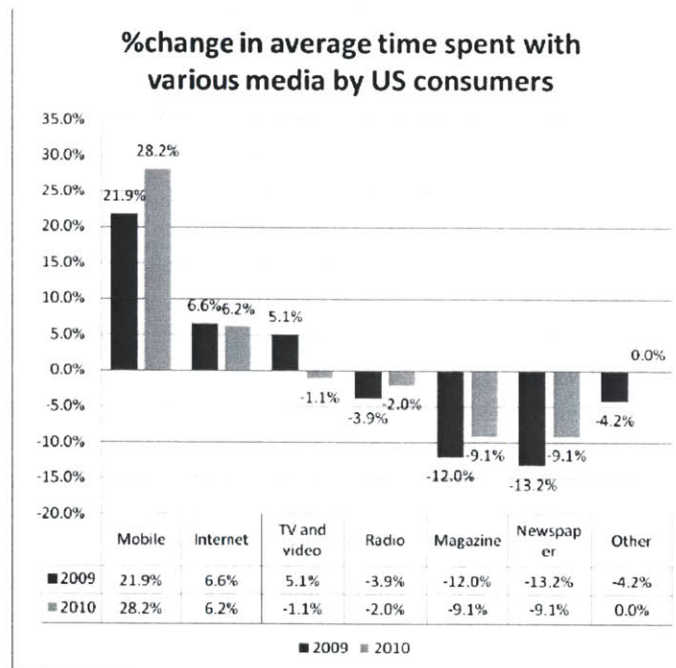
Figure 4 - Growth of Average Time Spent per Day with Major Media by US Adults

Source of data: eMarketer, Dec 2010 (Elkin, 2011)

1.2.5 Mobile Internet Traffic

Mobile Internet traffic worldwide is rising continuously, as shown in Figure 5. It doubled in 2010, alone, with 3.45% of total traffic at the end of December 2010. This trend is expected to continue over 2011 (Elkin, 2011). Facetime and Skype video calls will drive this even further, as they start to become the preferred mode of communication over voice, thanks to lower rates, improved quality, and easy availability

through smartphones. Similarly, as video and online games on smartphones gain prominence, mobile Internet traffic is expected to grow exponentially in 2011, and into the future (Elkin, 2011).

Mobile internet traffic % of total internet traffic - worldwide
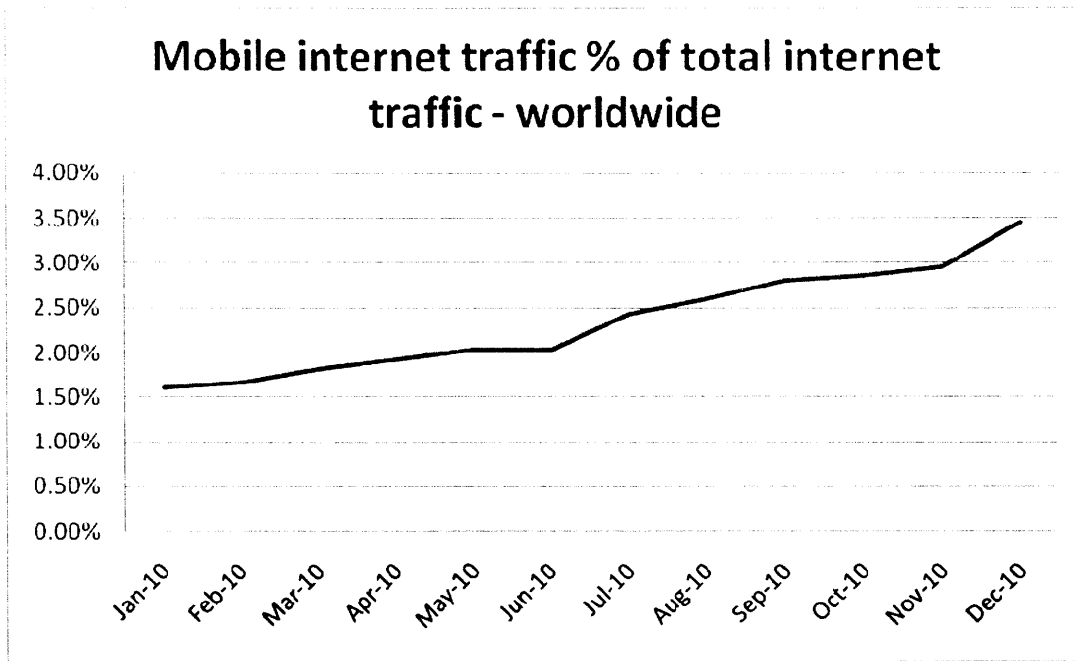
Figure 5 - Worldwide Mobile Internet Traffic - 2010

Source of data: Net Applications report as cited in press release, Jan 1 2011 (Elkin, 2011)

2 Smartphone Eco-system

The Smartphone ecosystem consists of wireless network operators, handset manufacturers, operating system vendors, application developers, content providers, and mobile advertisers. We will discuss each player in the ecosystem in detail below.

2.1 Wireless Network Operators

Network Service Providers are the companies, which acquire radio spectrum licenses from the government of the country to provide a medium for carrying voice and/or data (Wikipedia: Mobile Network Operator, 2009). The spectrum they acquire depends on services like GSM and CDMA (Wikipedia: Mobile Network Operator, 2009). In traditional terms, they are nothing but telephone companies providing wireless carrier services to mobile phone users. An emerging category among mobile network operators (MNOs) is mobile virtual network operators (MVNOs). These operators are those who choose not to deploy their own infrastructure, but instead, lease it from other operators (Wikipedia: Mobile Virtual Network Operator, 2011). According to totaltele.com, there are currently 602 MVNOs worldwide and at the current growth rate, MVNOs will surpass MNOs by 2013 (Lennighan, 2010).

Traditionally, voice services have formed a major component of the mobile operators' revenue. But with increasing competition, these profit margins are steadily declining. The growth, which was exponential at one point, is slowly heading towards saturation. This leads to price wars, lower profit margins, and there have been major consolidations, especially among the U.S. wireless providers (Ali A. Nejad Amiri, 2008).

2.1.1 Market Share of Network Operators

The U.S. Smartphone Mobile Service Provider's market share, as reported by comScore (calculated using 3 month average ending in 2010), is shown in Figure 6. AT&T has the highest share of the market at thirty-eight percent. Verizon is placed second with twenty-six percent, and Sprint and T-mobile are a distant third. AT&T and Verizon together control over 65% of the Smartphone market in the U.S.

	Verizon	AT&T	T-Mobile	Sprint	Others
■ Mobile	31.3%	26.6%	12.2%	11.9%	18.0%
▦ Smartphone	26.7%	38.3%	15.1%	15.9%	4.0%
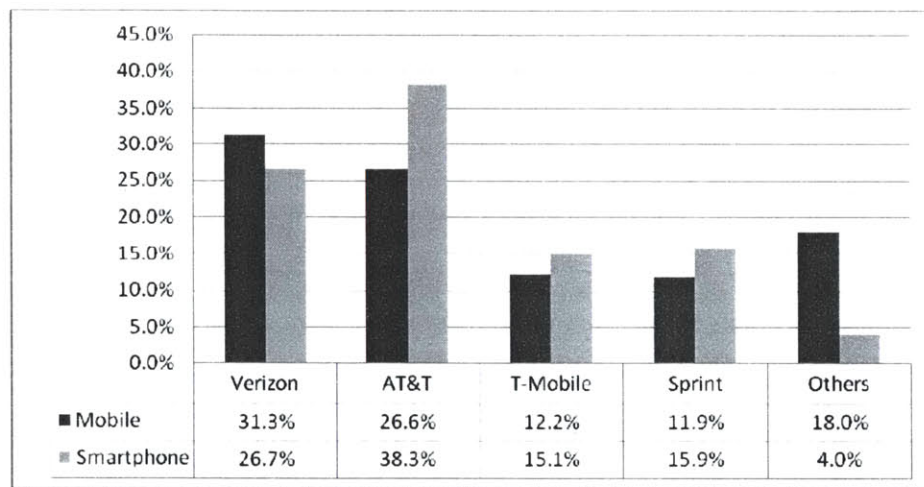
Figure 6 - US Network Operator Market Share by Mobile vs. Smartphone (comScore, 2011)

Source: US Mobile Service Provider Market Share, December 2010- comScore Inc

On account of an exclusive deal with Apple to offer the iPhone, AT&T (as of December 2010) has a lead over other carriers within the Smartphone segment in the U.S. It gained significant number of subscribers in 2010 in U.S., adding over ten million new subscribers, from eighty-five million in the fourth quarter of 2009 to ninety-five million in the fourth quarter of 2010 (Appendix: Figure 51) (AT&T, 2010). Although AT&T leads Mobile Network Operators war in terms of smartphones, the scenario differs a bit when we consider all mobile devices, with Verizon holding the lead with 31.3% of the mobile market (Figure 6).

There have been some significant developments within the Mobile Service Providers' industry in U.S. in the beginning of 2011, which are sure to change the whole landscape. On January 11 2011, Verizon announced that it would offer iPhone on its network (until now exclusively offered by AT&T), starting 10th of February 2011. Since the launch, Verizon has gained a considerable size of iPhone users and currently has 12% of the market share. One out of eight iPhone owners in U.S. currently uses Verizon's network (Lain, 2011).

Another major development came when AT&T announced a thirty-nine billion dollar takeover of T-Mobile on March 20th 2011 (Remizowski, 2011). This will result in AT&T becoming the leading wireless provider in the U.S., with over 38.8% of the market share (based on Figure 6). It will also result in the top two wireless carriers controlling over seventy percent market share in U.S. and leaving Sprint to a distant third, with a little around twelve percent of the market share. In essence, the U.S. wireless industry is shaping out to be a duopoly (like the Cola market) developing from the current oligopoly (Verizon, AT&T, Sprint Nextel, and T-Mobile).

2.1.2 Shift of Balance

Traditionally, network operators charged users for mobile content data. For example, Verizon wireless charged fees to consumers for downloading music over its network. But this revenue is sharply declining as App stores are taking over the content distribution. The trend started with Apple creating its own distribution channel (iTunes) when iPhone was introduced in 2007. The deal that Apple made with AT&T fundamentally altered the balance of power between carriers and handset manufacturers in U.S., giving Smartphone OS/hardware vendors direct control over the customer relationship. As Jim Gerace, Verizon wireless' vice president, rightly noted back in 2007, as the reason why Verizon refused the deal with Apple, "they would have

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been stepping in between us and our customers to the point where we would have almost had to take a back seat . . . on hardware and service support" (Cheng, 2007). This soon became a reality, with Apple coming into the market in collaboration with AT&T. iPhone not only re-energized the Smartphone industry, it changed the focus from carrier-controlled featured phones to open web and application based smartphones (Elkin, 2011). To counter the loss of control over content distribution channel and capture value from mobile content ecosystem, carriers are trying multiple strategies with limited success so far.

With the drop in voice revenues, Mobile Service Operators (MSO) want new ways to reinvent their services. They know now that they should not be limited to just carrier of voice and data, if they want to retain their value in the mobile Smartphone industry value chain. As such in February 2010, they announced the arrival of Wholesale Applications Community. The twenty-four biggest mobile network operators, including China Mobile, Deutsche Telekom, Vodafone, NTT DoCoMo, Telefonica, SK Telecom, Sprint, AT&T, Verizon Wireless, and hardware manufacturers including LG, Samsung, and Sony Ericsson are part of this community (VisionMobile, 2010).

Mobile Service Operators aim is to provide a platform for easy application development, where an app developed for one platform can run seamlessly on other platforms. With the revenues dropping in other areas, this can be a major drive for revenue generation (Wikipedia: Wholesale Applications Community, 2011).

Network operators are keen on providing full-fledged app stores for the entire app life cycle; right from the app ingestion to app discovery. But reports from Mobile Developer Economics (2010) indicate that developers are quite wary about the usage of mobile network operators as a channel for their apps (VisionMobile, 2010).

According to app store analytics platform Distimo, twenty-two carriers around

the world, including the top four in the US (Verizon, AT&T, Sprint and T-Mobile), have their own app stores or are hosted by a third-party provider (Elkin, 2011). It might be possible for them to get into agreement with specific app developers to develop content that can only be distributed through their channel. This can probably move the balance of power towards carriers. But it is highly unlikely that these strategies will work and it is probably too little, too late. They will mostly remain as the providers of bandwidth pipe for handling ever-growing data needs of the consumers.

In spite of losing on the content distribution front, carriers benefitted from explosive growth in data revenues as content hungry consumers flocked to mobile devices. By the end of the last quarter of 2010, AT&T reported $4.9 billion in revenue, up from $3.9 billion in the same quarter of 2009 (AT&T, 2010) (Appendix: Figure 57). eMarketer reported that, by 2015, data revenues expected at $77.4 billion would surpass voice revenues, which will go down to $77.2 billion from the present $109.8 billion (ATLANTIC-ACM, 2010).
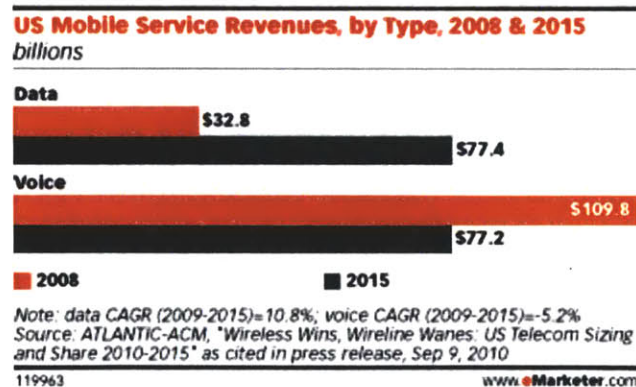
Figure 7 - Voice vs. Data revenues

Source: eMarketer (ATLANTIC-ACM, 2010)

2.2 Mobile Handset Manufacturers

2.2.1 Worldwide Market Share

1.39 billion Mobile phones were shipped worldwide in 2010, up 18.5% from the previous year, according to IDC's worldwide Mobile Phone Tracker (The Mac Observer, 2011). Figure 8 shows the market shares of major vendors for years 2009 and 2010.

RIM and Apple, pure Smartphone players, had a growth of 41.4% and 89.2%, , for year-on-year respectively. They were able to make a place for themselves in the top five worldwide mobile handset manufacturers, mainly due to their strongly integrated store, OS and devices. Nokia lost over 4% market share in 2010 over 2009 (The Mac Observer, 2011; International Data Corporation, 2011a).
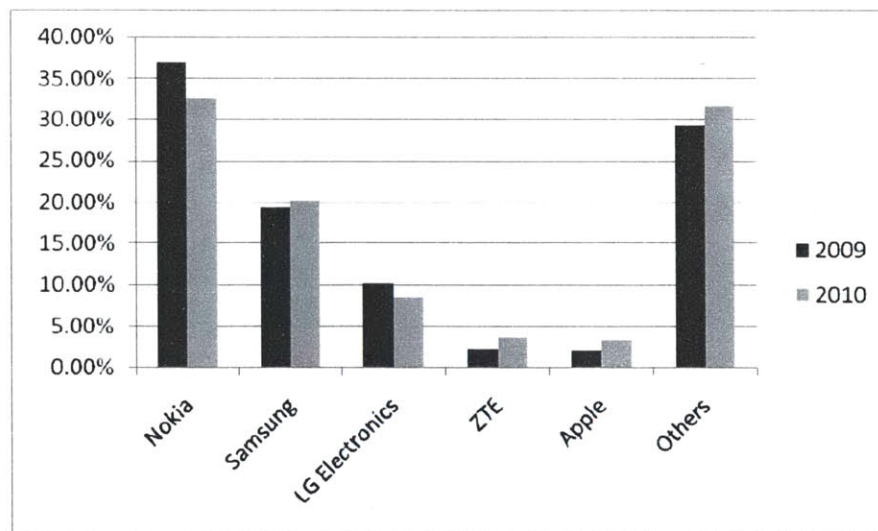
Figure 8 - Mobile Phone shipments worldwide by Vendor, 2009-2010

Source: IDC statistics on worldwide mobile shipment (International Data Corporation, 2011a; The Mac Observer, 2011).

Apple is expected to continue gaining shares among the device manufacturers

with its integrated strategy. As the adoption of tablet grows, their iPad device will switch more consumers to Apple and could lead to higher adoption of iPhone devices. Android is yet to make a mark in the tablet segment, but with the launch of multiple Android based tablets in 2011, the scenario is expected to change significantly.

2.2.1.1 Smartphone

The growth in the Smartphone segment is changing the landscape every quarter. All mobile vendors are focusing on the fast-growing Smartphone market segment. As inferred from the data reported by eMarketer for Smartphone shipments worldwide in 2010, Smartphone sales reached 302.6 million, an increase of 74.4% year-on-year (International Data Corporation , 2011b).

2010 Smartphone shipments worldwide by Vendor
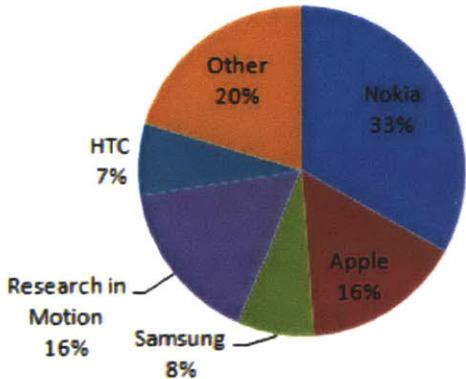
Figure 9 - 2010 Smartphone shipments worldwide by Hardware Vendor

Source: - Smartphone Shipments worldwide by Vendor Q4 2010 and 2010- eMarketer (International Data Corporation , 2011b)

From the hardware vendor perspective, Nokia held the lead position worldwide with

33.1% market share followed by RIM and Apple devices, each with about 16% market share. Samsung and HTC are the other two players in top five. Samsung and HTC each hold around 8% of the market share and are fast growing, thanks to the popularity and adoption of the Android OS.

2.2.1.2 Smartphone vs. Feature Phones Market Share Comparison

Smartphone currently accounts for only 22% of the mobile market share. But it is growing at a fast rate. Feature phone users looking for more functionality are moving towards low-end smartphones and it is contributing tremendously to this growth. The growth rate is expected to be at 43.7% in 2011 according to IDC. Smartphone market grew over 74.4% in 2010 over 2009, compared to 18.5% growth in the mobile phone market overall according to IDC (The Mac Observer, 2011).

Feature Phone vs. Smartphone
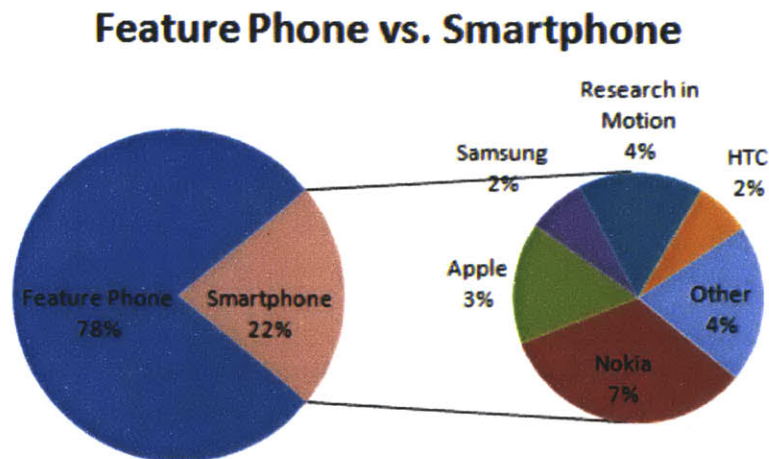
Figure 10 - Smartphone vs. Feature phone market share in 2010

Source: Mobile Phone shipment worldwide and Smartphone shipment worldwide, 2010 reported by eMarketer (IDC research) (International Data Corporation , 2011b; International Data Corporation, 2011a)

Within each vendor, smartphones are a smaller percentage of the total OEM's mobile phone shipments, but the ratio is expected to grow substantially in the coming years.

2010 mobile vs. smartphone market share
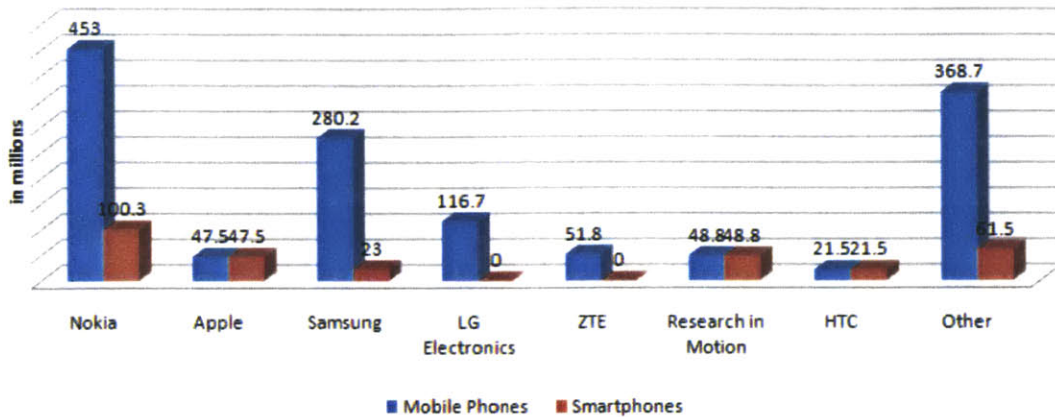
Figure 11 - 2010 Smartphone vs. mobile phone by Vendor

Source: Mobile Phone shipment worldwide and Smartphone shipment worldwide, 2010 reported by eMarketer (IDC research) (International Data Corporation , 2011b; International Data Corporation, 2011a)

2.2.2 United States

The United States continued to be the largest single country in terms of Smartphone shipments (Canalys, 2011). As reported by comScore in the 2010 year end review (Figure 7), Samsung was the leading OEM in U.S., followed closely by LG. Motorola, the previous year's leader, was third with a market share of 16.7%, down 6.7% from the previous year (comScore, 2011).

2.2.3 Mobile Phone Market Share Across Other Regions

In terms of region, Europe, Middle East and Africa (EMEA) remained the largest market with 38.8 million sales (Canalys, 2011). Nokia was the leading OEM in Asia and EMEA regions. Top 3 OEMs for EU5 and Japan are shown in Figure 13 (comScore, 2011).

OEM Installed Base U.S. Market Share
Source: comScore MobiLens, 3 mo. avg. ending Dec-2010
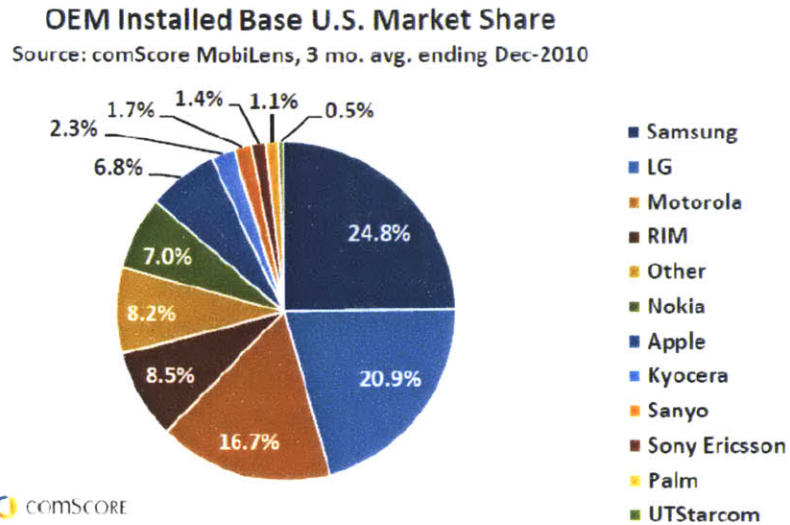
Figure 12: OEM Market share in US (comScore, 2011)

UK		France		Germany		Italy		Spain		Japan	
Nokia	30.4%	Samsung	34.1%	Nokia	33.1%	Nokia	47.4%	Nokia	47.0%	Sharp	25.3%
Samsung	19.4%	Nokia	20.6%	Sony Ericsson	18.2%	Samsung	21.4%	Samsung	15.3%	Panasonic	15.0%
Sony Ericsson	13.7%	Sony Ericsson	10.7%	Samsung	17.8%	LG	7.2%	LG	10.0%	Fujitsu	11.7%

Figure 13 - Top 3 OEMs by Installed Base as % share of Mobile Market across EU5 and Japan (comScore, 2011).

The most significant market in Asia is China. As Canalys reports, "Chinese market grew 134% year-on-year, notably faster than the U.S. market which grew at 64% in the quarter" (Canalys, 2011).

2.3 Smartphone Operating Systems

2.3.1 Symbian OS

Developed from the Symbian platform, Symbian OS is currently the biggest

market shareholder for smartphones globally. Its success is greatly attributed to its alliance with some strong handset manufacturers in Asia, like Nokia (also its major shareholder). Currently Fujitsu, Nokia, Samsung, Sharp, and Sony Ericsson make handsets for Symbian. Lately, Symbian's market share is sharply declining due to the emergence of strong competitors with better user interface, apps, and stronger services. A major blow to Symbian happened when Nokia announced a strategic partnership with Microsoft. It remains to be seen as to how Symbian OS will evolve in the future without Nokia (Wikipedia : Symbian, 2011).

2.3.2 RIM Blackberry

Originally made for business purposes and the first Smartphone OS, which brought Smartphone to daily life of people, RIM Blackberry was a sensation in the early 2000s. But this platform is also losing its market share because of strong competition. It's a closed-source proprietary system. RIM App World was launched in April 2009, and roughly has over 20,000 apps with 900 apps being added every day (Dignan, 2011).

There is a sharp contrast when one sees demographics of Blackberry users compared to other Smartphone users. Blackberry users are middle-aged, high-income professionals, where iPhone users are younger, highly educated, employed as managers or professionals. Android users are mostly young males who are either students or employed in sales, service, or blue-collar jobs with moderately high incomes (TNS-US, 2011). This brings it up to a point, where we believe; Blackberry is mostly popular for corporate use.
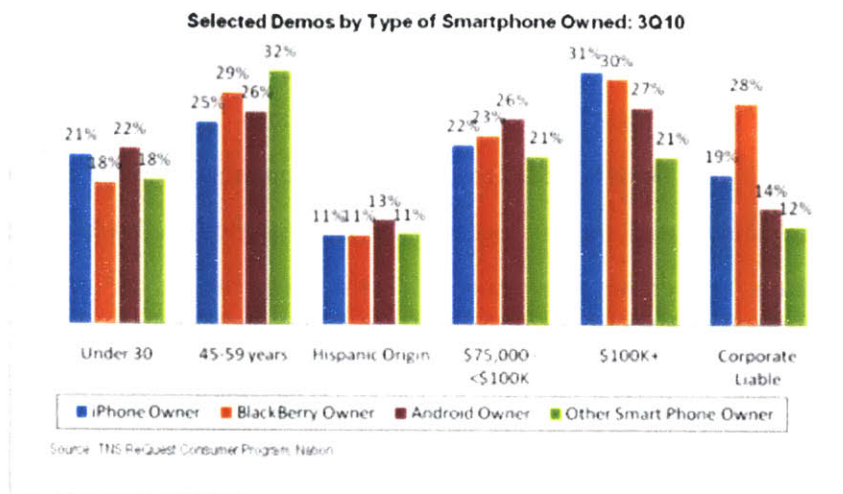
Figure 14 - Demographics of Smartphone Users

Source: TNS-US.com (TNS-US, 2011)

2.3.3 Android

Android is a Linux based open source, which has Google as its major stakeholder. Google and other major hardware and software developers, like Intel, Samsung, ARM, Motorola, and many other players formed Open Handset Alliance, which owns this system (Wikipedia: OHA, 2011). Android, as discussed in above sections, has seen an explosive growth in the fourth quarter of 2010.

Android's rapid adoption was largely attributable to the proliferation of new devices across carriers and OEMs that used the platform. Wikipedia reports "As of December 2010, Google said over 300,000 Android phones were being activated daily, up from 100,000 per day in May 2010. In February 2011, during the 2011 Mobile World Congress, Eric Schmidt announced that Android has reached 350,000 activations per day" (Wikipedia: Android OS, 2011). In terms of the Android version, 61.3% of Android devices now run Android 2.2, according to data collected by Google during two weeks ending on March 15, 2011 (Duncan, 2011) (seen in the following table).

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Android's fragmented strategy seems to be working for the handset manufactures. Business Insider reported HTC's gross profit almost tripled in the year 2010, after it collaborated with Google for the launch of Nexus One (Yarow & Angelova, The Android Effect On HTC, 2011). Android gives unknown mobile device manufacturers instant credibility and market access. On the flip side, Android is reducing handset manufactures to commodity and has the same effect as Windows had on PC manufacturers.

Platform	API Level	Distribution
Android 3.0 (Honeycomb)	11	0.2%
Android 2.3.3 (Gingerbread)	10	1%
Android 2.3 (Gingerbread)	9	0.7%
Android 2.2 (Froyo)	8	61.3%
Android 2.1 (Eclair)	7	29%
Android 1.6 (Donut)	4	4.8%
Android 1.5 (Cupcake)	3	3%

Figure 15- Android Distribution by version
Source: Google's report (Duncan, 2011)

2.3.4 iOS

The iPhone operating system from Apple, derived from Mac OSX. Apple did not support the ability to develop third party applications till the release of iOS 2.0 in July 2008. It is one of the most popular U.S. Smartphone devices and enjoys the highest operating profits in U.S., due to its integrated approach (end-to-end services) (VisionMobile, 2011).

2.3.5 Windows Mobile

Earlier, Microsoft's operating system (a closed source and proprietary for Microsoft) for mobile, lacked significantly in its capability to provide support to the touch screen devices. In the second quarter of 2010, its share dropped significantly to just five percent worldwide (Wikipedia: Windows Mobile, 2011). Unable to control the experience on OEM devices and to compete against the superior touch screen devices by Apple and Google, Microsoft scrapped the earlier OS and launched Windows Mobile 7 (WM7) in October 2010, in Europe and Asia-Pacific and in November 2010, in the U.S. It initially partnered with AT&T/T-Mobile, and Verizon/Sprint deployment is expected in the first half of 2011 (Wikipedia: Windows Mobile, 2011).

Microsoft launched its apps marketplace in November 2010 and reached 10,000 Apps on March 11th 2011. The company also claims to add 100 new apps a day. At this pace, Microsoft is landing 3,000 apps a month and will overtake RIM in terms of app count in the next 6 months (Dignan, 2011). This change might be significant because Blackberry holds a strong hold on enterprise mobile users segment. Traditionally, Microsoft has credibility in the enterprise software segment for desktops/laptops and it might be able to play this to its advantage to get a strong foothold among enterprise mobile users.

2.4 Market Share

In this section, we report on the market share of five major Smartphone OS vendors: Symbian (Nokia), RIM (Blackberry), Android (Google), iOS (Apple), and Windows Phone 7 (Microsoft).

2.4.1 Worldwide Market Share by Q4 2010 Sales

As Canalys reports, with the shipment of around 101.2 million units of smartphones in the fourth quarter of 2010, and around 300 million in 2010, the Smartphone industry witnessed an amazing growth. This represents a year-on-year growth of 89%. In terms of new Smartphone sales, during the fourth quarter of 2010 Android overtook Nokia as the leading Smartphone OS vendor and Apple overtook RIM as the third largest OS vendor worldwide (Canalys, 2011). Nokia's share fell from 46.6% in 2008 to 30.6% in 2010 in the Smartphone segment. Windows Mobile had a share of 13.6% in the third quarter of 2008, declining by 77% by the end of 2010. Microsoft's share however is expected to increase in 2011, with the deployment of more WM7 based devices and the adoption of WM7 by Nokia Smartphone devices. Android has been gaining at the expense of Symbian and Windows worldwide to become the leading Smartphone OS vendor. Figure 16 summarizes the Mobile OS market share for the fourth quarter of 2010 (Appendix: Figure 54).
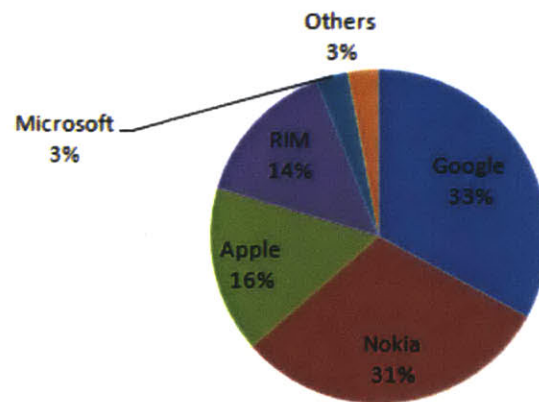
Figure 16 - 2010 Q4 Worldwide Smartphone sales Market Share by OS Vendor

Source: Canalys report on Smartphone analysis, Quarterly shipment data (Canalys, 2011).

In terms of installed base for Smartphone subscribers worldwide, Android is expected to become the second largest OS by 2012, according to the "Convergence

2010" report released in July 2010. Figure 16 shows a visual representation of the installed base of Smartphone OSs worldwide.

2.4.2 US Market Share

Although Symbian has a very large market share worldwide (30.63%), it lags significantly, with only 2% market share in United States. The battle for smartphones in U.S. is heating up and according to the recent report from The Nielson Company, Android had a market share of 29% in January 2011, and iPhone and RIM each with 27% competed for the second position (Nielsen Wire, 2011; The Nielsen Company, 2011). But the report also points out that RIM and Apple are clear winners, due to their integrated device and OS strategy, as they capture most of the value created by their ecosystem.
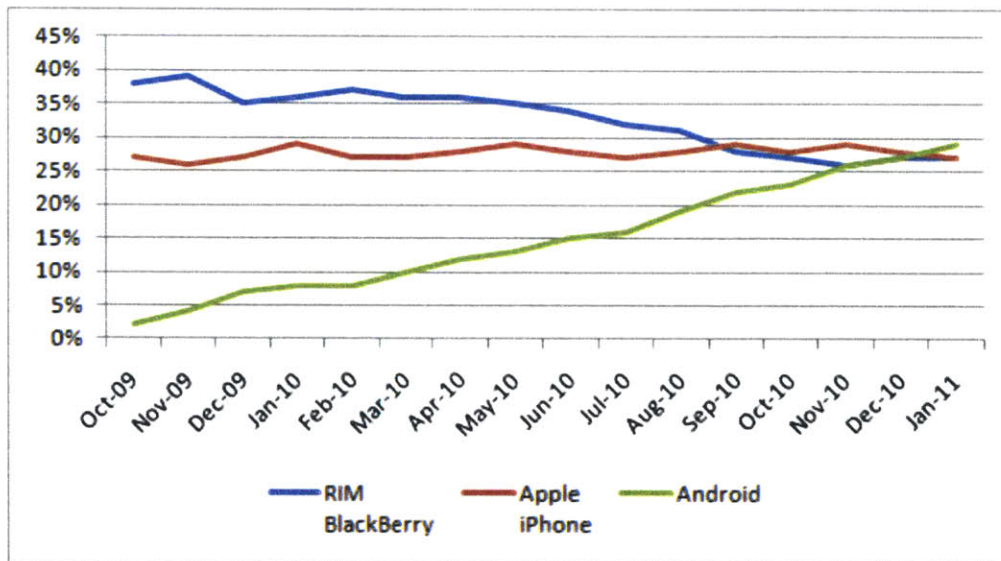
Figure 17 - US market share by OS vendors

Source: Nielsen report on Smartphone OS Market Share among US Smartphone Owners (The Nielsen Company, 2011; Nielsen Wire, 2011)

As shown in Figure 18, since the launch of Windows Mobile 7, Microsoft has been able to gain 10% of the market share and HTC is leading the Windows Mobile ecosystem.

Motorola and Samsung have 1% and 2%, respectively. HP has 1% market share, but that might soon change, as it gets ready to release Palm OS-based mobile devices (HP acquired Palm OS in 2010) (Seigler, 2010). HTC also leads the Android ecosystem in U.S. with 12% market share. Motorola with 10% and Samsung with 5% are the other major players in the Android ecosystem(Nielsen Wire, 2011).
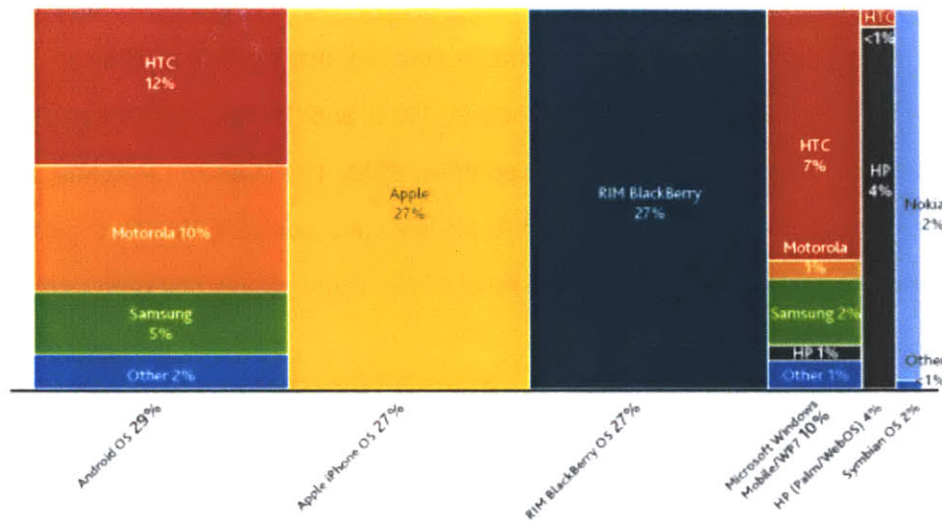
Source: The Nielsen Company

Figure 18 - Market share by OS vendors and OEM manufactures in US; Nov'10 - Jan'11 (Nielsen Wire, 2011)

With the recent strategic alliance of Nokia and Microsoft, landscape is poised to experience a major change both in U.S. and worldwide (International Data Corporation, 2011).

2.5 Open vs. Closed Systems

The main war between OS's is said to be between open and closed systems. There is no clear winner until now, but the two big players, Google and Apple, have adopted very different approach to reach market leadership position. As Steve Jobs points out, it

is not the war of open systems and closed systems, but a war between "integrated and fragmented systems." Developing apps for multiple flavors of Android OS, especially when OEM vendors are dragging their feet on updating to the latest versions, is a big challenge for developers (Tech Crunch, 2010a). According to the Baird's survey, Android developers have negative perspective about the Android OS fragmentation and the trend is becoming more negative compared to the fourth quarter of 2010 (Power, Beckert, & Flis, 2011).

According to the recent 2010 fourth quarter market share results, Android has been leading both worldwide and in United States; and Apple is placed third worldwide (Canalys, 2011). Fragmentation strategy can be effective when the new entrant wants to quickly gain market share by leveraging the innovations among handset manufacturers. Google, to a large extent, was able to bring together multiple mobile device vendors against Apple to create a very profitable ecosystem. According to the Braid's survey, developers have a positive outlook on both Android and iOS platforms and continue to develop for both platforms. We will this in detail in a later section.

The strategy of open source software and device manufacturer's ability to use it without royalty payment was enticing. This led to hardware manufacturers flocking to Android, launching multiple devices in the Android ecosystem. Google's main strategy was to sell search on these mobile devices. Since its launch in October 2008, the fact that Google became the single largest deployed OS on the smartphones worldwide is a staggering growth. But as Google released new software updates, the combination of customizations by OEMs and slower adoption of new OS versions by them caused inconsistent user interface experiences for consumers, as well as issues to developers who had to support various flavors. To address the growing concerns among the developer community related to Android fragmentation issues, in recent months, Google started holding back on the early software releases to only preferred partners. It has been forcing these partners to sign "non-fragmentation clauses," requiring them to

get approval from Google for any customization of the OS. Google has become a lot more discriminating in favor of manufacturers who run Google services on their devices (Bloomberg Bussinessweek, 2011). Android's over-the-air upgrades approach has resulted in higher OS upgrades compared to the two-step process of Apple. According to an article, which appeared in Tech Crunch in September 2010, two weeks into the latest release, only 5% of Droid users had not yet upgraded to the latest OS release, compared to the 44% of iPhone 3GS users who were yet to upgrade to iOS 4 (Schonfeld, 2010). This huge difference highlights the benefits of OTA upgrade strategy (Appendix: Figure 55). Numbers released by VisionMobile's Mobile Megatrends report in 2011 show that end-to-end players are largely tapping profits like Apple and RIM. Because of fragmented approach, the other top 5 OEM manufacturers lack in profit margins.
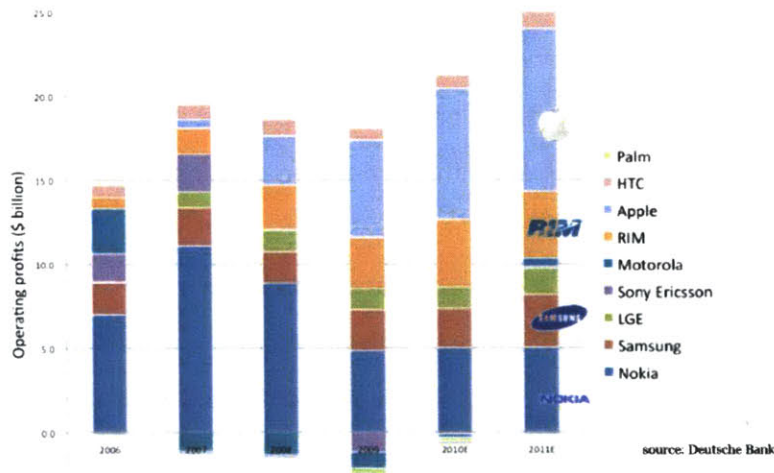
Figure 19 - Operating Profits by various players
Source: Deutsche bank (VisionMobile, 2011)

2.6 Mobile Content Eco-System

The content ecosystem is quite broad, with several players in it. Content publishers are the companies that produce the content. News and entertainment form one of the most popular categories, and companies like CNN and the Weather Channel

are involved in the generation of such content. Apart from news and entertainment, horoscopes, music, travel, and games form other popular categories. Social networking companies like Twitter and Facebook generate a lot of consumer based content on mobile. It is significant to note that this content access is not just done by mobile but by several other wireless devices like Kindle or iPad, or gaming consoles and, in fact, even digital photo frame sometimes.

Tremendous growth in this market segment has led to a debate on whether content providers should pay for the network they use. There is growing pressure on the service providers' infrastructure to handle this explosive growth in data consumption. Infrastructure innovations happen at a much slower rate than rate of growth of data consumption traffic. Charging content publishers for network usage drives them to make applications, which are more optimized for network usage. Currently, videos and music consume a lot of bandwidth (Elkin, 2011).

2.6.1 Mobile Content

Mobile content saw an explosive growth in 2010 as consumers started using mobile devices beyond voice and SMS texts. A large percentage of mobile phone users access mobile content, according to a comScore 2010 Mobile Year in Review report. This number was 46.7% in U.S. and 41.1% in Europe. Even though there is a huge media attention to apps, the comScore study reveals that the access to content via browser was slightly higher than apps (36% vs. 34% in the U.S.). This report also shows that 82% of app users also access mobile browser and 78% of browser users also access apps. This suggests that a large percentage of people access content both via browser and apps (comScore, 2011). (Appendix: Figure 52)

The fastest growing mobile content categories are social networking with 57.9

million subscribers (up 56 %), classifieds with seventeen million subscribers (up 55 %) and online retail with 53% increase for 2010 in U.S (comScore, 2011). (Appendix: Figure 56). comScore report suggests that "among Smartphone users, 57.3% (36.2 million) accessed social networking sites or blogs at least once during the month of December 2010." The growth of social networking via mobile phone is mainly due to the increase in adoption of Facebook. Facebook reached 90% of social media users, and grew 120% over the previous years. YouTube (74% growth) and Twitter (71% growth) tied for the second position (comScore, 2011).

In terms of access pattern for different countries, Japanese users had high propensity to use mobile devices for simple tasks, such as taking pictures, than their counterparts in the U.S. and Europe. Europeans are classified as the heaviest texters and Japanese are the lightest, mainly due to a higher usage of mobile email in Japan. Europeans are also heavy users of mobile games and are keen on listening to music on their mobile devices. U.S. users are more likely to access social networking compared to Europeans and Japanese. In addition, US users are also using their devices actively for mobile banking. Japanese, on other hand, are most likely to access financial information and stock quotes. With the exception of social networking and texting, Japanese are most active on mobile content consumption (comScore, 2011).

Top Mobile Activities in the U.S., EU5 and Japan by % Share of Total Mobile Users

Source: comScore MobiLens, 3 mo. avg. ending Dec-2010, Japan data for Dec-2010 only

■ U.S. ■ EU5 ■ Japan
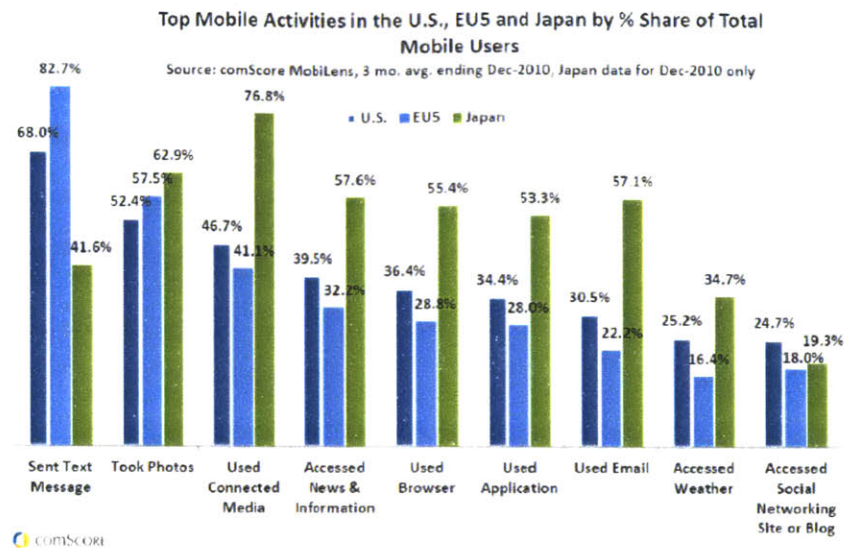
Figure 20- Top mobile activities in EU5, US and Japan

Source: comScore 2010 Mobile Year in Review (comScore, 2011)

2.7 Application Developers

Apple's app store reached another milestone on March 3, 2011, with ten billion downloads in less than three years since its launch on July 10, 2008. The fact that seven billion apps were downloaded in the last year alone shows the increased rate of adoption of apps and the popularity of app stores (Apple, 2011). This underscores the importance of apps for advanced mobile platforms, which include smartphones and tablets and answers the question as to why mobile manufacturers, OS vendors, and network providers are trying to entice app developers to their platforms. In the last two years, mobile app developers have become one of the hottest commodities of the mobile market.

Figure 21 (taken from Business Insider) summarizes the apps distribution among the four major Smartphone platforms in the U.S. With over 370,000 apps in the Apple iTunes store and 250,000 in the Android market place, it is clear that Apple and Android

have the highest mindshare among the app developers (Yarow & Angelova, Google Is Closing The Gap On Apple's App Store, 2011). It took less than three years for both Apple and Android to reach those numbers. RIM, with 20,000 apps, is the distant third, but faces the risk of being overtaken by Windows Mobile in just six months. MSFT has around 10,000 Apps currently and is growing fast, with 3000 Apps a month (Dignan, 2011).

Number Of Apps Available At Smartphones' Apps Stores
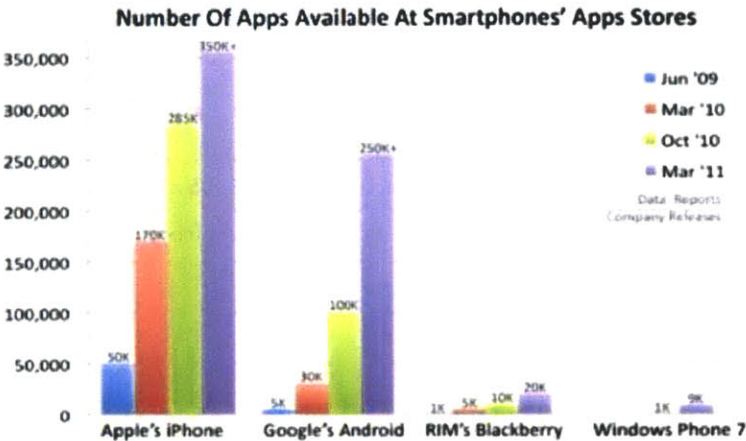
Figure 21 - Number of Apps in each App Store

Source: Business Insider Report (Yarow & Angelova, Google Is Closing The Gap On Apple's App Store, 2011)

Number of apps measures success of a platform, which in turn is directly proportional to the app developer eco-system a platform was able to attract. In an attempt to increase the stickiness with the platform, and create a barrier to entry for other platforms, Apple did not support cross-platform technologies such as Flash, initially for a couple of years, and it paid off well. Since adopting a new platform requires a steep learning curve (except for Android, as it was based on the Java platform, which had a huge installed base of developers), Apple created a high switching cost for developers. On September 9th 2010, Apple lifted its ban on Flash development for the iPhone (Sorrel, 2010) but having developed deep expertise on iOS platform for so many years, the developers weren't really very enthusiastic about this announcement.

Currently, there are plenty of iOS developers in the market and developing a native app provides a better user experience than developing with cross-platform technologies.

2.7.1 Platform Choice

There is a lot of research being done to understand why and how the developer community chooses one particular platform over another for development. Vision Mobile reports that mobile app developers, who were inclined to the usage of Symbian back in 2008, have now moved onto iOS and Android platforms over the last couple of years. Android remains the front-runner in this aspect, with over 60% of the developers having developed apps for Android. It wins over iOS as being a more comfortable platform to develop on. Symbian, with its traditional not-so-well developed developer support, tends to lose out (Constantinou, 2010) (Appendix: Figure 58). According to the first quarter 2011 Mobile Developer Survey by Baird, 71% of the 2000 respondents prefer Android, but there is a significant overlap with iOS, which is developed by 62% of respondents. (Power, Beckert, & Flis, 2011)
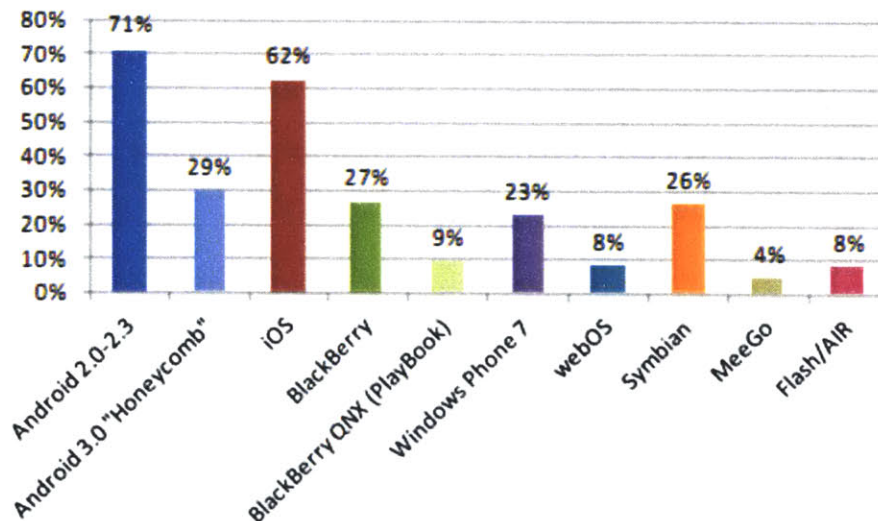
Figure 22 - App Developer preference by Smartphone OS (Power, Beckert, & Flis, 2011)

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71% of developers develop for more than one platform, indicating that there is room of more than one platform to succeed. 41% said they develop for over three platforms and 27% for over four, indicating that the top three to four platforms will take a majority of the mind share among app developers. Also, as the technologies and porting tools mature and app developers gain experience, they become adept at porting across platforms. They will follow the money and will develop for multiple platforms to increase sales and target more users (70% of iOS developers develop for Android and 63% of Android for Apple) (Power, Beckert, & Flis, 2011). Vision mobile notes that application developers almost always develop apps for multiple platforms, around 2.8 platforms per developer (with 3+ years of experience) on an average (comScore, 2011).

According to the Baird survey, 28% of developers are looking for porting solutions compared to 23% in the fourth quarter of 2010. 16% already use some form of porting tools and 56% said they are not looking for any solutions. Among the tools developers use, Unity3d, Titanium, MonoTouch, and Adobe packages are popular for porting. According to the same survey 72% of the app developers are currently developing for iPad, which is a leading indicator of the availability of the number apps on tablets. Understandably, iPad (49%) has higher adoption over Android (38%) and Blackberry's playbook has 10% mind share among app developers (see Figure 59 for more details). 51% of developers expressed interest in developing for Android 3.0 (Honeycomb) (Power, Beckert, & Flis, 2011).

Mobile Developer Economics noted that there are a few key considerations developers have in mind when making a choice of platform to develop for. From a business perspective, what is the market penetration and rate of growth of the OS? What is the ROI for developing for this platform? (Constantinou, 2010)Around 80% of the developers considered the large market penetration of the OS platform as the key factor in deciding the platform. Revenue potential, availability of app store, and large developer adoption has other major factors in order of importance. Ease of

development (learning curve) and user interface of the OS platform is as important as the monetization aspects. Android, Flash, and mobile web development tools are appreciated because of their ability to code quickly. iOS is considered as having a great UI experience for end users. Symbian and Java have a notorious reputation for bad development support (Appendix: Figure 62) (Constantinou, 2010).

Being able to code and prototype quickly is definitely most important to the developers, according to the Vision Mobile Developers Economic 2010 report. Large developer community is also important, as it provides the support infrastructure through technical forums and sample code snippets. Development environment (IDE) and the cost of development tools are important, as well. Even though most of the OS platforms have a fee for entering the developer program, they rarely charge for the development tools (Constantinou, 2010).   The learning curve of a platform contributes to the ease of development. Developer Economics brings out the fact that Android is considered to be the easiest to learn (average of about 6 months) and at the other extreme is Symbian, with an average of fifteen months. iPhone and Flash are the next easiest to learn with average learning duration of seven months. Some developers also note that developing for Android is so easy that they could learn the intricacies in just a month. Even though iPhone is based on a complex C-like language, the drag and drop facilities reduces coding effort tremendously (comScore, 2011). According to the Braid's survey in April 2011, Windows Mobile 7 is perceived positively in terms of ease of development, which is good news for Microsoft, which is trying to entice developers to port applications to its platform (Appendix: Figure 62) (Power, Beckert, & Flis, 2011).
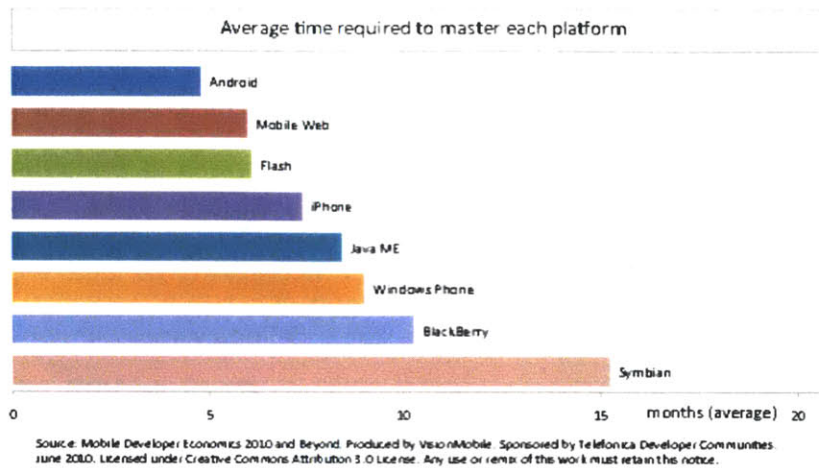
Figure 23 - Learning Curve for various OS Platforms

Source: Mobile Developer Economics Report (comScore, 2011)

The learning curve for the platform is eased out by the availability of developer tools and IDE. A good IDE should have a good emulator, easy to use interface, strong debuggers, and should be lightweight. Tools need to be fast and accurate in showing the target device. In case of issues, developers need support and there are several ways they reach out to for technical support, which depends greatly on platforms.

Android's OS fragmentation and store fragmentation is a major concern for 56% of the developers surveyed in the Baird's "Q1'11 Mobile Developer Survey". Google has recently taken steps to address these issues with the "non-fragmentation clause" giving Google the final authority to approve changes to its core platform. This is a step to have a more controlled OS platform. This will hugely standardize the experience on Android devices. According to John Lagerling, director of global Android partnerships at Google, it is about "quality control, fixing bugs early, and building towards a common denominator. After that, the customization can begin" (Bloomberg Bussinessweek, 2011). Following the announcement of Microsoft and Nokia's partnership, 66% of Symbian developers plan to develop for Windows Mobile 7 and, among non-Symbian developers, 52% have shown interest in developing for WM7. This paints a good picture

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for the future of Windows platform. Combining the developer communities of Windows and Symbian will help not only mature the OS platform, but will be a formidable base against Android and Apple (Power, Beckert, & Flis, 2011).

2.8   App Store

App store with a single channel of distribution has hugely simplified distribution issues previously faced by developers by reducing the overhead of managing payment, marketing, etc. One of the main reasons for app developer's adoption of iPhone and Android platforms is the emergence of these very app stores. As discussed earlier, there are many concerns among developers with the fragmentation in the Android marketplace. Everyone in the mobile ecosystem wants his or her own app store. Following advantages of app store can help explain the rush by OS vendors (Google, Microsoft, Java), OEMs (Apple, Nokia, RIM, Motorola, Intel, Dell), carriers (Verizon, China Mobile, Airtel, Aircel), Independents (Appitalism, Amazon) to create their own app store (VisionMobile, 2011). Gateway to app discovery process creates a competitive advantage. Amazon is trying to play into this space by providing an Android app store for Android OS, an equivalent to Apple's app Store for iOS. On March 22nd 2011 Amazon launched the Android app Store (Kincaid, J., 2011a). Amazon claims to be addressing the fragmentation, curation, and recommendation issues associated with Androids' own market place (Kincaid, J., 2011b) (VisionMobile, 2011).

Control over the distribution channel is a strategic advantage to ensure compliance from the eco-system players, such as handset manufacturers. Google focuses on this attribute of the App store control points. Recent "non-fragmentation clauses" enforcement by Google for their licensees is a good example of how a platform leader can police the ecosystem. A platform leader can extract revenue by monopolizing the payment gateway. PayPal and Vodafone try to exploit this attribute of the app store

control points (VisionMobile, 2011).

OS Vendors increase the stickiness of the platform using exclusivity of the app to the platform. This is no longer a competitive advantage, as more and more developers are building apps for all leading platforms. The main goal of Apple for not supporting cross platform technologies like Flash was to increase the switching cost for customers (VisionMobile, 2011). (Appendix: Figure 63)

In spite of the fact that other alternatives are available for selling apps for a few platforms, most app developers prefer selling through an app store for the convenience of time-to-payment (Visionmobile, 2010) (Appendix: Figure 64). Mobile Developer Economics 2010 report suggests that among the app stores, native app stores are the more preferred ones. 95% of the apps for iPhone are sold through iTunes, followed by a little below 90% for Android from Android Marketplace. For Blackberry and Windows, around 65% of the apps come through their native stores. A majority (75%) of the Symbian apps go through Nokia Ovi store. A significant number among these (i.e. 20-25%) also use the Android app store. That makes the brain drain evident towards these new platforms. Java ME developers mostly go to GetJar, followed by Nokia Ovi store (Visionmobile, 2010).

2.8.1 Amazon App Store

Android Marketplace is installed by default on Android devices shipped by OEMs, along with other Google applications. The key difference between the Google Android and the Apple app stores is that Google does not have an approval system for apps. Unlike iTunes, developers can quickly iterate and submit applications for download without a rigorous curation process at Android Market Place. Number of users downloading and using the app, filters them by quality (Kincaid, J., 2011b; Kim, A.,

2010). To address this issue with Android Market place, Amazon is adopting Apple's approach of having an approval process for Android apps. Amazon claims to keep its approval process transparent and developers do not need to make any changes to the deployment files. The same files can be submitted to Android Market Place and Amazon stores (Kincaid, J., 2011b).

The pricing model in the Amazon app store is quite different compared to other app stores. Amazon retains the control over the pricing scheme and could offer the app for discount to promote the app and increase the sale volume. Developers are guaranteed 20% of list price (set during approval process) or 70% of the sale price whichever is greater (Amazon Appstore). It remains to be seen how successful Amazon's app store will be, especially when Google starts tightening it's policies to address the Android Marketplace fragmentation issues. It is highly unlikely that Google will concede the apps distribution channel (consumer relationship) to a third party app store.

2.8.2 App Store vs. Other Channels

A major reason for app stores being so popular is because they have greatly reduced the time-to-shelf and time-to-payment. Time-to-shelf means the time taken for an app to be available to download from the time the application was submitted. Time-to-payment means the time taken from when the consumer makes payment to the time it reaches its developer (Amazon Appstore). Without app stores, this process was terribly slow and too complicated for small app developers. As the report from Mobile Developer Economics 2010 suggests, time to shelf came down from 68 days to 22 days, on an average. In terms of time-to-shelf, according to app developers it is 24 days for iOS, a week for Android and 58 days for Symbian (this is another reason why Symbian is losing its market share so quickly) (Constantinou, 2010).

According to the data collected by 148apps.biz website, the average delay for approval in the Apple app store is down to 3.88 days in March of 2011 (148 Apps, 2011a). Figure 24 discusses the maximum delay and average delay for the Apple store over the last couple of months. Over the last six months, the maximum delay has reduced from 168 days to 30 days. The average time has reduced from 10 plus days to less than 4 days. These improvements coincided with the press release by Apple on September 9th, 2010 promising to simplify the app store review guidelines (Apple, 2010).

Average Approval Time on Apple App Store

	2010-10	2010-11	2010-12	2011-01	2011-02	2011-03
Max Delay	168	151	122	88	53	30
Average Delay	10.84	12.79	10.62	12.18	6.47	3.88
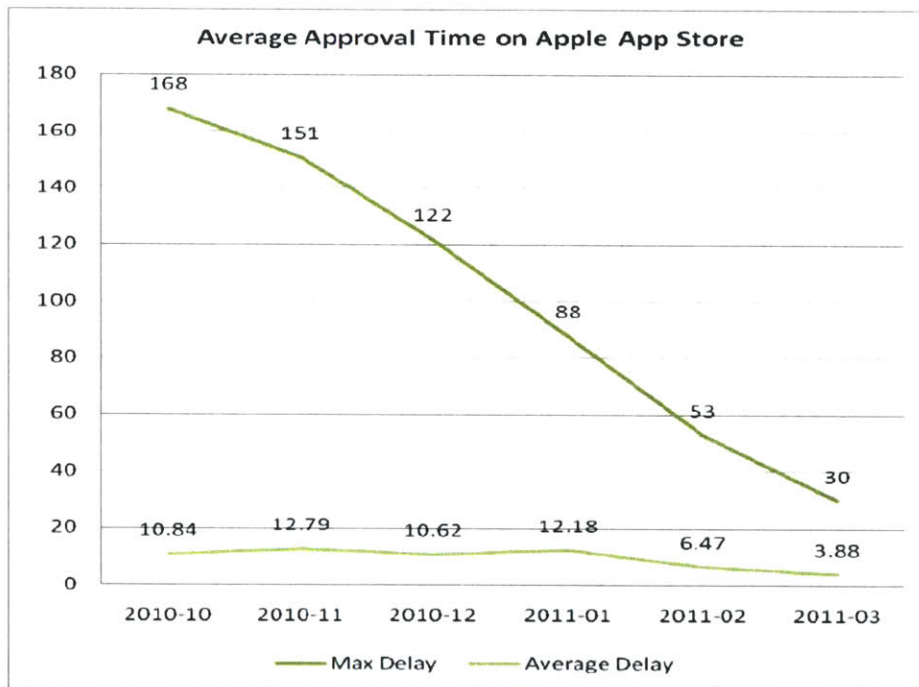
Figure 24 - Average Approval Time on Apple App Store from Oct 2010 to Mar 2011 (148 Apps, 2011a)

Time-to-payment is typically very important for small developers. It can impact any company negatively if it takes too long to get the revenues back from the distribution and payment channels. App stores have brought down this time to less than half from the traditional 82 days to 36 days (Constantinou, 2010). Apple remains the fastest and Symbian and Java ME are the slowest. Figure 25, from Mobile Developer Economics, summarize these crucial time factors for different platforms.

Which platform app the developers choose, is also affected by the revenue

model they go for. Pay per download is the popular choice. Sometimes developers also choose one-off development fees for custom apps and, if it is a preinstalled app, then royalties per device are charged. App stores support for   pay   per   downloads   works really well.   Ad funded models (apps which make money through advertisements), despite the hype, lag much beyond the pay per download model, as the research from Mobile Developer Economics shows (Constantinou, 2010). Another revenue model that is evolving is per active user fees, i.e., subscription fees, though it is not very popular right now. In-app purchases introduced by Apple have been hugely popular among developers, as discussed in the following section (Constantinou, 2010).
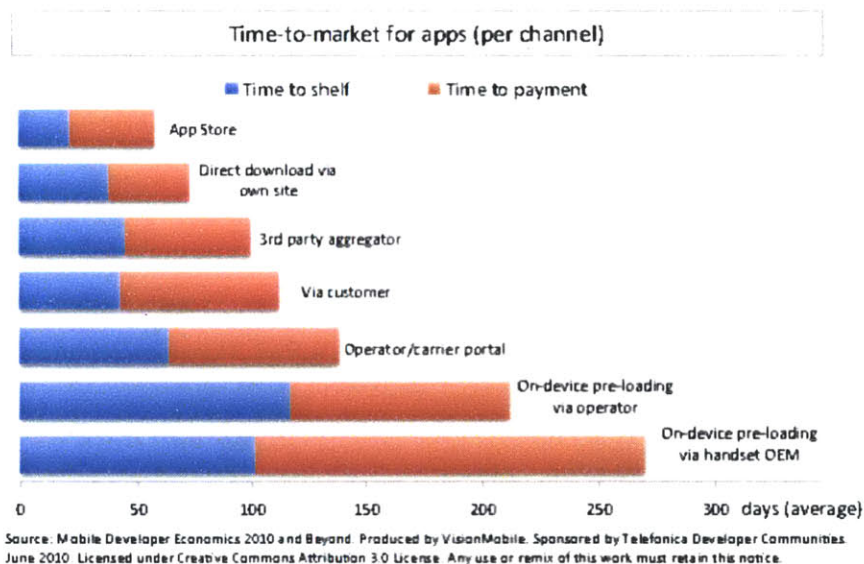
Figure 25 - Time-to-market for apps

Source: Mobile Developer Economics 2010 and beyond (Constantinou, 2010)

According to the Baird's survey, developers have good visibility in the Apple and Research-in-Motion's app store. Respondents developing for Android are concerned with the "junk apps" on the Android Marketplace. Over 40% of the developers felt their apps were highly visible on the Apple store compared to 18% for the Android store. This is a cause for concern for developers trying to monetize. Amazon's app store, as

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discussed earlier, is expected to streamline this process and developers have welcomed the move by Amazon (Power, Beckert, & Flis, 2011).

2.8.3 Free vs. Paid Apps

According to Distimo, growth in free apps outpaced that of paid apps across every OS platform in 2010. Since app stores have made the distribution and channelization so simple, a lot of developers can just put their app in the store for fun. In the flurry of free apps, it really gets difficult to monetize this platform. Stores should consider the strategy of putting a minimum download fee for all apps. Figure 26 highlights that there are more free apps in the Android app store and Android users are less willing to pay for the paid apps. Since most of the Android developers come from the open source community accustomed to providing software for free, they tend to lean towards giving away apps for free on Android. According to Distimo, in-app purchasing in free apps more than doubled from June to December 2010, on both the iPad and iPhone, as a percentage of total app revenue (14% to 34% for iPhone and 7% to 5% for iPad). The percentage of paid apps is falling, as well, for both iPhone and iPad. This shows that there has been more adoption of the in-app purchase model by developers. Android is under pressure to release similar a feature due to the success in the Apple app store. In-app purchase also solves the problem of distributing the app to review websites and giving out promo-codes for paid apps. Since developers do not have to worry about releasing two versions ("Lite" and "Paid") of the app, anymore, the adoption is expected to increase even further (Tech Crunch, 2010b). This trend of free apps is exerting downward pressure on paid app pricing. According to Distimo, even the competition between app stores is partly to blame. As discussed, with the introduction of Amazon app store, this trend is expected to continue for some time. The paid apps model is still viable if the app developers provide premium value and increases the consumers' willingness to pay (Elkin, 2011).

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Apple App Store—iPad
76%
26%

Apple App Store—iPhone
71%
29%

BlackBerry App World
75%
26%

Google Android Market
41%
60%

Nokia Ovi Store
74%
28%

Palm App Catalog
69%
31%

Windows Marketplace
79%
22%

■ Paid   ■ Free

Note: figures for BlackBerry App World are worldwide; numbers may not add up to 100% due to applications switching from free to paid or vice versa during the reporting period
Source: Distimo, "Distimo Report, August 2010," Sep 2, 2010
119762   www.eMarketer.com

Figure 26 - Free vs. paid apps

Source: eMarketer (eMarketer, 2010; Elkin, 2011)

US iPhone and iPad App Revenues, by Monetization Type, June & Dec 2010
% of total

iPad
June 2010
88%   7% 5%

Dec 2010
71%   15%   14%

iPhone
June 2010
64%   14%   22%

Dec 2010
51%   34%   15%

■ Paid apps
■ Free apps with in-app purchases
▨ Paid apps with in-app purchases

Source: Distimo, "Distimo Report, Full Year 2010," Jan 10, 2011
123847   www.eMarketer.com

Figure 27 - iPhone and iPad App Revenues

Source: Distimo report on iPad and iPhone app revenues (Elkin, 2011; eMarketer, 2011)

In terms of Paid apps, RIM's App world has the highest price on average per app of $6.97, compared to the $4.00 on Apple's popular app store (according to the latest data as of April 2011, the average cost of apps on Apple store is $2.31) (148Apps, 2011).

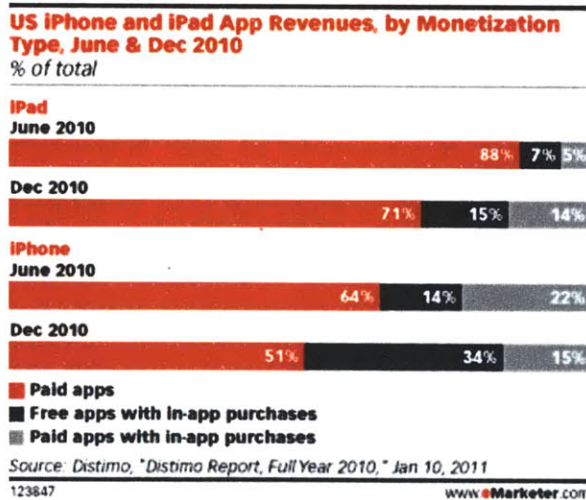On the lower side, Nokia and Android stores have a lower average per app price of around $2.00-$3.00. These numbers are continuously falling, since the data is almost over one year old. The purpose of Figure 69 in the Appendix is to show the relative comparison (Elkin, 2011).

2.8.4 Apple App Store Metrics for iPhone Apps

78% of the apps on the app store are below $2.00). 36% of the apps on the app store are free and the percentage of free apps has been increasing continuously. 42% of games are priced at $0.99, 36% are free, and 12.5% are offered for $1.99. Among regular apps, 36% are free, with 27% being $0.99, and 12% costing $1.99. Based on the current trends, most of the apps are priced under $5.00 (148Apps, 2011).

According to the Baird's survey, there has been an increase in revenue opportunity in the Android Marketplace in the first quarter of 2011, compared to the fourth quarter of 2010. This is mainly attributed to the increased revenue from advertisement. The trend is towards a larger portion of the revenue from advertisements on Android. It remains to be seen how much of this will result in developers being able to successfully monetize their investment in apps. Apple's app store was voted by 74% as the store with the highest potential to make revenue, while Android received less than a 30% vote. Blackberry/QNX platform had the highest increase compared to last quarter with 50% positive vote (Power, Beckert, & Flis, 2011) (Appendix: Figure 69).

Mobile advertising is becoming a larger share of revenue on each platform. 30% of the respondents to the Baird's survey used Admob (Google) vs. 15% using iAd (Apple). Even though Admob has higher numbers, iAd had higher profitability. Blackberry's Adservice was rated as not profitable platform (Power, Beckert, & Flis, 2011).

App Price	# Apps	% of Apps	# Games	% of Games	Total	% of Total
0	113,897	36.24%	19,969	36.58%	133,866	36.3%
0.99	85,979	27.36%	23,062	42.25%	109,041	29.6%
1.99	39,976	12.72%	6,810	12.48%	46,786	12.7%

Figure 28- App store metrics by Price(148Apps, 2011)
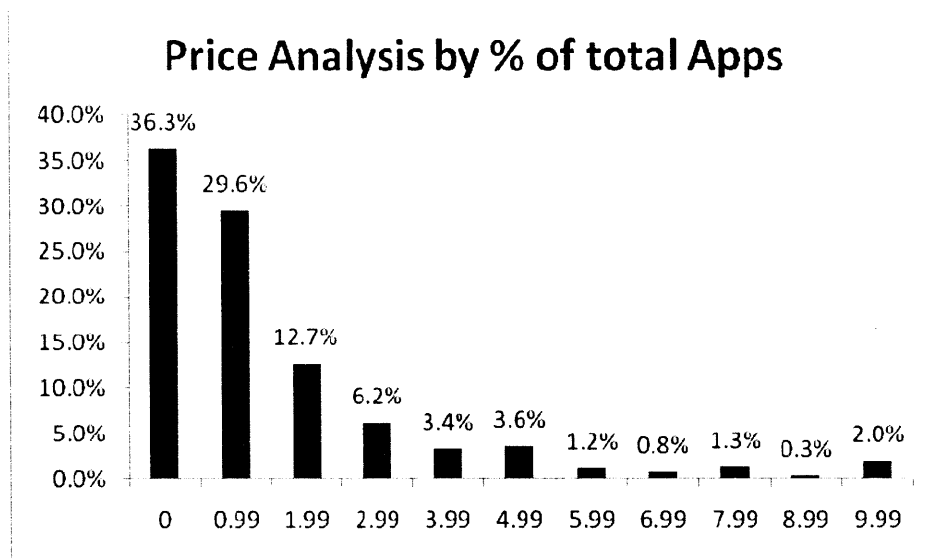
Price Analysis by % of total Apps

Figure 29 - Price analysis by % of Apps on Apple App Store (148Apps, 2011)

2.8.5 Apps Discovery

Even with app stores simplifying the process of app distribution to markets, there are still some challenges that exist. With thousands of apps flooding the mobile markets for iPhone/iPad and Android devices, it is tough for consumers to find apps they need from among over-rated low quality apps. Application exposure remains one of the biggest challenges which developers face. There is no standard way to search for the right apps, since there are no standard ways of measuring the quality of an app. Users rely on peer reviews and app store results to decide what to get. But that might not be a real measure of the value of an app.

At the same time, for the app-developers there is no professional way to market their applications. Reaching the top results in the app store is vital, since that is the preferred method of app discovery, as shown in Nielsen's finding in Figure 30.
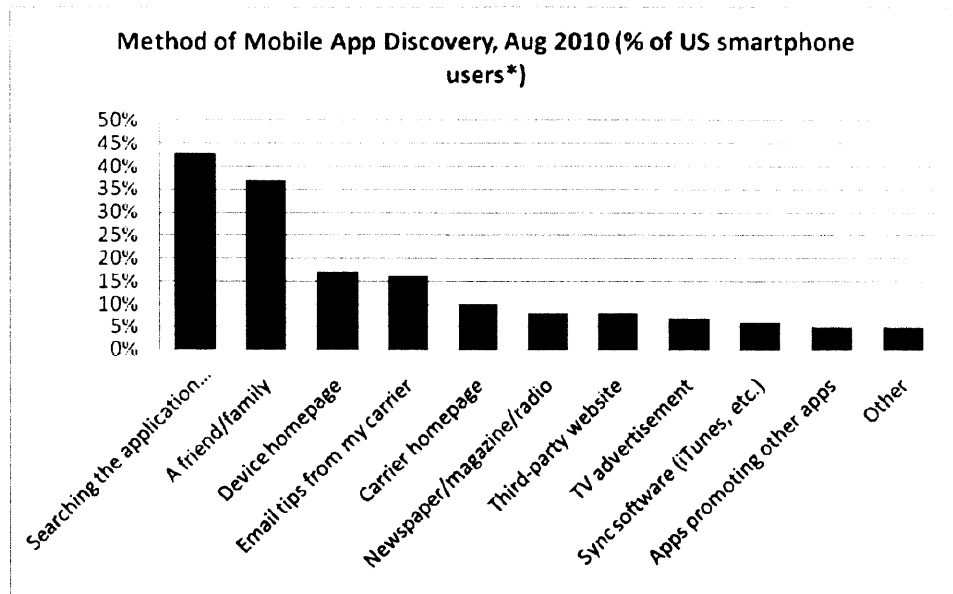

Figure 30 - Method of mobile app discovery (Elkin, 2011)

An interesting observation made by Mobile Developer Economics suggests that more than half of the developers are ready to pay extra for premium app store placement. Developers now have the following options to market their apps:

1. Marketing through media: Market the app through social media, magazines, tech-journals, popular app review sites (apps are reviewed for a cost), app recommendation engines, etc. There are app discovery startups and firms which work on recommending the apps to the consumers based on the past preferences. In addition to it, there are also app-malls, which are like app mini stores that target mini- segments (O'Sullivan, C., 2011).

2. Advertizing/PR: A very few use the online advertising facilities and professional PR services that cut the developer's effort to reach different channels mentioned above, by

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marketing on behalf of the developer through all these channels (O'Sullivan, C., 2011).

3. Advertising through other Apps: Ad-Networks like Tapjoy are embedded into popular/subsidized mobile applications that advertise about other potential applications that the user could download. Tapjoy charges the developer a fee every time a user downloads the advertised app. This increases the exposure of the apps to more users through apps they are already using (O'Sullivan, C., 2011).

3   Smartphone Industry Analysis

"When an industry with a reputation for difficult economics meets a manager with a reputation for excellence, it is usually the industry that keeps its reputation intact."
–Warren Buffet

Smartphone industry is an emerging industry with superior returns. In this chapter, we perform Porter's 'Five forces' analysis for the Smartphone industry. We will discuss the value chain of this industry and try to evaluate different players to see who has the bargaining power. We will then determine who is creating and capturing value in this industry.

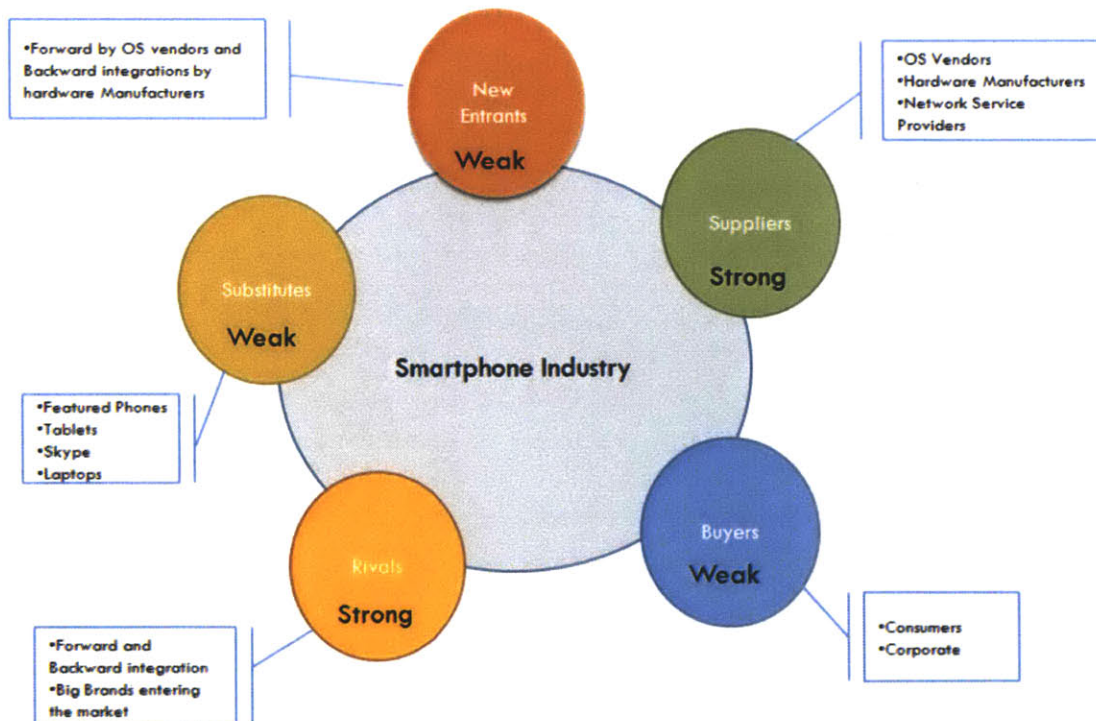## 3.1   Porter's Five-Forces Applied to the Smartphone Industry

Figure 31 - Porter 5 force analysis for Smartphone industry.

3.1.1 Suppliers

There are mainly three groups in the Smartphone industry:

1. Mobile OS Vendors,

2. Hardware Manufacturers

3. Network Service Providers.

Smartphone industry has competition in all the three groups of suppliers mentioned above. Smartphones compete based on differentiated user experience and the applications ('Apps') they provide. Both these factors are controlled primarily by the operating system (OS) on the device. Hence, Mobile OS Vendors hold the maximum power among the three groups of Suppliers.

3.1.2 Rivals

As mentioned above, OS Vendors compete based on the adoption of platform by App Developers (in essence, number of apps), distribution channels and user experience. Device Manufacturers using Android OS or Windows Mobile 7 ('WM7') have strong rivalry, as they try to differentiate themselves from their competitors (commoditization of device manufacturers), leading to a price war among this segment. Network Service Providers on the other hand, are competing based on the service quality and prices offered. Almost all the major smartphones come with a range of options for service providers (commoditization of service providers).

3.1.3 Buyers

Due to brand loyalty (e.g., iPhone) factors and user stickiness on developing familiarity with a specific OS's platform features, buyer's power is low for Mobile OS platform. Since devices are turning out to be a commodity (e.g., Android based

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Smartphone) as service operators subsidize them, buyer's power is high for this segment. In case of service operators, buyer's power is moderate to low, due to the high cost of switching carriers and bundled features, like free in-networking calling plans.

3.1.4 New Entrants

New entrants in the Mobile OS market face a high barrier to entry due to number of apps already on the incumbent's platform and the associated App Developers' switching cost to learn a new platform. New entrants in the device manufacturer's space have low barrier to entry as alliance with Android or Windows Mobile 7 gives them instant credibility and access to the market. Network Service Providers face a high barrier to entry because of complications associated with licensing out radio spectrum from governments and the high capital investment required to set up the infrastructure.

3.1.5 Substitutes

Threat of substitutes is low as this is an emerging industry with high-expected future growth. This industry is just entering the development stage (takeoff stage in S-curve).

3.2 Value Chain of Smartphone Industry

Mobile OS Vendors license the software to Handset Manufacturers. Handset Manufacturers bundle the OS with a Smartphone device and, depending on the alliances, distribute it through various Service Operators. "Mobile OS," "Mobile Device," and "Service Plans" are complements to each other and are sold as a bundle offered by

Service Operators. Most of the time, bundle offering is highly subsidized against a 2-year contract (typical in the U.S.).

The appeal of Smartphone bundle offering is also affected by the apps ecosystem. Apps can be categorized into Platform Apps (between platform Users and Content Providers) and Utility Apps. They have an important role in augmenting the value of the Smartphone device (platform). App Developers make use of distribution channels like iTunes and Android Market for distributing apps to end-users.

Advertisers (not shown in the previous diagram) play a critical role in subsidizing content and/or apps to end-users. We will cover more about Advertisers while discussing the multi-sided network effects of Mobile OS platforms.

3.2.1 Who Controls the Smartphone Value Chain?
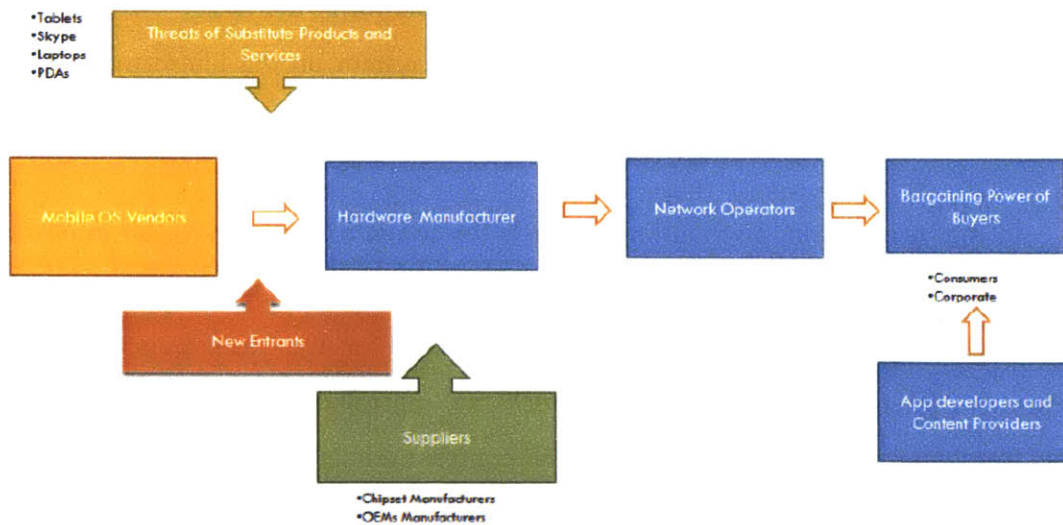

Figure 32 - Smartphone industry value chain

It's interesting to see the flow of value within Smartphone industry value chain.

Handset Manufacturers are increasingly turning their devices into commodities by integrating them with Mobile OS Vendors like Android and Windows Mobile 7. Efforts by device manufacturers to customize mobile OS to differentiate themselves from their competitors have largely been unsuccessful, due to low adoption by App Developers. Incentivizing the App Developers' community to develop for a platform is difficult until it has reached critical mass of user adoption. But the critical mass of user adoption is dependent on the availability of apps (complementary products and services) on the platform. Ultimately, consumers want a fast and reliable network, complementary products and services, and high performance OS/user experience. Smartphone Device Manufacturers have seen a strong growth in the last decade, especially the last year, because of sudden explosive user adoption of smartphones. Since it is hard to differentiate among different devices and manufacturers, mobile hardware industry is increasingly seen as manufacturing a commodity product (except device manufacturers with coupled Mobile OS, e.g., iPhone, Blackberry).

Content Providers depend on other services deeply to deliver the content to end-users. The larger the user base of a particular platform, the larger is the Content Provider's interest and willingness to publish their content on the platform. A similar strong dependency exists in terms of App Developers.

In the value chain, distribution channels for content delivery have an important role. An effective and strong distribution channel can help market the product and make it available to a majority of consumers boosting the ROI for App Developers and getting them more interested in the platform. Effectively, controlling the distribution channel gives tremendous control to manipulate and control the market. Prior to the launch of iPhone in January 2007, Network Service Providers controlled the distribution channel to consumers. With the launch of the iPhone, Apple negotiated the control of content distribution (content installed on the Smartphone) with AT&T and took away the control from the Network Providers. Apple built a strong distribution channel in iTunes for

music and apps. They simplified the app distribution, discovery, and installation processes for users. Google introduced the Android Market place to distribute apps, as well. But, essentially, these distribution channels moved away from Service Providers and are now tied to the OS they run on. The epicenter of the whole value chain lies with the Mobile OS Platform Vendors.

3.3 Conclusion

Mobile OS platforms exert the maximum power in the Smartphone eco-system after Network Providers conceded the distribution channel of content to OS platforms. Some OS Vendors tightly integrate their OS with hardware (Apple and RIM) and others license the OS to Hardware Manufacturers and let each Hardware Manufacturer or Network Provider build their own distribution channel (Android) or use an existing generalized market (Android Market). In the following chapters we will study Mobile OS platforms in detail and examine various value creation and value capturing strategies by leading Mobile OS Platform Vendors.

4 Multi-Sided Platform Analysis of Mobile OS Platforms

Mobile OS platform is a 4-sided Market, facing App Developers, Advertisers, Network Providers, and End-Consumers (Users).
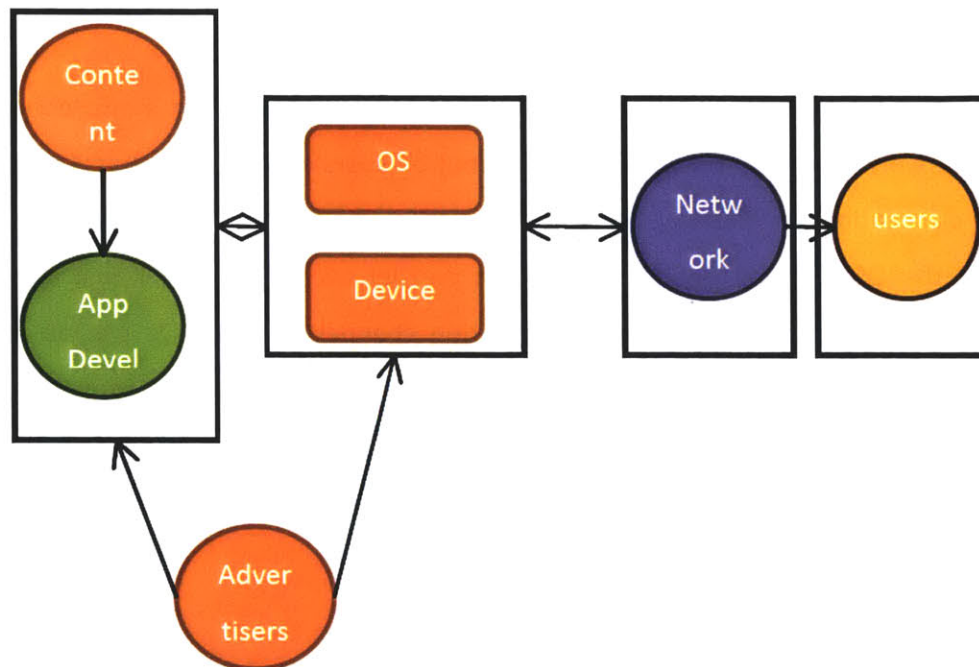

Figure 33 - Four-sided Mobile OS platform market

Mobile OS is either integrated with the hardware device, as in the case of iOS, Palm OS, RIM; or it is decoupled from the hardware, as in the case of Android and Windows Mobile 7. As discussed in chapter 3, Mobile OS is the central element in the mobile eco-system that provides differentiated user experience and has considerable power in the value chain. For discussion in this chapter, we will use mobile OS to mean a combination of the mobile OS and the device.

Two apparent markets for mobile OS are the Users and App Developers. App

Developers augment the value of the platform by providing more complementary services, driving the end user adoption. Since developers, in general, are looking for monetary benefits, a platform with a large user base (or a growing one) is more attractive to them. Platform Vendors take several measures to attract the developer community by providing strong support for app development with SDK, development tools and a responsive support team.

In addition to Users and App Developers, Advertisers also form one of the markets for the mobile OS platform. More Users on a platform creates higher incentive for Advertisers to sign up (pay) with the platform to reach its user base. More Advertisers incentivize App Developers to create subsidized (ad-supported) content, which in turn provides higher adoption of the platform by the End Users. In addition to reaching Users through apps, Advertisers also reach Users directly through the mobile OS platform itself (example: iAd and Google mobile advertisement platform).

Network Service Providers form the fourth and final market for the platform by providing a medium for smartphones to reach the end consumers. As discussed in chapter 3, Network Providers bundle their services with the device and OS platform to give Users an end-to-end subsidized solution. Since most of these subsidies are given through a contract and the switching cost between providers is high, it is important for OS platforms to be made available through a variety of Network Providers (or at least a few significant ones) to drive the end user adoption. In addition, by giving incentives like free in-network calls, Network Service Providers usually introduce strong network effects in the end user market. A very good example would be iPhone market penetration in AT&T before it was opened up to Verizon in February 2011. To have a successful mobile platform, it is important for the OS to be adopted by all four sides of the mobile industry.

The difference between complement strategy and multi-sided network strategy

is shown in Figure 34 below for clarity (two sided shown to keep the figure simple). If two separate products are sold to the same user, it is a complement strategy, but if product A is sold to the user segment A and product B is sold to user segment B and if the platform acts as the intermediary to let the two user segments interact with each other using the platform, then it is a two-sided network.
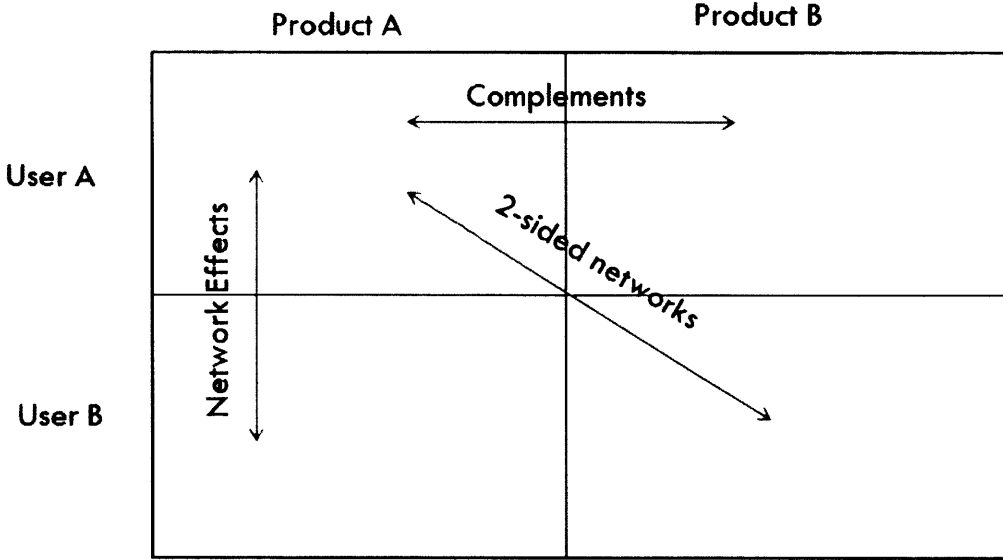

Figure 34 - Complements and Network Effects in two-sided platform

Source: Erik Brynjolfsson - class presentation.

Another element of the mobile industry is Content Providers. Content Providers are channel agnostic. A mobile device is a content consumption channel and hence Content Providers cannot be directly considered one of the markets of mobile OS platforms. Content is consumed on mobile devices through either an app or mobile browser.

4.1 Network Effects

Network Effects of four-sided market between the App Developers, Advertisers, Consumers, and Network Service Providers can be classified into same side and cross side as described below.
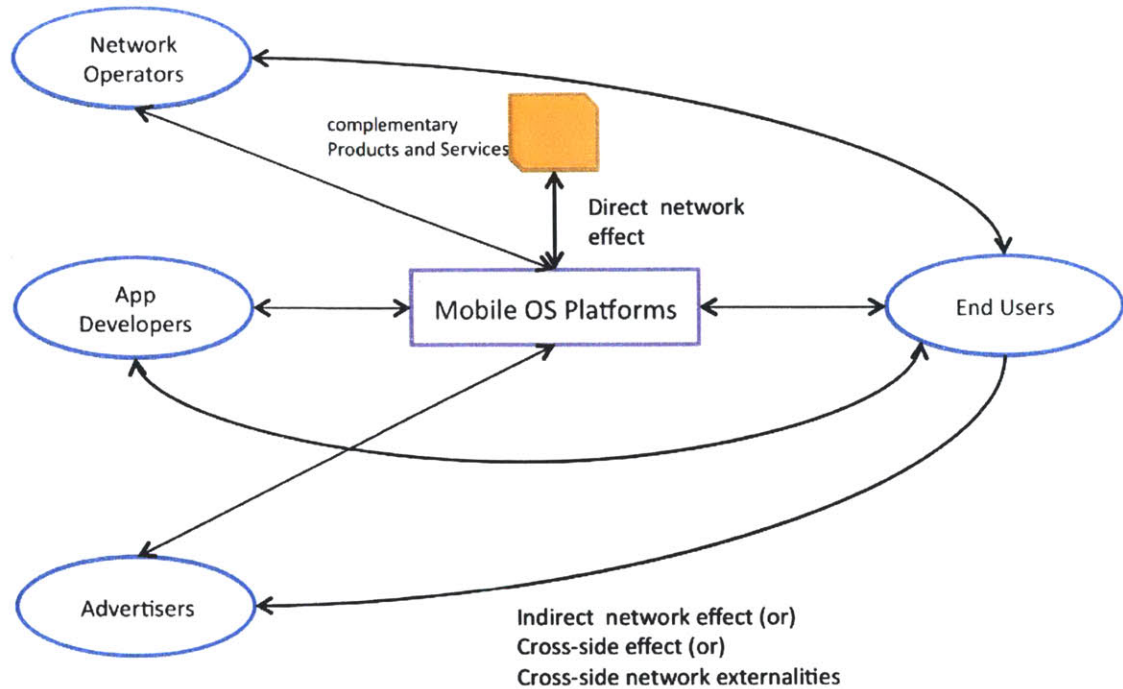
Figure 35 - Same sided and cross-side network effects in smartphone industry

Source: (Evans, 2006)

4.1.1 Same Side Network Effects – Compatibility Between Platform & Complements

Complements are the services, which increase the utility of platforms for platform markets. Complements and platform need to be compatible, and this results in same side network effect. In the case of the iPhone, complementary services like iTunes, App store, etc., increase the value of the platform. Similarly, in the Smartphone market, apps created by app developers increase the utility of the phone. End-Users discuss apps and devices they like with their friends and acquaintances, leading to more Users adopting the platform. This would be termed as same side network effect in the end-users segment. If more app-developers are adopting a platform (mainly driven by monetary benefits), it becomes attractive to other developers as well (the competing

app development companies), again driving the same side network effect in the App Developer user segment.

Network Service Providers, by bundling their service to phones, provide a complement to the mobile platform and contribute to same side network effects. A very good example is the iPhone in U.S. before it opened up to the Verizon network in February 2011. Since in-network calls are free with AT&T, people interested in smartphones started adopting iPhone because their friends were using it. As end-Users adopt a Network Provider, they drive more and more people into the same providers' network. This becomes an incentive for the smartphones supported on the provider's network, as it gets a bigger potential subscriber market interested in buying the product.

4.1.2 Cross-Side Network Effects – Strong Ecosystem:

In a multi-sided platform, network effects are within the same market segment and across the market segments (crossover network effects). More Users attract App Developers to develop more apps for the platform so they can monetize from the large user base. More apps, in-turn, augment the platform value, driving even more Users to the platform. This is a cross-network effect. Similarly, more Users on a mobile OS platform pull more Advertisers, who are willing to pay a premium to reach the user base. But more Advertisers create negative network externalities for the consumers of Smartphone device. To counteract these negative network externalities and maintain the higher fidelity of the platform, the OS Providers should find innovative ways to embed advertisements. Free or subsidized content supported by advertisements reduces the negative network externalities to some extent.

In chapter 5, we will see how these network effects are controlled and

manipulated by mobile OS platforms to form successful platform strategies. We will also talk about the strategies that major OS Vendors are using currently.

5 Mobile OS Platform Strategies

In this chapter, we are going to apply "Winner-Take-All" framework (Thomas Eisenmann, 2006) to analyze whether mobile OS platform is a Winner Take All (WTA) or Winner Take Most (WTM) platform. We will analyze various levers of Platform Leadership for all major mobile operating systems in the industry.

5.1 Winner Take All or Most (WTAoM) Analysis

Winner-take-all (Thomas Eisenmann, 2006) model analyzes a platform to determine if it has the attributes of being an industry's leading platform. WTA analysis can be applied both at industry and platform level. WTA implies that the loser takes nothing, i.e., there is space for only one player in the market. In this section we will discuss the WTA framework and will use it to determine whether mobile OS and hardware platform is a winner-take-all or winner-take-most market.

A market is most likely to be served by a single platform when it is a natural monopoly like rail system, electrical grid, etc. These platforms typically show the following characteristics:

a. Strong positive *Network effects* (as mentioned in chapter 4).

b. Market has very high multi-homing and switching costs

c. Demand for differentiated product is weak.

5.1.1 WTAoM analysis applied to Mobile OS platforms

The following table (Figure 36) and Figure 37 show the strength of the above-

mentioned characteristics applied to Mobile OS Platforms, Hardware Manufacturers and Service Operators.

	Network Effects	Differentiation	Multi-Homing Costs	WTAoM?
Typical WTA	Strong	Low	High	Yes(WTA)
Mobile OS	Strong	Moderate - High	High	Yes(WTM)
Hardware Manufacturers	Weak	Low	High	No
Service Operators	Fairly Strong	Low	High	Yes (WTM)

Figure 36- WTA element analysis for Smartphone industry
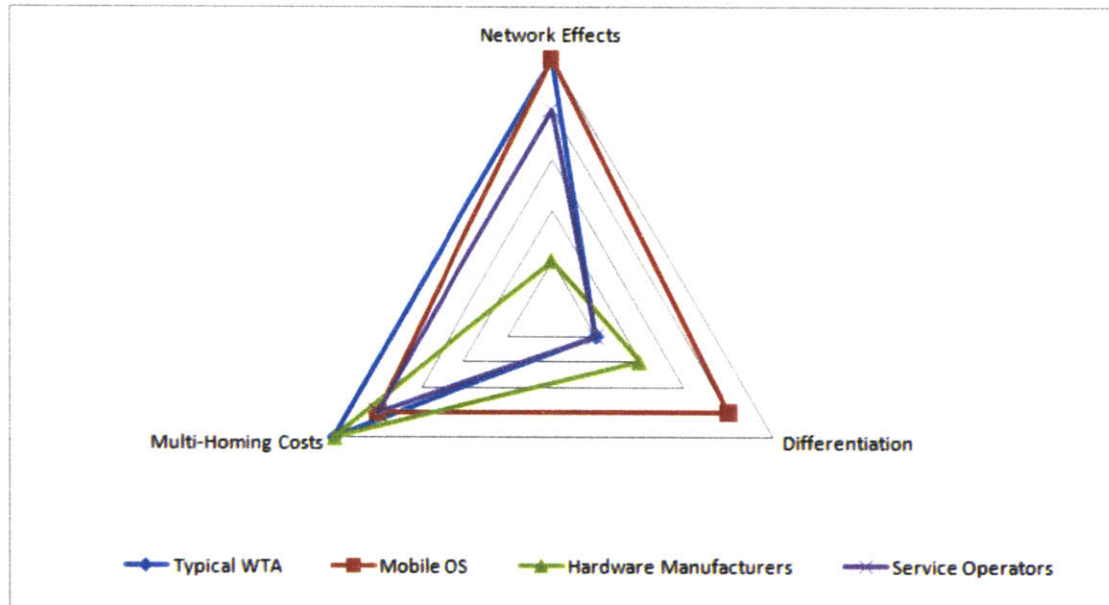

Figure 37 - WTA analysis of Smartphone industry

5.1.1.1 Network Effects

As discussed previously, App Developers would be more interested in developing for a platform with a large user base. But more App Developers create more apps, increasing the value of the platform, which attracts even more Users to adopt it. In

addition to cross-side network effects, same-side effects exist due to platform features directed towards one user group (like 'Facetime' on iPhone), complementary platforms (like iTunes and iPad), etc. Network Service Providers and Advertisers give similar network effects, as well, as discussed in chapter 4.

Content for the apps mostly resides in the cloud. Many App Developers are now moving to the model of thin clients with the data on cloud, where the client is customized for different OS platforms. Even otherwise when this is not possible, App Developers are building same apps for major OS platforms. Due to this commoditization of apps, content itself does not provide a network effect.

Due to all these reasons, network effects are moderately strong for the mobile OS.

5.1.1.2 Multi-Homing and Switching Cost

Multi-homing Cost is the cost of owning more than one platform. If the cost is high, Users usually stay on a single platform. High costs lead to winner-take-all or winner-take-most platforms. Low *Switching Cost* can lead to incumbents being exposed to the entrenchment from a new entrant or envelopment by another. If the switching cost is high, the platform will be a WTA platform.

Multi-homing costs are very high in the mobile industry, as the hardware cost is high for smartphones and multiple operating systems cannot co-exist on the same device. Switching cost is low, because the data for the apps resides in the cloud. Fear envelopment is low, but entrenchment or competitor gaining market share is high.

5.1.1.3 Demand for Differentiation

If the demand for differentiation is not high, then the platform will take the entire market share. There are two features that mobile OS's depend on to differentiate themselves in the market:

User Experience

User experience holds the key to the Smartphone industry. Since Smartphone has high user interaction and small screen space, easier and cleaner interfaces see faster adoption. Therefore, demand for differentiation in terms of user experience is high.

Apps

Although it seems that there is a high demand for differentiation in terms of apps for the platform, this is going away slowly because App Developers are moving towards becoming platform agnostics (at least for the top three platforms). All major apps want to have maximum reach to the consumers and in the process are adopting the following approaches to develop cross-platform apps which are supported by all major platforms:

1.   Design the applications with core functionality residing on the cloud and native applications built over the web services to take advantage of device-specific user interface features and hardware capabilities. This is good for apps, which do not need a constant connection with the cloud during user interaction. On slower networks (like 3G), such connections might hinder the user experience. But with the emergence of high capability networks, even these restrictions are going away.

2.   Design cross platform web applications using either HTML5 or cross platform mobile application development tools. HTML5 seems to have a high

adaptability for cross-platform applications. Tools like AppAccelarator, WidgetPad, RhoMobile and Phone Gap make the development of apps using the standard web technologies like HTML5, JavaScript, PHP, Ruby and CSS3 easier. They leverage these technologies to provide cross-platform compatible apps, which can access important features like GPS and Camera, traditionally limited to native apps. All these tools offer support across all major Operating Systems like iOS, Android, and most of the time Blackberry and Windows Phone 7 (Mashable) (Designing Multi Platform Mobile Applications).

5.1.2 WTAoM Conclusion

App Developers will not develop for all platforms and will focus on platforms with maximum user adoption and revenue potential. Based on the above analysis, I conclude that mobile OS platform is a few-winners-take-all market with top 3-4 OS Vendors being dominant in the market.

5.2 Elements of Platform Leadership

"It is a vision that says the whole of the ecosystem can be greater than the sum of its parts, if firms work together and follow a leader."

- Annabelle Gawer and Michael A. Cusumano, *Platform Leadership* (HBS Press, 2002)

In this section, we will discuss elements of platform leadership as discussed by Michael Cusumano in his book *Staying Power: Six Enduring Principles for Managing strategy and Innovation in an Uncertain World.* We will apply this framework to analyze the three major mobile OS platforms.

As explained by Cusumano in his book, new platforms drive new businesses

around them, both in terms of complementary products and services needed to support the platform. A product can become a platform by following a few simple techniques during its evolution.

a) Build a core "system-like" product that solves a key problem.

b) Make it easy and incentivize the process of complement development around the core product.

c) "Tip" the market in the platform's favor.

Platform products depend on complementary products to drive value out of them and often keep the interfaces as open as possible and easy to integrate, to encourage fast adoption. This has been termed as "coring" and "tipping levers."

We list below the four levers and the principles of platform products as identified by Gawer and Cusumano in their book *Platform Leadership* (HBS Press, 2002).

5.2.1 Scope of the Firm

It is the breadth of what the platform provider tries to do itself. More specifically, what complements the platform provider decides to develop versus what he opens up for the third party providers.

5.2.2 Product Technology

Platform leaders need to decide how much modularity should be allowed in their architectures and how much openness/accessibility should be given through the exposed interfaces. They have to make sure they preserve the core intellectual property and make product imitation difficult.

5.2.3 Relationship with External Complementors

There is a fine line to balance the collaborative versus competitive relationship between platform providers and their Complementors. Platform providers need to address the conflict of interest issues, which might arise when they enter the business space of Complementors by bundling similar complementary services for their own platform. They also need to worry about the consensus between Complementors and partners.

5.2.4 Internal Organization

Platform providers may have to deal with external and internal conflicts while preserving the rights of Complementors. To resolve this potential issue, they should separate the core product and complementary products into different departments, with a virtual Chinese wall between the two. But in some situations, close integration is encouraged to have better results.

Now we will analyze these four levers for the three top mobile OS: iOS, Android and Windows 7

5.3 iOS (Apple)

5.3.1 Scope of the Firm

The 'iOS' mobile operating system is tightly coupled with its hardware and sold integrated with iPhone, iPad and other iTouch devices. Apple disallows the existence of Complementors for the services it provides. For example, iOS is integrated closely with

the hardware capabilities of iPhone and with iTunes to provide a simple and elegant distribution channel, which makes it easy for Users to find and download apps on their devices in a single click.
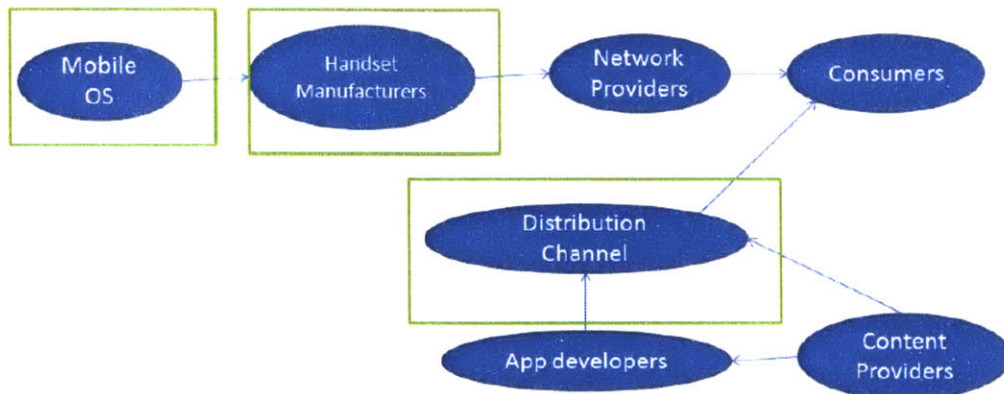

Figure 38 - Apple's scope in the mobile ecosystem

5.3.2 Product Technology

Apple adopted a closed platform approach by disallowing third party app installation on iPhone before the debut of App Store (July 10, 2008). The SDK was first released on March 6, 2008, to allow third party Developers to develop apps for deployment on iPhone through the app store. It adopted an Open-but-not-Open strategy, also called a "Walled Garden" approach. Apple preserves the core APIs of iOS and reviews the apps before making them available on the iTunes store, to prevent a violation of developer agreements. This approach lets Apple keep the platform fairly closed to protect its IP. An iOS integrated with the hardware and the App store provides internal consistencies and makes it difficult for competitors to emulate.

5.3.3 Relationship with External Complementors

Apple's ecosystem consists of Content Providers and App Developers. It avoids

conflicts of interest by "not" developing products in the Complementor's business segment. Except for some of the core apps, which are shipped with iPhone, Apple develops no other apps. It also does not provide content itself, but ties up with content publishers for making their content available on iTunes. By providing prompt developer support services and well-documented APIs, it has built a strong developer community. It takes the responsibility of app distribution to itself, making it easy for developers and publishers to make their content available to End-Users and provides a single point of purchase to all End-Users. In return it charges thirty percent of the revenue generated by selling apps and an annual registration fee to the developers. This helps them generate financial returns from the value they create as a platform in the eco-system. Also, app development for iPhone can only be done on Mac OS.

5.3.4 Internal Organization

By choosing to not compete in the complementary product (Apps and Content) markets, Apple avoided conflicts of interest with third-party developers and developed an environment of healthy competition among the Complementors. Since its core business does not affect the external Complementors' business, it uses internal services to closely integrate the whole system to give a fine-tuned experience to the end user.

5.4 Android (Google)

Android is a Google backed open source mobile Operating System.

5.4.1 Scope of the Firm

Google adopted a fragmented approach by licensing the mobile OS to hardware

device manufacturers for customization and use. To displace Apple's dominance in mobile market space, it made Android an open source operating system. Hardware Manufacturers often tweak the OS to differentiate themselves. To better control the end user experience, Google teamed up with HTC to release its flagship device called Google Nexus S, but it never completely entered the handset manufacturing business. Google does have its own distribution channel called "Android Market" which it uses to compete with third party distribution channels that exist for Android. App Developers and content publishers can publish their content for Android through Android Market or through third party app stores like Handango, MobiHand and, lately, Amazon's AppStore (Perez, 2008). In addition, Google also has its presence in the App Developer's segment. It creates apps like "Google Voice" and "Google Maps" for Android, as well as for other platforms, including iOS. The following diagram illustrates firm's position in the mobile eco-system.
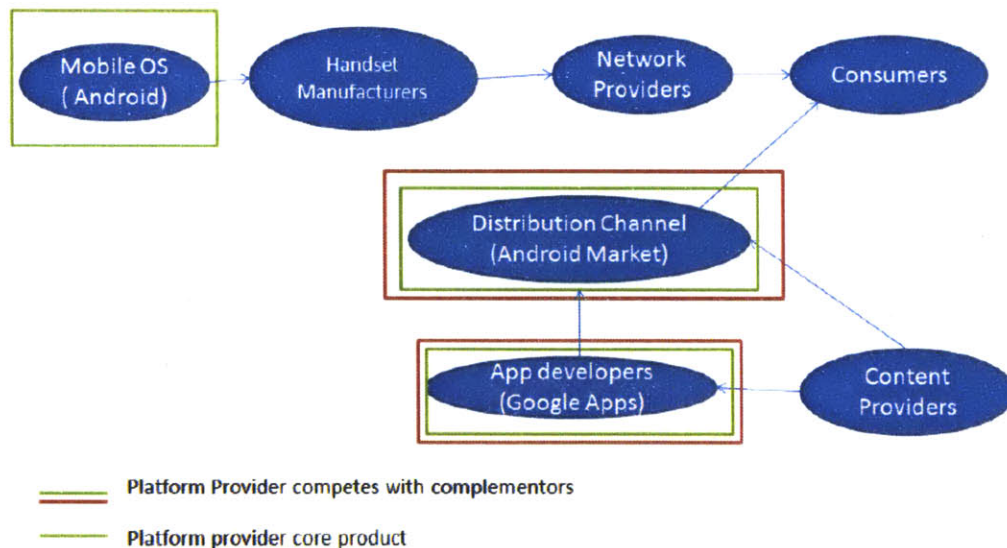

Platform Provider competes with complementors

Platform provider core product

Figure 39 - Google in mobile ecosystem

5.4.2 Product Technology

Android is legally an open source platform. But Google adopts an open-but not

open strategy for Android. Android is released under the Apache 2.0 software license, which allows anyone to use, modify, and redistribute the code. But unlike open source, it is not possible for small developers to contribute to the platform or see the day-to-day updates. Google periodically releases major updates to Android in press releases, very much like Apple for its new features on the iPhone. Thus Google preserves the core features and competency of the Android platform to itself while keeping it open. Android gives you two options: take what Google gives you or fork your own version of Android from the source code (Gilberstaon, 2010).

5.4.3 Relationship with External Complementors

Open Source attracts a lot of developers. Google provides good support for Android API's and over the years, a strong developer community is building up. It organizes periodic get together events for developer communities to help spread awareness about its platform. Third party distribution channels and App Developers compete with them in their ecosystem. It is a much less restricted platform compared to that of Apple's platform. It gives freedom to developers and content publishers to go with the distribution channel of their choice. Also, there is no long approval process for getting apps launched into the market. Android only shows a warning message listing all the permissions any app requires. If a user grants the permissions, any application can be installed and run. Like Apple, Google also charges App Developers thirty percent of the revenue they make from selling apps on its platform. But they keep the developer signup cost low, less than one-third of what Apple charges. Developers can use Mac, Windows, or Linux platforms to develop apps, unlike Apple, which provides SDK only for Mac.

5.4.4 Internal Organization

Google competes with its Complementors in multiple spaces, but in return

provides a much more open platform with very limited restrictions. Android apps are almost never rejected and can be developed on any platform. By making Android an open source platform and giving support to many internal APIs, Google prevents the anti-trust lawsuits from its Complementors. It also gives public APIs for some of the apps it provides, like Google Maps, which the third party providers can in turn use to build apps around them.

5.5   Windows Mobile and Windows Phone 7

5.5.1   Scope of the Firm

Like Apple, Microsoft has mostly adopted a closed and integrated platform approach. But unlike Apple, Microsoft lacks presence in the Handset Manufacturer segment. Windows OS is licensed out to third party Handset Manufacturers. Recently, in February 2011, Microsoft joined hands with Nokia, to become the primary OS on all the Nokia Smartphone devices. This is a big step for Microsoft, which was until now struggling to mark its presence in the mobile industry. Microsoft also provides a distribution channel in the form of Windows Phone marketplace to sell apps made for its platform. After Nokia's deal with Microsoft, Nokia's Ovi store will integrate closely with Windows Phone marketplace. Apart from this, Microsoft has its presence in the App Developer's business space with its own apps like Bing search and Bing Maps. These apps are also available for other platforms like iOS and Android.
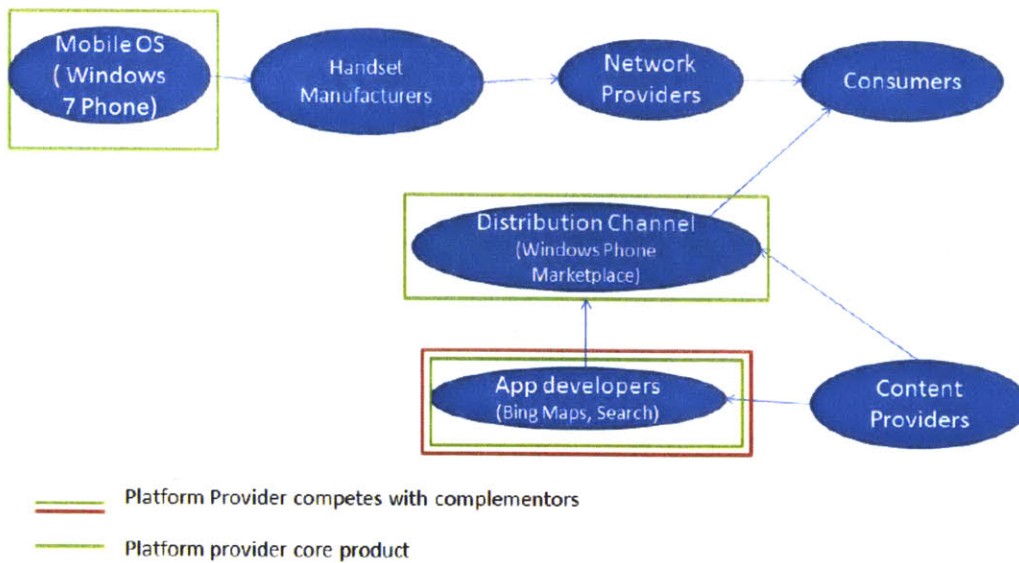
Figure 40 - Microsoft's scope in mobile ecosystem

5.5.2 Product Technology

Core competency for Microsoft is its OS software and it keeps it closed and integrated. Handset Manufacturers are not allowed to tweak the OS. Approval and distribution process in the Windows Phone marketplace is similar to that of iTunes. Apps have to go through Windows Phone marketplace and it requires developers to submit their app for a review process. Windows Phone marketplace helps in app discoverability in a way similar to what iTunes does. In return, like Apple and Google, Microsoft charges an annual registration fees to developers and also a thirty percent revenue share.

5.5.3 Relationship with External Complementors

Microsoft needs external developers to develop apps for its platform to increase the platform value. Partnership with Nokia is one such move to attract the developer community. With Nokia, it has a partner in the Handset Manufacturer industry, which gives it a wider audience in the consumer market. This, in turn, attracts more

application developers to its platform. In addition, Microsoft offers free tools for app development like Visual Studio 2010 Express and Expression Blend. These are similar to desktop and web application development tools, like Visual Studio, which are quite popular among the developer community.

5.5.4 Internal Organization

Microsoft also has its presence in the App Developers' market segment. Financial sharing through Microsoft's distribution channel is similar to that of Apple's, but in addition, Microsoft also competes with external developers by developing and making its own apps. Most of these apps are free and preinstalled on its platform. Since this is just a small section of apps available on the marketplace, the market is still quite open to the third party developers. Like Google, it makes the apps even for other platforms like iOS and Android, to capture mobile content market share.

6   2011 and Beyond

2010 was the year of mobile, with an astonishing growth of eighty-nine percent year over year in the worldwide Smartphone market segment(Canalys, 2011). According to Net Applications report (as cited in press release, Jan 1, 2011), 2010 saw the Mobile Internet traffic more than double (Elkin, 2011). This was not just attributed to the growth of smartphones, but also to the tablets and e-Readers. With some big names like Apple and Google entering the tablets market space, competition has heated up. iPad's arrival followed by Samsung Galaxy(Android based), has made this market space interesting. All this led to a huge boost in mobile content consumption. Apple's iTunes store reached ten billion downloads on Jan 22, 2011, of which seven billion were downloaded just in the last one year; another factor attributing to exponential rise in content consumption (Apple, 2011).

The Smartphone market still has a lot of appetite for growth. Taking the example of the U.S. only, it has only reached 31.2% of mobile Users in 2010 (comScore Data Mine, 2011). Hardware and software technologies continue to grow and we are seeing some promising innovations. As smartphones get cheaper, their appeal to wider audiences will improve and we will witness a higher adoption of these devices in the consumers and business Users' segment. As these devices grow, mobile content consumption will increase, as well.

There have been some significant developments in 2010-2011, in the Smartphone industry, which are bound to change the landscape. We will discuss those events and their impact on the Smartphone industry in the following sections.

Alignment of Nokia with Microsoft is the beginning of reshaping of the landscape. It

is not only a cause of concern for RIM, but also threatens the extinction of Symbian OS, over years. But as previously discussed in chapter 2, Symbian developers are showing interest in adopting Windows Mobile 7 OS, making it an easier transition for Nokia to Windows mobile ecosystem. In the next section, I will provide an analysis into the Nokia and Microsoft strategic partnership and its impact on RIM using the fourth quarter 2010 market share data from Canalys. I briefly discuss Google and Apple's strengths and weaknesses and analyze how the competition will take shape between the two leading Mobile OS platforms in future. We will then dig deeper into the enterprise market segment where the competitive landscape is taking a very different shape due to the virtual monopoly of RIM's Blackberry.

2010 saw a much stronger growth compared to that of 2009. Shipments soared to 101.2 million units in the fourth quarter of the year (Canalys, 2011). As discussed in chapter 2, Android posted strong growth numbers in 2010, and its growing dominance in the Smartphone industry is far beyond questionable. Apple displaced RIM to become the third largest platform in terms of market share of Smartphone sales worldwide in the fourth quarter of 2010; showing the strong emergence of Apple worldwide (Supersite for Windows, 2011) The rise of Android, combined with the popularity of Apple's iPhone and iPad, is creating an urgent need for other OS Vendors to innovate and differentiate. 2011 promises to be a competitive year, with vendors trying to stop the erosion of market share using technologies such as 3D, NFC, Augmented reality, dual core, bar codes, integrated mobile payments, etc (VisionMobile, 2011).

6.1   Microsoft and Nokia Partnership

Despite positive reviews from critics, Windows Mobile 7(WM7) faces a steep battle ahead to increase its market share from the current three percent worldwide (Supersite for Windows, 2011). The growing competition from Android and Apple is

going to make it increasingly tough for Microsoft to fight this battle alone (Canalys, 2011). Strong adoption by OEMs and carrier marketing support is crucial for Microsoft's success. Due to lack of both these factors, initially, forecasters just ignored Windows Mobile 7 in their predictions, assuming growing Android and Apple's dominance will mask it. OEMs are not willing to adopt this platform, because there is a lack of app Developer enthusiasm for it. App Developers are not willing to spend their time on the platform because its user adoption is very low. Unless one of the segments, either of App Developers, Users, or OEMs/carriers is incentivized to adopt, it is difficult for the platform to take off.

As for Nokia, it is losing its market share to Android and iPhone globally. Nokia's OS, Symbian, has less than two percent market share in U.S (nielsen wire, 2011). Worldwide market share for Symbian showed a decline, as well, in 2010. Even if Nokia joins hands with Android, it still becomes difficult to differentiate itself in the slurry of several OEMs. To counter the eroding market share and create a strong mobile ecosystem to battle Google and Apple, Nokia announced on 11th February 2011, a strategic partnership with Microsoft's Windows mobile (Supersite for Windows, 2011). On aligning with Microsoft rather than with Google, Nokia CEO Stephen Elop said, "It would have been difficult differentiating within the Android ecosystem and the risk of commoditization was very high. Windows Phone was the best opportunity to build, lead, and fight" (Supersite for Windows, 2011).

Nokia and Microsoft complement each other very well to build a healthy ecosystem. "Together, we have highly complementary assets and competences, allowing this ecosystem to achieve more than any other industry partnership could achieve. The partnership with Nokia will dramatically accelerate the development of a vibrant, strong Windows Phone ecosystem", notes Elop (Supersite for Windows, 2011).

A quick analysis of this ecosystem reveals the strength of this deal. Microsoft,

which until now lacked OEM adoption, gets one of the world's largest OEM's support and, hence, instant access to new markets. Nokia Maps will be brought into Microsoft's mapping services. Microsoft brings its successful product line of Xbox LIVE and Office, to the mix and makes this ecosystem attractive for mobile gamers and enterprises. Bing search engine, widely touted as the decision engine, comes to Nokia smartphones, which makes it a competitor to Google in the mobile search space. This partnership includes joint marketing initiatives, integrating Nokia's content and application store Ovi into Microsoft's' Marketplace. This increases user base for Windows marketplace, immediately, and makes it attractive for App Developers. In addition, Microsoft's developer tools are easy to use and have long been in the market to make developers comfortable with them. This brings down the learning curve for developers and makes them more willing to contribute to this ecosystem, compared to that of Symbian.

With a projected market share of 34%, Nokia and Microsoft make WM7 an immediate force to reckon with in the Smartphone OS platform war (Canalys, 2011).
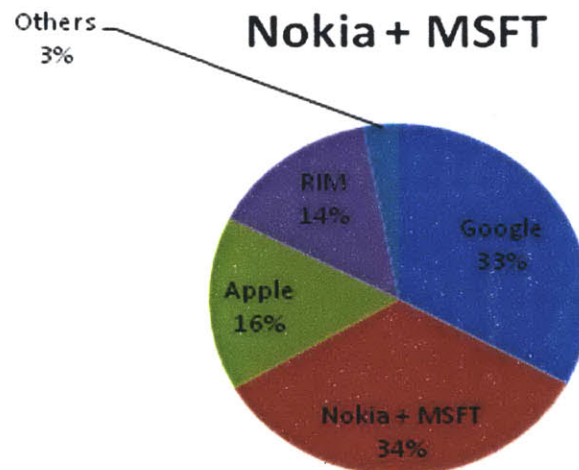
Figure 41 - Hypothetical Global Market Share (Nokia & MSFT Alliance)
Source: Canalys report (Canalys, 2011)

Since the deal between Nokia and Microsoft is not exclusive, Nokia will still have to find ways of differentiating itself from other WM7-based smartphones. Microsoft and Nokia will collaborate quite closely on development, joint marketing initiatives, and a shared Windows Phone roadmap.

6.2   Research in Motion (RIM)

The two-way race between Apple and Android and the recent alliance between Nokia and Microsoft relegates RIM to a distant fourth worldwide with market share of fourteen percent (Canalys, 2011). A similar decline can be noticed in U.S., where RIM's market leadership position has been declining. As discussed in chapter 2, Android overtook RIM in the fourth quarter of 2010 (nielsen wire, 2011).

But RIM's stronghold lies in enterprise segment and its counterparts still haven't been able to successfully displace it from this segment. TNS survey indicates that RIM has over eighty-one percent penetration among corporations with 1000+ employees and sixty-nine percent overall (TNS-US, 2011). Although RIM is the lead holder of market share in corporations of all sizes from one to 1000+, it is more widely adopted in bigger corporations than the smaller ones. This does not come as a surprise, because bigger corporations are generally more security-sensitive than smaller ones, and RIM beats all the providers in this respect. According to TNS BusinessWave data, iPhone adoption is taking place at a faster pace as more companies are exploring it due to the employee inclination towards iPhone. It stands a second to RIM in corporations. The gap is closest in corporations with employee size one to four, with iPhone at thirty-five percent market share and RIM at a good fifty-two percent (TNS-US, 2011). A major threat to RIM is the enterprise employee's inclination towards carrying a single device for both personal and office related activities (convergence of devices) and subsequently pushing enterprises to support personal devices for work related activities (Consumerization of

IT). This is helping iPhone and Android in making major inroads in the enterprise segment.
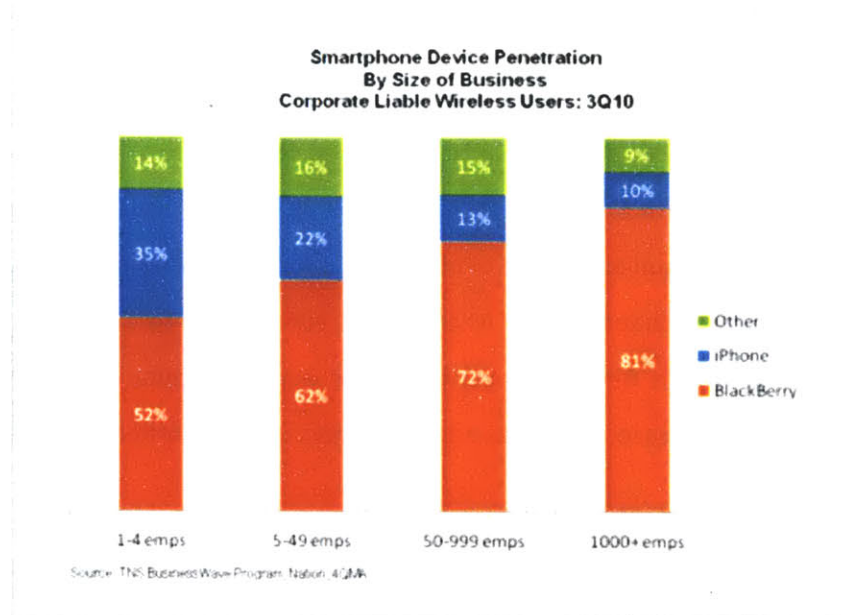
Smartphone Device Penetration
By Size of Business
Corporate Liable Wireless Users: 3Q10

| 1-4 emps | 5-49 emps | 50-999 emps | 1000+ emps |

Source: TNS BusinessWave Program. Nation 4QMA

Figure 42 - Smartphone penetration in Enterprises
Source: TNS survey (TNS-US, 2011)

RIM's success in enterprises is due to its reputation for strong mobile device management and control (MDM) and security. But, lately, all major Mobile OS Providers have come up with strong security features. Starting with Apple's OS 3.1 and Google's Android 2.2, both software platforms offer built-in security features, aimed at satisfying enterprise customers. Apple now supports e-mail message encryption, device wipes, pass-code locks, auto-lock, automatic auto-wipes, protected configuration profiles and continuous refresh. Various solutions of Microsoft, IBM, and Juniper are providing mobile device management and control solutions to secure iPhone and Android and make them as rugged as Blackberry. Device Makers like Motorola are working towards providing better security and remote management above the security features inherent in Android (Reardon, 2010). The combination of these enhancements led to Forrester recently releasing a report concluding that iPhone and iPad are "secure enough" with

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the right policies and technical controls (Jaquith, 2010). Also, due to a strong presence in enterprise software, Microsoft is well positioned to penetrate the enterprise market for mobile.

Blackberry lags in quantity and quality of applications. In the face of this eroding market share in enterprises and unable to match the capabilities of iPhone and Android devices, RIM is faced with the same three options as Nokia: Align with Android, Align with Windows, or Continue as-is. The continue-as-is option is least preferred among the three. As discussed in chapter two, Microsoft is soon going to overtake RIM in the application count. Unless RIM can incentivize the App Developer community to start building apps at a rapid pace, it will have to start looking at the other two options, which are discussed below.

6.2.1.1 Aligning with Google

On 9 Apr 2010, Research in Motion (RIM) announced it is acquiring the QNX platform, which can run Android Apps (Diaz, 2010). Experts see this as RIM's alignment with Google Android platform. If RIM aligns with the Android app store, it will be a big boost for Google's ecosystem, as it gives App Developers access to a large Blackberry installed user base. It also gives RIM access to a large number of Android apps and can increase user adoption of Blackberry in the consumer segment. If RIM still continues to have the security features it provides, Android apps support can potentially slow down the eroding market share in the enterprise segment, too.

But Android has a large fragmented ecosystem across OEM device manufacturers and the Android Market place. Due to large adoption by various device manufacturers, it is very difficult to differentiate in the Android ecosystem and the commoditization risk is very high. In case of Android ecosystem, all players create value,

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but Google captures most of the value.

These new alignments of Nokia (with Microsoft) and RIM (with Google) is bound to put immense pressure on Apple in its worldwide expansion, since the market share of Android and Windows Mobile 7 will cause developers to focus more on Android and the Windows Mobile 7 platform.
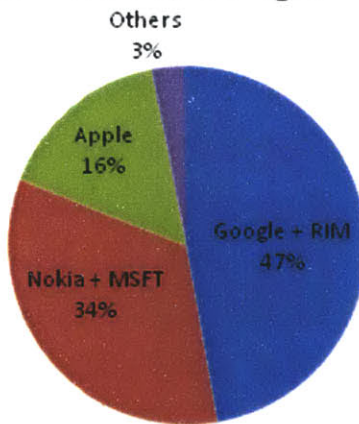

Figure 43 - Nokia + MSFT and Google + RIM Hypothetical Market Share
Source: Data taken from Canalys Report (Canalys, 2011).

6.2.1.2 Aligning with Microsoft

Microsoft could be a strategic fit for RIM. One is the winner in enterprise mobile space and other in enterprise software space. Enterprises will show a clear inclination to this platform, as they complement and bring new values from coordination between mobile and enterprise software applications. Although Microsoft and RIM compete in the mobile OS space, BlackBerry's ability to communicate with Microsoft Exchange Server is an attractive feature for enterprises (Now, both Android and iOS devices can sync with Exchange via ActiveSync).

To make RIM more attractive to enterprise Users, recently, on March 16th 2011, RIM announced a cloud-based data storage partnership with Microsoft (Ferenczi, 2011). RIM will use Microsoft servers and software to provide cloud-based storage solutions to its clients. Traditionally, Blackberry customers maintain expensive Blackberry Enterprise Servers on company grounds (Ferenczi, 2011). This alignment shifts the data to the cloud managed by RIM and makes the rollout easier for Blackberry. It also gives Microsoft ammunition to compete with Google/VMware in the cloud based software space.

If RIM decides to partner with Microsoft's WM7 Operating System, it gives RIM an opportunity to expand its stronghold in enterprise by being compatible with Microsoft's enterprise products. This alignment can create barriers of entry in enterprise segment for iPhone and Android. As shown in Figure 44 below, this alignment will have a projected market share of 48% percent for Windows Mobile 7, with Nokia dominating the consumer segment and RIM the enterprise segment.
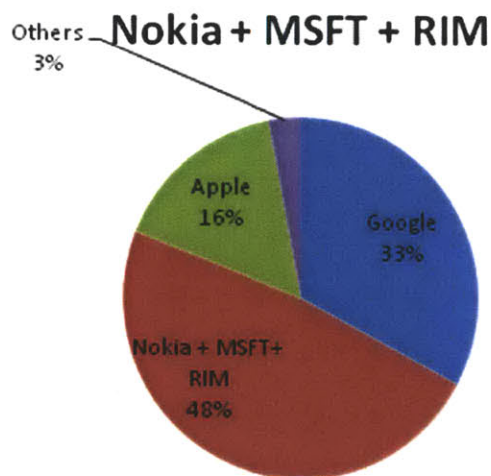
Figure 44 - Nokia + MSFT + RIM Hypothetical Market Share

Source: Data taken from Canalys Report (Canalys, 2011)

6.3 Google vs. Apple

Android's competitive advantage lies in the availability of a wide range of handsets from manufacturers through every major carrier (Open Innovation). The Smartphone market was shaping out to be a duopoly between Apple's iPhone and Google's Android before the Microsoft and Nokia alliance came along. Though the alliance has the potential to disrupt the market place, but how much it really achieves is yet to be seen. Until then, Apple and Google will remain the most attractive platforms for developers and the number of apps in their app stores reflects this, as discussed in chapter 2.

6.3.1.1 Android SWOT Analysis

Android is a fully integrated open source software platform, which is backed by Google's brand. Lack of license fees is one of the major advantages of Android. But OEMs have to pay for some must have features of Android, like the software to edit Microsoft Office documents, audio/video codecs, or improved location services (Blodget, 2010). Even then, Android has the widest range of devices in its portfolio and is riding the Smartphone market growth worldwide.

Fragmentation remains a major threat for Android ecosystem. The lack of application approval process around the Android market place is causing issues related to security, privacy, and application discoverability. Android is also weak on UI design and UX experience. If it plans to make headway into the enterprise segment, it needs to strengthen its security to convince enterprises to adopt the Android based devices.

Nearly half of all U.S. Android subscribers came from Verizon last year. Arrival of iPhone

at Verizon is bound to divert focus from Android and it remains to be seen how much impact it will have on Android sales.

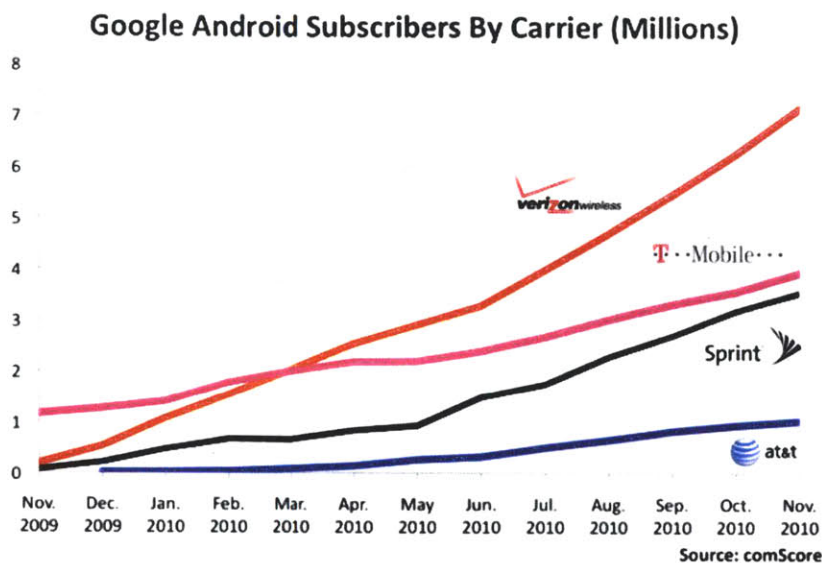**Google Android Subscribers By Carrier (Millions)**

Figure 45 - Android Subscribers by Carrier (comScore Data Mine, 2011)

Mainly due to the performance of device vendors such as LG, Samsung, Acer and HTC, Google based smartphones (Android, OMS, and Tapas) overtook Symbian in the fourth quarter of 2010 globally. They grew 4,127%, 1,474%, 709%, and 371%, respectively, year-on-year. HTC and Samsung together accounted for nearly forty-five percent of Google OS-based handset shipments (Canalys, 2011). Same story is playing out in United States, as well, with HTC and Motorola holding around seventy-six percent of the Android market share, as discussed in chapter 2 (nielsen wire, 2011).

6.3.1.2 Apple SWOT Analysis

Android counters Apple's brand appeal with strength in numbers. Regardless of the geography and market segment, Apple leads with one integrated software and hardware product. Other competitors with integrated solution, like RIM, lack Apple's

brand and Google's scale to compete in the Smartphone landscape. Apple's competitive advantage lies in its holistic offering: single, high quality user interface, single appealing device offering in each segment, a family of platforms like iTunes, iPhone, iPad, breadth of content distributed through a single channel iTunes (apps, music, books, video, etc). It controls end-to-end user experience (Elkin, 2011).

Though it is making some promising progress globally, it still remains to be seen how it expands worldwide with Microsoft/Nokia collaboration bringing in another strong competitor, in addition to Google's Android.

6.4   2011 – A Year of Tablets

2011 is destined to be the year of tablets. Apple repeated the strategy of integrated software and hardware product with the release of iPad in April 2010. iPad is clearly leading the tablet market space with over 60K Apps by the end of Jan 2011, since its launch in April 2010 (Apple, 2011). In January 2011, more than eighty tablets were announced, claiming to be "iPad Killers." The tablet market is shaping out very similar to smartphones. It remains to be seen if the proliferation of Android 3.0 (Honeycomb) based tablets can achieve the same market penetration as the smartphones based on Android OS. iPad had 2010 all to itself and eMarketer predicts iPad as the market leader, at least through 2012 (Elkin, 2011). With the launch of BlackBerry's new QNX-derived OS, the enterprise space will see an increased adoption of tablets.

Tablets are traditionally media consumption devices, but with the introduction of front facing cameras on iPad2 and other Android based tablets, there will be an increasing use for video conferencing. With the growing prominence of Skype in replacing voice calls, it gives a very clear opportunity for tablets to become communication devices. As software vendors like Microsoft and Google build workplace

applications, tablets can become commonplace in enterprises in the near future. The same players in the Smartphone market are playing leading roles in the tablet market and the competitive landscape is shaping out be very similar to the Smartphone market.

6.5   4G – Expansion of Wireless Bandwidth

Expansion of fourth generation (4G) networks by wireless carriers will add significant capacity and bandwidth and could lead to explosion of online content availability and consumption through mobile devices (smartphones and tablets). Consumers will pay more for faster speeds, but with lower-cost and lower-bandwidth plans, net result will be an increase in the total number of Users accessing Internet from their wireless and portable devices.

6.6   Enterprise Market Segment

Smartphone usage continues to rise among enterprises and TNS BusinessWave confirms that smartphones are becoming increasingly important for the business market.

Smartphone Penetration of Wireless Hand-held Data Devices by Size of Business Corporate Liable Wireless Users

Source: TNS BusinessWave Program, Nation, 4Q'MA
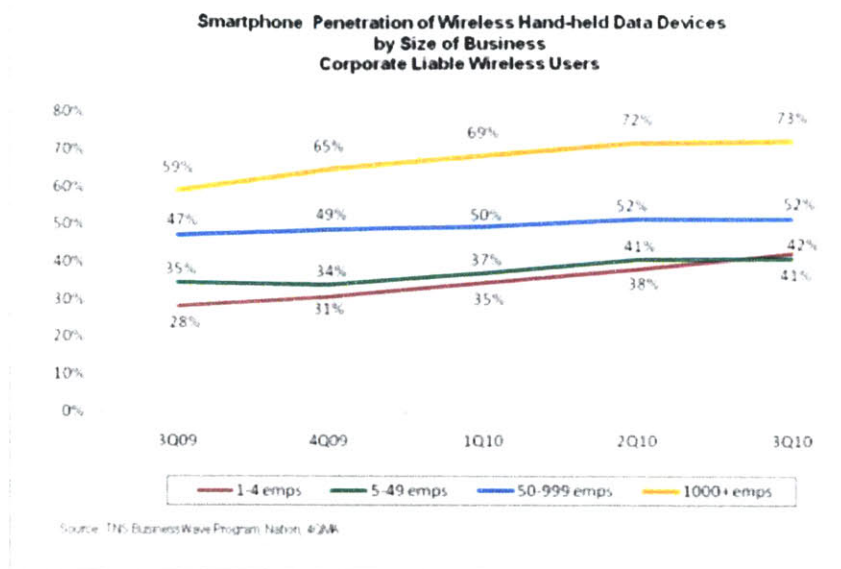
Figure 46 - Data Devices penetration in Corporate (TNS-US, 2011)

The advances made in Smartphone capabilities, combined with the increase in wireless bandwidth and availability of Apps is improving personal productivity of employees in enterprises. Demand by information workers for accessibility to data on the move, combined with instant-on feature of the latest smartphones is increasing its adoption. Non-mobile workers, too, are demanding access to corporate emails and calendar on their personal devices as the usage of these devices becomes commonplace in their regular lives. With the release of iPad in April 2010, tablet adoption is expected to grow in two years, impacting laptop sales (Arthur, 2011).

Most firms are currently developing only customer-facing apps and are using it for email and calendar. Enterprises need to be convinced about the security and device management issues around the latest smartphones for supporting personal devices on corporate networks. Companies need to evaluate devices and mobile apps on the basis of delivering business value to their organizations. Development and adoption of business applications will depend on perceived value as demonstrated by ROI and integration of mobile apps with business process and their ability to optimize it. As

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security issues are increasingly being addressed by leading Smartphone providers,(as discussed in the previous section) focus is going to shift on management of apps and delivering them in compliance with enterprise goals (Jaquith, 2010). Firms also need to deal with issues, which arise due to the integration of new platforms and legacy systems.

6.7 Long-term Outlook of the Mobile Platforms

BAIRD published the results of the first quarter of 2011 Mobile Developer Survey in April 2011 (Power, Beckert, & Flis, 2011). As per the research, App Developers continue to have a strong positive long-term outlook for both Apple iOS and Google Android, due to various factors like app-visibility, ease of development, monetary returns from apps, as well as advertising. Their positive outlook of Android is significant, in spite of the well-known fragmentation issue with Android OS and app stores (sales channels). At the same time, developer's view on RIM is strongly negative. They view RIM's move of opening QNX to Android applications as a negative for both QNX and RIM in the long term, since this means that RIM is incentivizing App Developers to use a different platform. Surprisingly, Microsoft's WP7 has a better outlook in the remaining platforms; better than RIM, partly because of its alliance with Nokia, which has increased it's relevance in the market and made it a more attractive platform to develop for (Appendix - Figure 73 - BAIRD Survey Data Q1'11).

6.8 HTML5 and its Impact on Mobile Application Development

When we are talking about the landscape of so many different mobile platforms and their future, I have to mention convergence technologies that enable App Developers to create apps for multiple platforms with minimum effort. HTML5 is one of the latest technologies that stand out.

HTML5 is the new specification language for HTML, the core mark-up language used for website development. HTML5 aims to transform the age-old markup language to fit into the multimedia realm. It makes it easy to build web pages with graphics and video content without using additional plug-ins like Adobe's Flash (Cloud Four, 2009).

The functionality of HTML5 is not only limited to website development, but can also be expanded to include web application development, where the devices are not necessarily connected to the Internet all the time. HTML5 provides the ability to cache data on devices when the device is not connected to the Internet, giving the user online-like offline access to the application (Mistry, 2011).

In this age, with multiple players in the Smartphone arena, App Developers who want to reach a wide user segment have to develop their apps using the native technologies of specific OSs' in question. There are quite a few cross-platform mobile application development frameworks like Phone Gap, QuickConnect, RhoMobile, Titanium Mobile, etc., that rely on HTML5 features to provide a rich application experience (Cloud Four, 2009). These frameworks let the App Developers use web technologies like HTML5, CSS, JavaScript, etc., to build their applications which could run on multiple mobile OSs' like iOS, Android, etc. HTML5 is still in very early stages of development and not all OSs have HTML5 compatibility: example, Blackberry (Cloud Four, 2009). It might still not be possible to do everything with HTML5 apps as compared to native apps, but it does have a promising future as the technology matures.

Commoditization of Apps

In the mobile space, there are no clear winners until now. As discussed in chapter 5, to reach maximum consumers, App Developers are getting inclined towards

using cross-platform frameworks like Titanium. But until now, there have been some serious limitations to such technologies. Emergence of HTML5 and its adoption by major platforms like Apple and Android, has given cross-platform technologies a boost.

In addition to it, App Developers are also moving to the model of thin client. For such apps, most of the functionality/data resides in the cloud and thin native clients are built for every major Smartphone OS with native technologies, to provide an enhanced and rich user experience.

7 Conclusions

2010 was an exciting year with some amazing technology innovations happening at a fast rate. 2011 will have a rapidly evolving market as well, and we will see the year going to tablets. It also promises to be a year of enterprise mobility. 2011 already started exciting with the announcement of Nokia and Microsoft strategic partnership, iPhone/Verizon deal, launch of iPad 2, and more than eighty me-too tablets.

Based on the Winner-Take-Most Analysis in chapter 5 we conclude that Apple and Android have emerged as two strong platforms and Smartphone OS will be a Winner-Takes-Most market. The Nokia and Microsoft alliance places them as a strong third contender in the mobile ecosystem. Apps are increasingly getting commoditized, as discussed above. We also pointed out in chapter 2 that developers are willing to develop for more than one platform; on an average they develop for 2.8 platforms (Visionmobile, 2010). So this highlights that developers will build for multiple platforms as long as it lets them reach a wider audience.

Hence, the Smartphone OS market will see the top 3/4 Smartphone OS Platform Vendors control the lion's share.

Mobile media has gained prominence in 2010, and with the introduction of 4G networks, we will see an increased adoption of it in 2011. 2010 was the year where Mobile Internet access doubled and there was an onslaught of mobile media creation by the likes of News Corp, Google, Yahoo, Movie studios. Fragmented strategies like News Corps, iPad only magazines, and NYT pricing schemes will not be very successful. How consumers use various devices to consume media is important and there is a major trend towards convergence.

Increase in mobile content consumption is leading to greater mobile advertising and 2011 will see more of this growth. Industry is seeking new ways to monetize and publicize via mobile advertising. There are many ways to mobile marketing, from banner ads to in-app ads, location-based services such as SMS or push notifications, etc. But in order to boost advertising on mobile media, Advertisers need a way to measure the effectiveness of ads. But accurately measuring this is extremely challenging, as traditional approaches to measure PC Internet do not apply to mobile space or must be adapted to particularities of a complex ecosystem.

Mobile has potential to increase the adoption on online retail sales, as well. With the introduction of features like mobile wallet, mobile phones are turning out to be convenient replacements of credit/debit cards. And this trend will increase more in 2011, as more retailers adapt to mobile payment options.

For everyone in the mobile eco-system (Handset Manufacturers, Mobile OS Vendors, App Developers, Content Providers, Wireless Network Operators and Advertisers), it is important to know how consumers are interacting with their smartphones and tablets and adapt quickly to maintain the competitive advantage.

8 Appendix

Figure 47 - Newton MessagePad

Source: Wikipedia (Wikipedia: OHA, 2011)

Year	iPhone		iPod Touch	iPad		iOS	
	Announced	Released	Released	Announced	Released	Dev.	Release
2007	Jan 9	Jun 29	Sep 13			1.0	Jun 29
2008	Jun 9 (3G)	Jul 11	Sep 9			2.0	Jul 11
2009	Jun 8 (3GS)	Jun 19	Sep 9			3.0	Jun 17
2010	Jun 7 (4)	Jun 24	Sep 7	Jan 27	Apr 3	4.0	Jun 21

Figure 48 - Timeline of Smartphone and Tablet products by Apple

Source: Wikipedia (Wikipedia : iPhone, 2011; Wikipedia : iphone (original), 2011; Wikipedia : iPhone 3G, 2011; Wikipedia : iOS version History, 2011; Wikipedia : iPhone 3GS, 2011; Wikipedia : iPhone 4, 2011; Carmo, 2007)

Smartphone Subscriber Penetration Worldwide, by Region, 2009-2015

	2009	2010	2011	2015
Japan	33.1%	36.1%	40.0%	57.8%
North America	26.3%	37.5%	49.8%	91.3%
Middle East and Africa	24.0%	28.5%	33.3%	58.9%
Western Europe	19.8%	28.9%	39.4%	74.7%
Latin America	13.5%	24.3%	36.2%	80.0%
Eastern Europe	11.7%	15.5%	21.4%	55.4%
Asia-Pacific (excluding Japan)	10.3%	14.7%	20.6%	53.3%
Worldwide	**17.0%**	**23.4%**	**31.1%**	**64.6%**

Source: company reports and Credit Suisse estimates, "Convergence 2010: The Wireless Web World," July 15, 2010

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Figure 49 - Smartphone penetration - worldwide by region

Source: Smartphone subscriber penetration worldwide **(Elkin, 2011)**

Smartphone Subscribers Worldwide, by Region, 2009-2015
millions

	2009	2010	2011	2015
Asia-Pacific (excluding Japan)	79.1	113.1	158.4	410.8
Western Europe	71.9	105.0	142.9	271.0
North America	64.4	91.9	122.1	223.9
Japan	41.8	45.6	50.6	73.0
Middle East and Africa	28.2	33.5	39.1	69.2
Eastern Europe	16.0	21.3	29.4	76.2
Latin America	10.7	19.2	28.6	63.3
Worldwide	**312.2**	**429.7**	**571.1**	**1,187.4**

Note: numbers may not add up to total due to rounding
Source: company reports and Credit Suisse estimates, "Convergence 2010: The Wireless Web World," July 15, 2010

117888   www.**eMarketer**.com

Figure 50 - Smartphone subscribers worldwide by region, 2009-2015

Source: Credit Suisse figures on Smartphone penetration by region (Elkin, 2011)

AT&T WIRELESS SUBSCRIBERS
In millions

	4Q09	1Q10	2Q10	3Q10	4Q10
	85.1	87.0	90.1	92.8	95.5
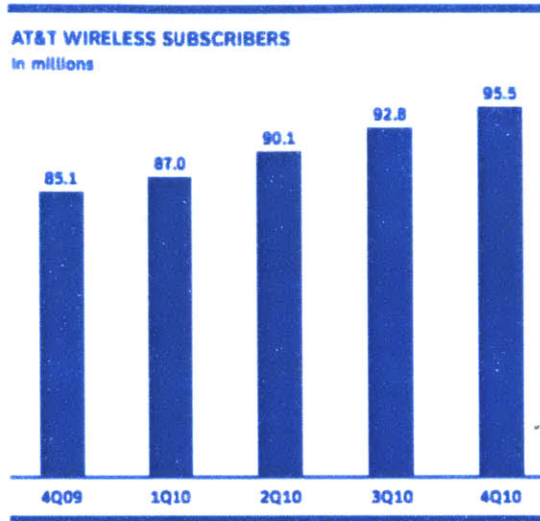
Figure 51 - AT&T Wireless Subscribers (AT&T, 2010)

% Share of Brower and Application Users
Source: comScore MobiLens, 3 mo. avg. ending Dec-2010 vs. Dec-2009

Used browser
- EU5: 29% + 8 pts
- US: 36% + 9 pts

Used application (except native games)
- EU5: 28% + 7 pts
- US: 34% + 8 pts

% Total Market
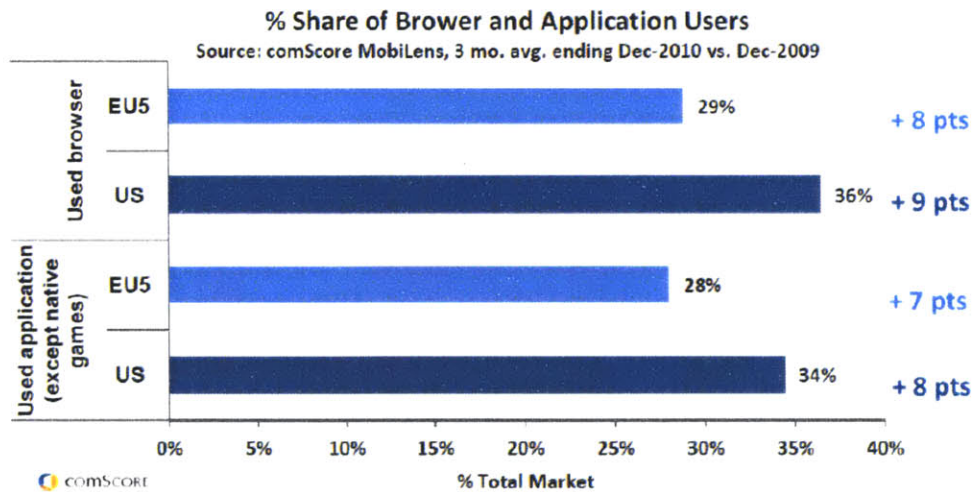
comScore

Figure 52 - %share of Browser and Application Users (comScore, 2011)

Smartphones subscribers worldwide - 2009-2015
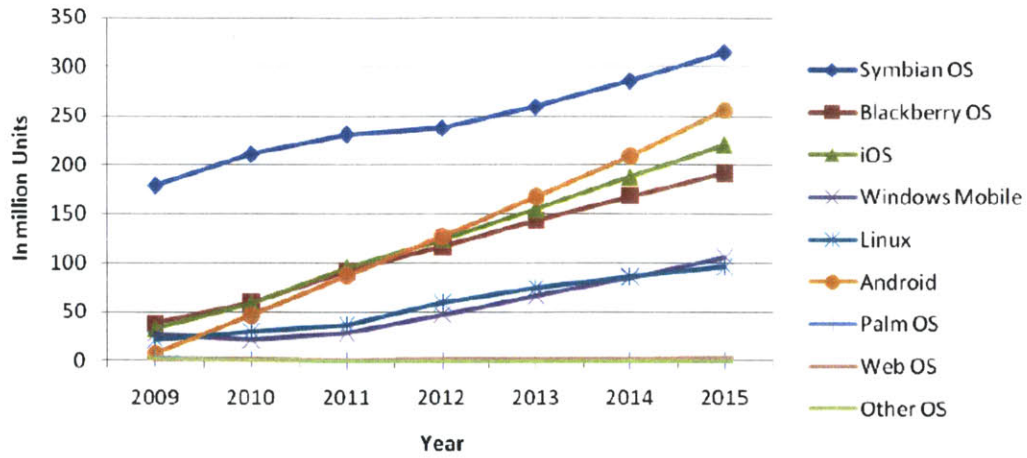
Figure 53 - Smartphone Subscribers worldwide, 2009 - 2015

Source: Smartphone Subscribers Worldwide by Credit Suisse (Credit Suisse, 2010)

	Q3 2008		Q3 2009		Q4 2009		Q2 2010		Q4 2010	
	Units	%	Units	%	Units	%	Units	%	Units	%
Google	0	0.0	1.45	3.5	4.7	8.8	14.70	23.3	33.3	32.9
Nokia	18.58	46.6	19.1	46.2	23.9	44.5	23.80	37.8	31	30.6
Apple	6.89	17.3	7.36	17.8	8.7	16.2	8.14	12.9	16.2	16.0
RIM	6.05	15.2	8.52	20.6	10.7	19.9	11.27	17.9	14.6	14.4
Microsoft	5.42	13.6	3.63	8.8	3.9	7.3	3.20	5.1	3.1	3.1
Others	2.89	7.3	1.31	3.2	1.8	3.4	1.90	3.0	3	3.0
Total	39.83	100	41.37	100	53.7	100	63.02	100	101.2	100

Figure 54 - Worldwide Market share, Q4 2010 (Canalys, 2011)
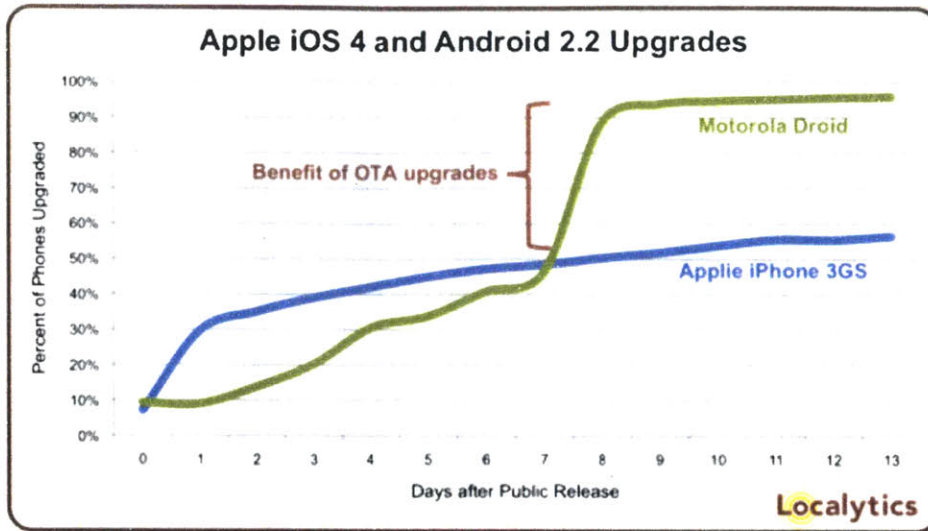
Figure 55 - iOS 4 vs. Android 2.2 Upgrades (Schonfeld, 2010)
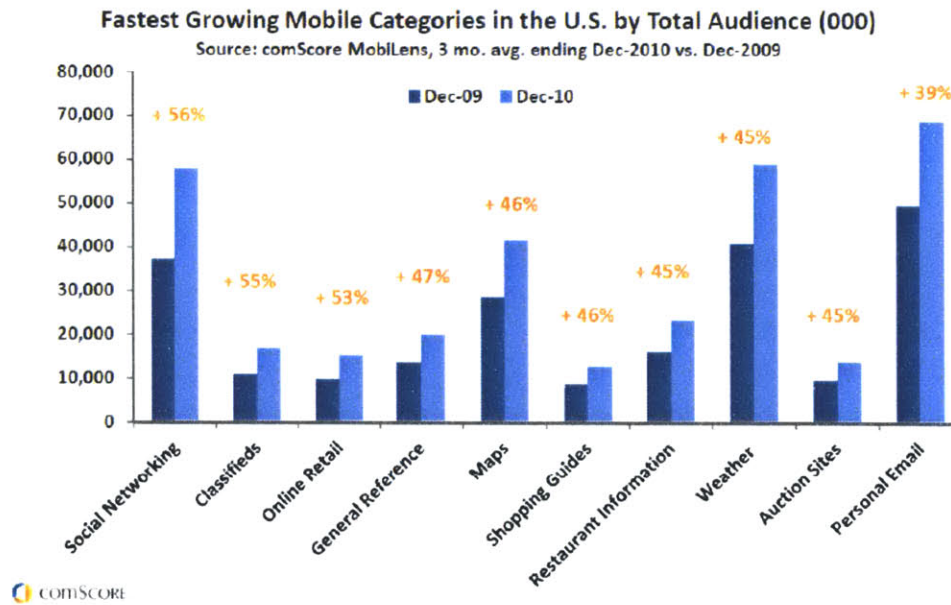
Figure 56 - Fastest Growing Mobile Categories in the US (comScore, 2011)

AT&T WIRELESS DATA REVENUES
Dollars in billions

	4Q09	1Q10	2Q10	3Q10	4Q10
	$3.9	$4.1	$4.4	$4.8	$4.9
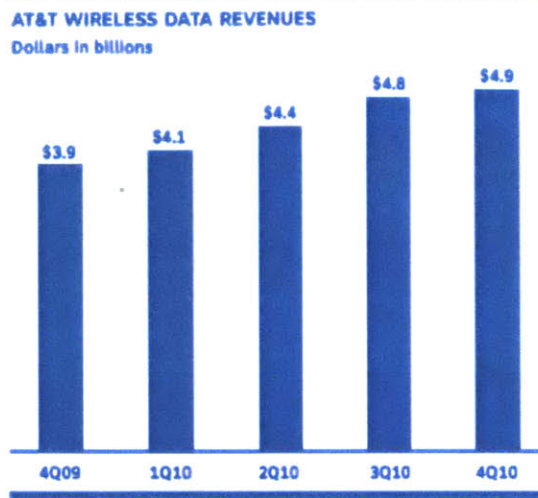
Figure 57 - AT& Wireless DATA Revenues (AT&T, 2010)

Platforms most used by mobile developers in early 2010

Android
iPhone (iOS)
Java ME
Symbian
mobile web
BlackBerry
Windows Phone
Flash or Flash Lite
Linux
BREW or BREW MP
Samsung Bada
Palm WebOS
Palm OS

% respondents normalised across 8 major platforms

0%   10%   20%   30%   40%   50%   60%   70%

Source Mobile Developer Economics 2010 and Beyond. Produced by VisionMobile. Sponsored by Telefonica Developer Communities
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Figure 58 - Platforms used by Mobile Developers in early 2010

Source: Mobile Developer Economics 2010 and Beyond (Constantinou, 2010)

Developer Sample by Tablet OS

iOS, 49%

Android, 38%

Don't currently develop for tablets, but considering it, 19%

BlackBerry QNX (PlayBook OS), 10%

Windows Phone 7, 4%

webOS, 1%

Other, 3%

No Plans to develop for tablets at this time, 4%
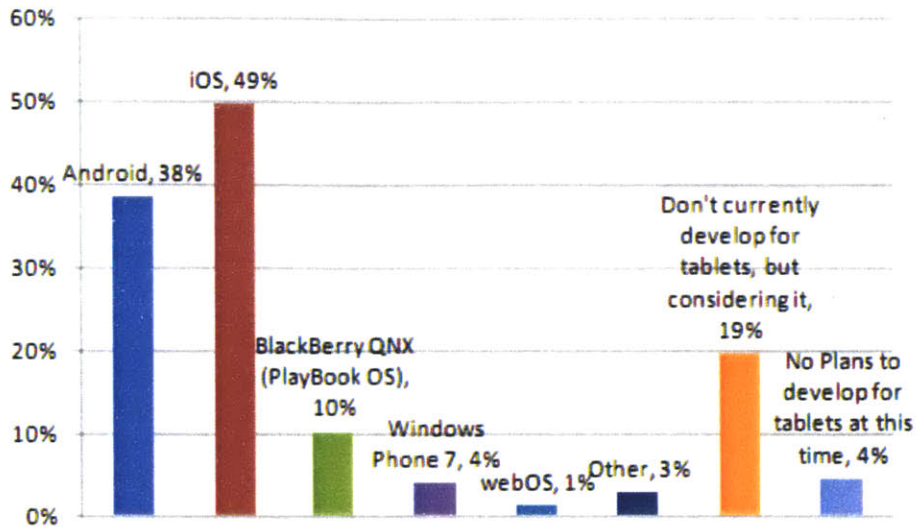
Figure 59 - Developer Sample by Tablet OS (Power, Beckert, & Flis, 2011)

Marketing reasons that mobile developers consider important in selecting a platform

Large market penetration

Revenue potential (direct or via advertising)

Has App Store

Large developer community

De-facto platform in my vertical industry

My boss said so

Everyone else is using it

Analytics tools (e.g Flurry)

0   10   20   30   40   50   60   70   80   90

Figure 60 - Marketing Reasons for selecting a Mobile OS Platform

Source: Mobile Developer Economics 2010 and Beyond (Constantinou, 2010)

Platform aspects considered 'best' by mobile developers

Figure 61 - Technical Reasons for selecting a Mobile OS Platform

Source: Mobile Developer Economics 2010 and Beyond (Constantinou, 2010)
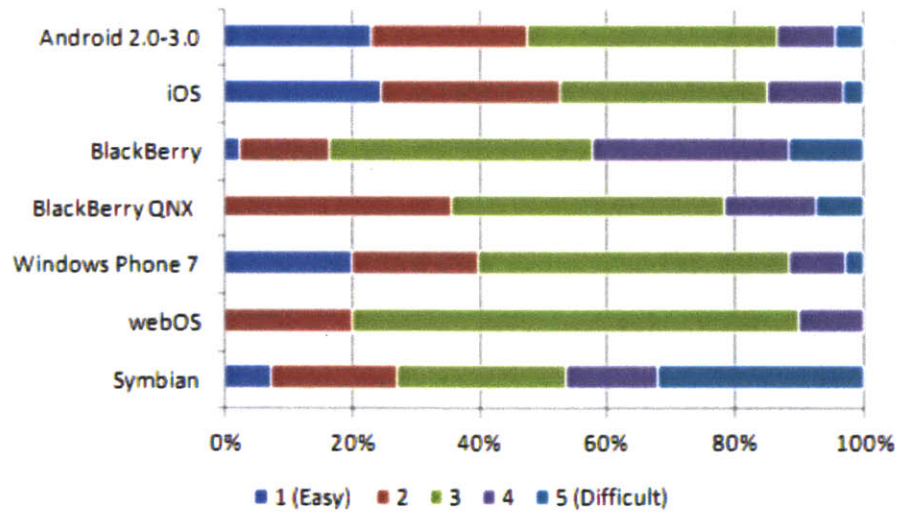
Figure 62 - Difficulty of development for the platform (Power, Beckert, & Flis, 2011)

Mobile Application Stores (end- 2010)

	App Store	Android Market	Ovi Store	BlackBerry App World	GetJar
Fundamentals					
Owner	Apple	Google	Nokia	RIM	Getjar Networks
Distribution model	via App Store on iPhone and iPod Touch	via Market on Android devices (closed source)	via download, and pre-loaded from 4Q09	?	via web only (direct + white label)
Platforms	OSX	Android	Symbian, S40	BlackBerry	Java, Flash, Android, RIM, WinMo, Palm, Android
Key figures					
Sales base since launch (2010 est.)	90M	77M	440M	125M	0 (plans to pre-load icon shortcut on phones)
Downloads per month as of end of 2010 (est.)	510M	270M	90M	60M	90M
Cumulative downloads since launch as of end of 2010 (est.)	10B	2.5B	N/A	N/A	1.6B
Applications to end of 2010 (est.)	300,000	130,000	25,000	18,000	76,000
Revenue model	70% to developer	70% to developer 30% optional to operator	70% to developer (less w/ carrier billing)	70% to developer	Ad-based apps + paid placement

source: VisionMobile research, Distimo

Figure 63 - Mobile Application Stores (end - 2010)

Source: (Mobile Megatrends 2011, 2011)
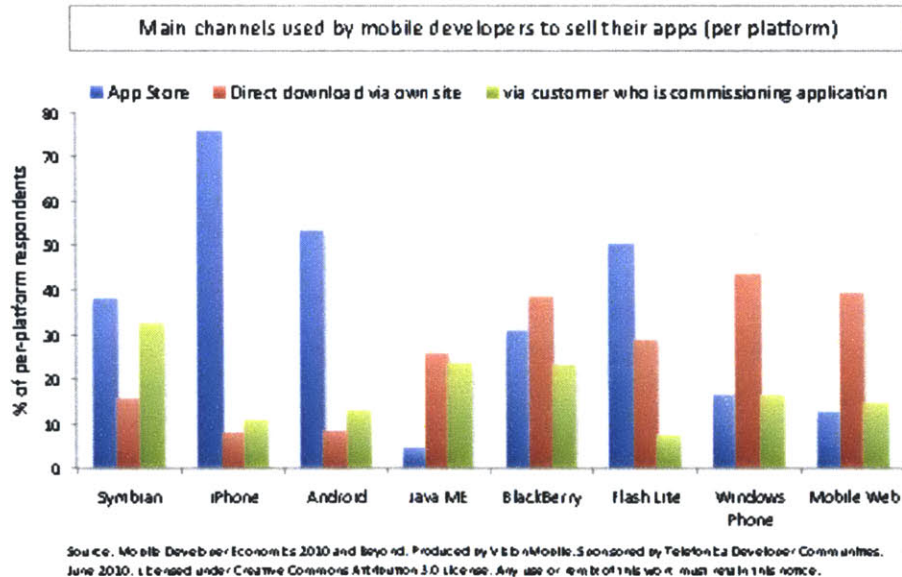
Figure 64 - Main Channels used by Mobile developers to sell their apps (Visionmobile, 2010)
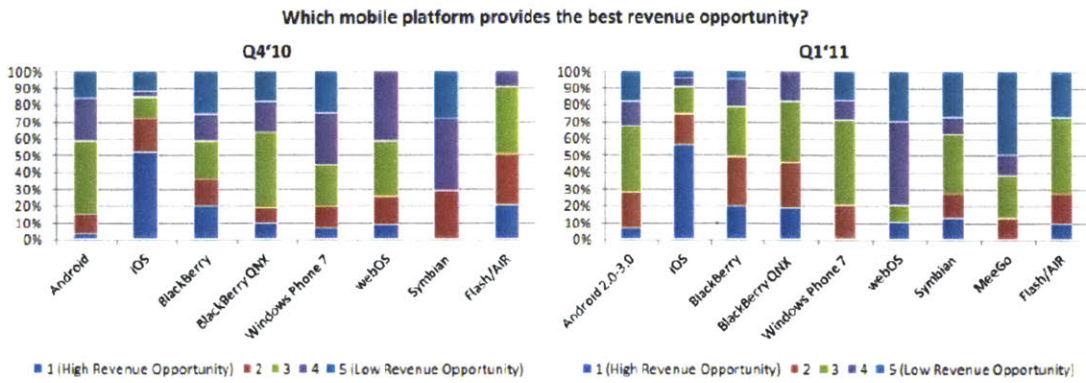
Figure 65 - Revenue potential of various platforms (Power, Beckert, & Flis, 2011)
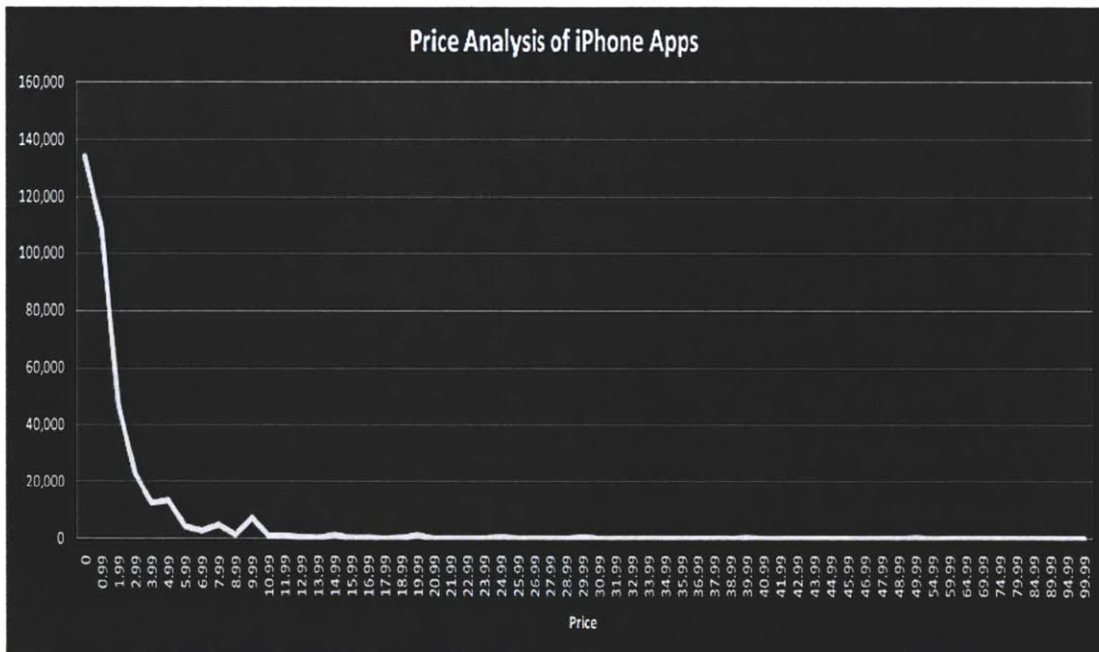
Figure 66 - Price analysis by # of Apps on Apple App Store (148Apps, 2011)

Who do you use for mobile advertising?

Don't Use Advertising 31%

Google/AdMob 30%

41%

28%

Q4'10

Q1'11

Other 11%

9%

22%

iAd/Quattro Wireless 15%

BlackBerry Adservice 4%
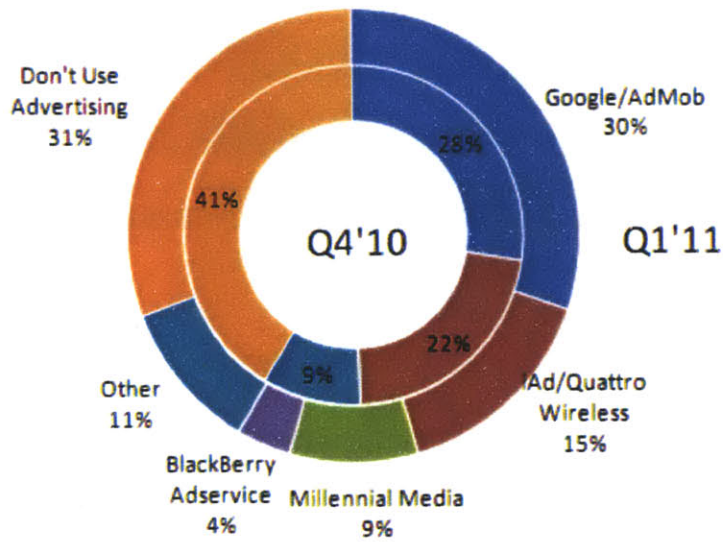
Millennial Media 9%

Note: In Q4'10 we did not request data on BlackBerry Ad Service or Millennial Media, those companies would have been accounted for in the other category.

Figure 67 - Advertising Platform (Power, Beckert, & Flis, 2011)

How profitable has your ad service been for you?

Google/Admob

iAd/Quattro Wireless

Millennial Media

0%   20%   40%   60%   80%   100%

■ 1 (Very Profitable)   ■ 2   ■ 3   ■ 4   ■ 5 (Not Very Profitable)
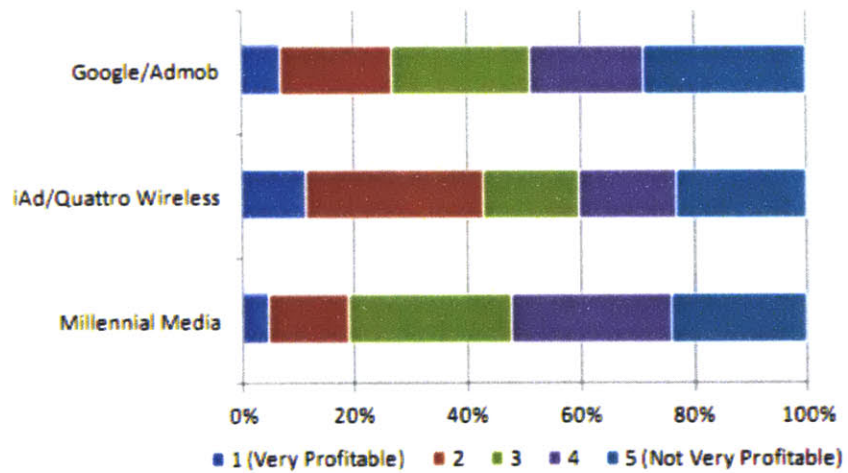
Figure 68 - Profitability of Ad platform (Power, Beckert, & Flis, 2011)

Average Paid App Price in Select US Mobile App Stores, May 2010

BlackBerry App World*
- $6.97
- $6.35

Windows Marketplace
- $5.96
- $5.68

Apple App Store—iPad
- $4.65
- $6.02

Apple App Store—iPhone
- $4.01
- $2.62

Google Android Market
- $3.29
- $4.27

Nokia Ovi Store
- $2.89
- $3.58

Palm App Catalog
- $2.45
- $2.76

■ All paid apps   ■ Top 100 paid apps

*Note: *the lowest price point allowed in BlackBerry App World is $2.99*
Source: Distimo, "Distimo Report, June 2010," Jul 1, 2010

117597   www.**eMarketer**.com
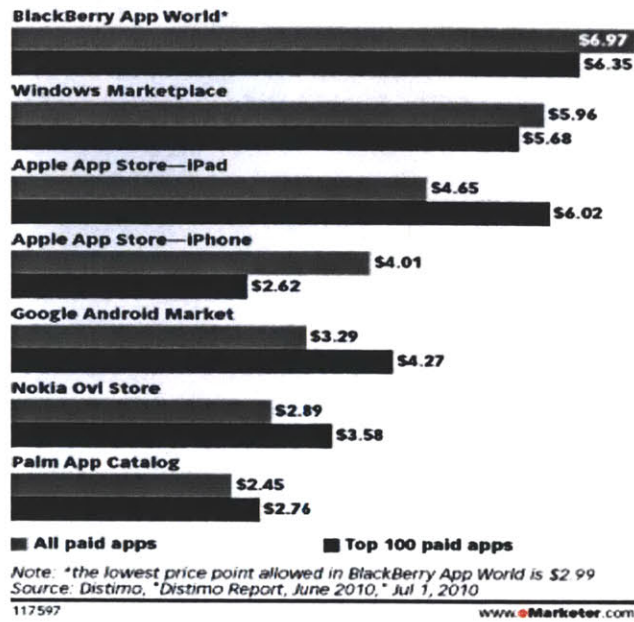
Figure 69 - Average Paid APP Price in US Mobile APP Stores, May 2010 (Distimo, 2010)

Social · Unified Communications · Search · Devices · Commerce · Developers · NOKIA + Microsoft · Operators · Entertainment · Advertising · Consumers · Store · Location

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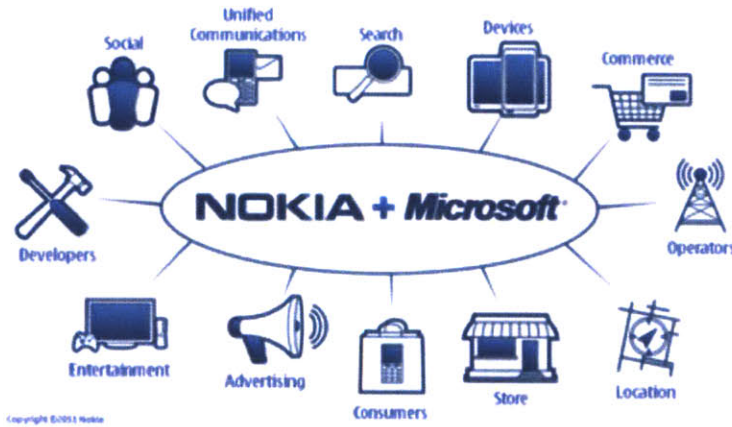
Figure 70 - Combination of Nokia and Microsoft Assets

Source: Nokia and Microsoft Strategic Alliance analysis (Supersite for Windows, 2011)

Manufacturer operating system share–smartphones

Nov '10 - Jan 11, postpaid mobile subscribers, n=14,701
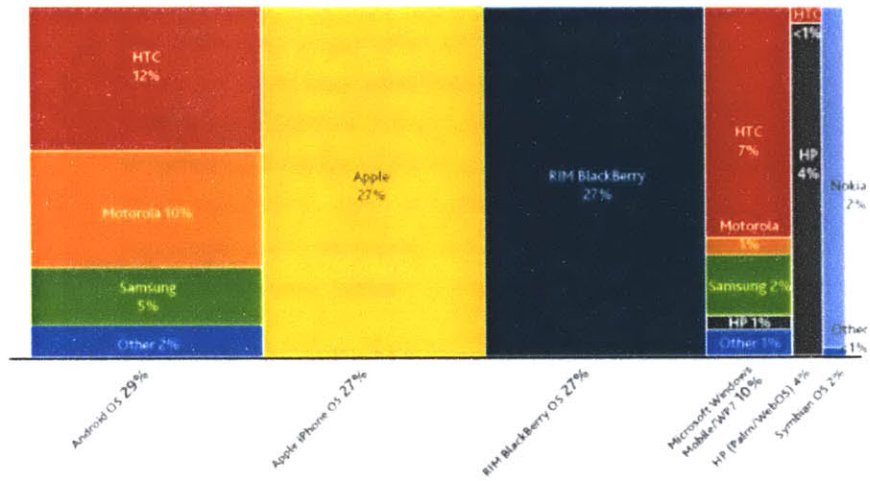
Source: The Nielsen Company

nielsen

Figure 71 - Device Manufacturer composition of Smartphone OS ecosystem in US

Source: Nielsen Company (nielsen wire, 2011)

Tablet and iPad Sales Worldwide, 2010-2012
millions of units, % of total and % change

	2010	2011	2012
iPad sales	13.3	34.0	56.1
—% change	-	155%	65%
—% of total tablet sales	85%	78%	69%
Total tablet sales	15.7	43.6	81.3
—% change	-	178%	87%

Source: eMarketer, Dec 2010

122239   www.eMarketer.com

Figure 72 - Tablet and iPad sales worldwide

Source: eMarketer (Elkin, 2011)

How do you view the long-term outlook for the following platforms?

Figure 73 - BAIRD Survey Data Q1'11 (Power, Beckert, & Flis, 2011)

9 Table of Figures

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