Workplace Service

STRATEGIC REPORT
Number: 2012-SR1
March 26, 2012

Aragon Research

Authors: Jim Lundy; Mike Anderson

The Enterprise Guide to Mobile and Tablet Computing

Tablets, and the unprecedented success of Apple's iPad, have disrupted the mobile and laptop markets and set in motion fundamental changes to enterprise computing. Viewed as a fad when they were introduced in 2010, tablets are now doing work in ways that laptop computers cannot. This is due to the wave of innovation enabled by mobile ecosystems and the apps that developers have delivered to fill them.

We have entered what Aragon calls the *Tablet Era*. The market shift of the last two years caught many providers unprepared. Even leaders and strong players with seemingly solid competitive positions have found themselves either viewing this transformation from the outside or scrambling to fill voids in their product strategies.

Tablet computers, smartphones and the mobile ecosystem that surrounds them are poised to change the face of enterprise computing. For many enterprises, they offer the possibilities of increased user productivity, lower cost and less IT overhead to manage them. For providers, the race has just started and what is surprising is how far industry titans were caught off guard.

Tablets have a symbiotic relationship with smartphones in that the core OS used by the leading Mobile OS providers has evolved to support both classes of device. This is a key tenet for enterprises to evaluate: One OS supports two classes of device. Indeed, most tablet OS providers use their core OS as the source for their mobile OS.

Mobile devices have also inspired a new category of software, the *microapp* or "app." With microapps, the device takes on the "personality" of the app; this represents a paradigm shift in computing across the board. Mobile apps have unleashed a new wave of innovation that is changing the workplace computing landscape.

This *Strategic Report* focuses on the critical aspects of tablets and mobile computing that are profoundly altering enterprise computing and software. It also defines and examines the critical elements of a mobile ecosystem. By understanding these elements, enterprises can be better prepared to make the right short and long term strategic decisions.

Table of Contents

Table of Contents (continued)

Table of Figures

Tables

Section 1: Executive Summary

1.1 Introduction: Welcome to the New World

Since the launch of the iPhone in 2007, success was all about the next generation of smartphones and hundreds of thousands of apps that went far beyond email access and texting. Then came the iPad, a new computing device that users and now enterprises are adopting in unprecedented numbers.

This begins a new computing era: the *tablet era*, marked by three key elements:
- The tablet devices themselves
- The way humans will interact with tablets (touch, voice, gesture)
- Tablet and mobile ecosystems that will power and drive this new era

The secret sauce that powers this shift is the mobile ecosystem, which has unleashed a wave of innovation that enables tablets to be used in ways unimaginable just a few years ago. The result is empowered users who leverage these capabilities to attain productivity levels that will benefit enterprises for many years to come.

This report discusses tablet computing and its key use cases, mobile ecosystems and their composition, and the key technology providers that will develop, nurture and maintain these ecosystems. Make no mistake; mobile ecosystems are at the heart of success with mobile devices. This report will help you prepare for the new era of workplace computing.

Five essential components form the foundation of a mobile ecosystem:
1. A multi-device operating system (MOS – one OS supports multiple form factors)
2. Mobile devices that will take on different form factors
3. Micro applications that run on multiple devices
4. An app store for application selection and distribution
5. Content and content stores

It is not enough to support just a smartphone with one OS and a tablet with another. Today, the era of the *multi-device OS* has emerged and the battle that has emerged is between Apple with its iOS and Google with Android. This battle started years ago and became public in 2007 with the announcement of the iPhone, iOS and Android. It has raged on since then and the other ecosystem providers have been forced to follow suit.

A multi-device OS is leveraged across multiple devices which today means that one OS supports a smartphone (smaller form factor) and tablets (multiple larger form factors). Having one common OS allows for faster innovation. Today the refresh rate for both mobile operating systems is an annual update each calendar year.

Microapps are small software applications for mobile devices. They can be purpose-built for a particular real-world task, or a scaled-down version of a larger application redesigned for a mobile environment. A microapp can be built faster than a conventional application, because it is doing fewer things, and the refresh rate for a microapp is usually once or twice a year.

An app store is an online distribution center where applications are sold online and automatically downloaded to the user or enterprise that is buying them. Microapps distributed via app stores often come in two flavors: free and premium (paid) versions. Prices for paid apps are generally dramatically lower than those of conventional applications: often under US $10.00 and with a majority coming in under $40.00.

Apple introduced microapps and app stores in July 2007 with the announcement of the iTunes App Store, a tightly managed service that revolutionized the way applications were delivered to users. Google quickly followed suit with its app store three months later in October 2007. App Stores are morphing into distinct categories: Public app stores controlled by the ecosystem provider, public app stores controlled by other parties, and private app stores that are managed by enterprises themselves for internal users as well as for their customers.

Because ease of use is so important in the mobile environment, the ecosystem providers have adopted curating approaches toward the apps in their app stores. Apple has taken the most aggressive stance with regard to strict user-interface rules and appropriate app functions and behaviors. Google has recently published design guidelines and security screening for Android apps, and each of the other contenders including Microsoft and RIM have implemented varying degrees of user-interface and other app rules. One function of the app store is to vet or filter submitted apps for conformance to these and other guidelines. The strength of this oversight varies; Apple's approval process is stricter than Google's, for example.

The IT industry has historically viewed Apple as predominantly consumer-oriented and not taken seriously in the enterprise, and is now reeling from the continuous string of hit products coming from Apple. Many of them have permanently changed the industry. Netbooks have given way to tablets, even laptops are challenged, and non-"smart" phones are no longer popular. Data, not calls, now powers carrier growth. Mobility, applications and ease of use are the key goals driving innovation.

Why Tablets Will Do More Than Just Replace Notebook PCs

Since 2010, the enterprise perspective on tablets has changed and so has what a tablet can do. This is primarily due to the realization that tablets can be fitted with applications that give the tablet a unique capability, such as acting like an order taking

device at a restaurant. A significant aftermarket has also grown, offering hundreds of ways a tablet can be enhanced (e.g. keyboard case) to replace dedicated devices (remote controls, manuals etc.).

Apple's iPad and the avalanche of competitive tablets that has followed provide the tipping point for entering a post-PC era. More fully functioning PCs in tablet form, with pen or stylus input, have been around for years but continue to have niche utility, mainly in vertical applications. However, redefining user interaction using touch has significantly improved the user experience, and the ecosystem around the tablet (content, apps and peripheral devices) now makes it a competitive tool for end user computing.

Microapps, running on tablets, will be the de facto way to access content (news, TV, movies) and to control devices (TVs, PCs, game consoles, etc.). In this sense, the tablet with its apps is the new "all-in-one" appliance. Future development will focus less on the tablet itself than on the apps that run on it, which will be the primary consumer selection criteria. The race to dominate tablet app development has already started, but it is about to explode. Moreover, the next generation of apps is poised to offer capabilities never before seen. iPhones can now park cars, power robots and more. The horizon has moved way beyond a very expensive remote for your TV.

Today more is at stake than just the operating system. It is all about the ecosystem, and building a successful ecosystem is difficult and expensive. A key differentiator among ecosystem providers will be deep pockets and the industry clout and visibility to attract hardware builders, carriers, and the millions of developers who will create the apps that make it all useful.

As we take a short preview of the major mobile ecosystem suppliers, it is important to observe that the length of time vendors take to update their ecosystems (and affiliated hardware platforms) is getting shorter (see Figure 1). With major OS updates and platform introductions occurring every year, the question is: *Can Microsoft keep up with the pace that Apple and Google have established?*

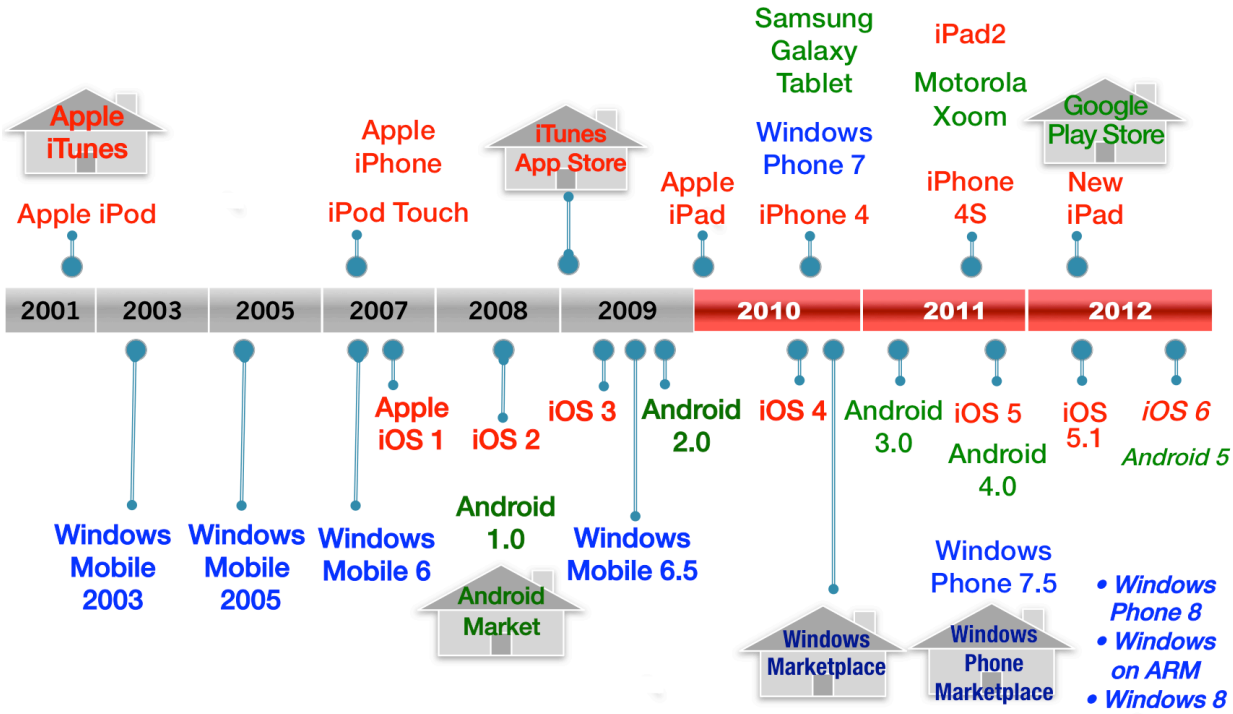


Figure 1: The Rise of Mobile Ecosystems: Apple, Google and Microsoft

1.2 Mobile Ecosystems – The Five Critical Players

Today the major players in the mobile ecosystem market are **Apple** and **Google**. They each offer a mobile operating system that includes a developer framework, an app store, and support for multiple types of mobile devices. Other providers that offer elements of a mobile ecosystem include Amazon, Microsoft and Research in Motion. Each of them is in a different stage of performance relative to their overall ecosystem. Table 1 provides a summary of the providers and their offerings in four areas.

Vendor	OS	App Store	Tablet Suppliers	Smartphones
Apple	IOS	iTunes App Store	Apple	Apple
Amazon	Android	Appstore for Android	Amazon	N/A
Google	Android	Google Play	Archos Barnes and Noble Coby Dell Huawei Motorola Samsung Viewsonic	Asus Google HTC Huawei LG Motorola Pantech Samsung Sharp Sony Ericsson

Vendor	OS	App Store	Tablet Suppliers	Smartphones
RIM	Blackberry OS	Blackberry App World	N/A	RIM
RIM	PlayBook OS 2.0	Blackberry App World	Playbook	RIM
Microsoft	Windows Phone	Windows Phone Marketplace	N/A	HTC LG Nokia Samsung
Microsoft	Windows 7	N/A	Asus HP Lenovo Samsung	N/A

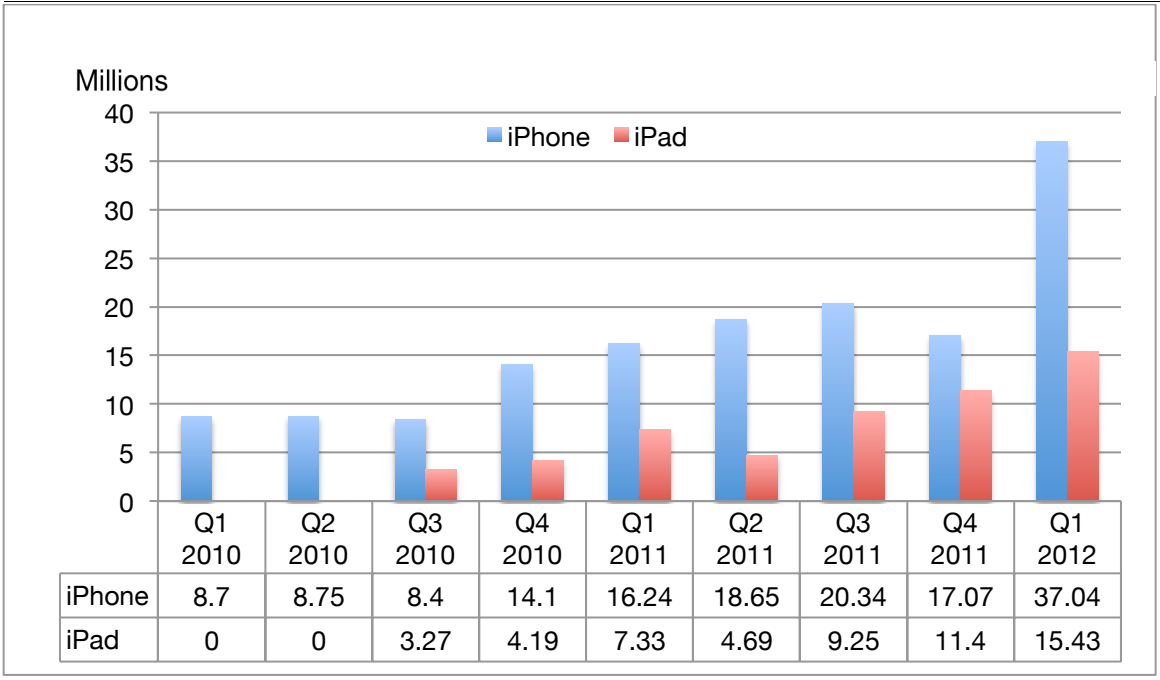
Table 1: The Major Mobile Ecosystem Providers

- **Apple**

When the iPhone was announced in 2007, no one would have predicted its rise to stardom as a computing platform, or the growth of iOS into a true multi-device operating system. Many even dismissed the iPad (a larger version of an iPhone without the phone feature) as a toy, but today the surprising number of iPads in enterprise use is driving a change in the workplace computing market that rivals the coming of the PC itself thirty years ago.

The first seed of the Apple mobile ecosystem was planted in 2001 when Apple introduced OS X, its Unix-based PC operating system, which iOS is based on. The second seed was the 2001 introduction of the iPod, Apple's portable music player, which had what would become iOS as its operating system. The third seed was the 2003 opening of the iTunes Music Store, a secure, tightly managed online facility where users could buy and download music and other content. By the time the iPhone came out in 2007, Apple had the beginnings of a well-developed ecosystem.

Apple took the tablet idea and made it a new product category so successful that it now threatens to overtake the laptop space in total sales numbers. In just 21 months, Apple has sold over 55 million iPads and it appears that there is no end in sight to this growth.



	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012
iPhone	8.7	8.75	8.4	14.1	16.24	18.65	20.34	17.07	37.04
iPad	0	0	3.27	4.19	7.33	4.69	9.25	11.4	15.43

Table 2: The Rise of the iPad Over 21 Months (Data Source: Apple Computer)

Given Apple's recent entry into multimedia textbook authoring software with iAuthor, it is probable that a large percentage of children in developed nations will be using tablets at school by 2015. Apple shows no sign of slowing down, and due to the strength of their mobile ecosystem, they will continue to hold the lead position in tablet computers.

Planning Assumption: Through 2014, Apple will continue to be the dominant supplier of tablets, mainly due to the strength of its mobile ecosystem.

- **Amazon**

  Amazon has had an eReader for many years and a growing ecosystem that includes an online store with books, music and other content as well as apps. Shifting from an eBook reader to the Kindle Fire was not hard. Amazon's ecosystem has been primarily focused on consumers, but since they are running Android on the Fire, they can take advantage of the growing number of apps available on Android. Although this also introduces a greater need to handle malware, not all Android apps will e available as Amazon evaluates and selects each app for the Kindle Fire.

- **Google**

  Google recognized the strategic importance of mobile and the underlying OS early enough that they have caught the tablet wave and have an ecosystem of hardware and carrier partners, many of whom, like Motorola, AT&T and Verizon, are former partners

of Microsoft. Indeed, Google is in the process of acquiring Motorola Mobility, Motorola's mobile hardware business. We expect that with this acquisition Google will be able to create more of the tight hardware/software integration that has helped make Apple so successful. However, it is not clear that Google has this design intention, so this is a work in progress.

Android – Past, Present and Future

Recognizing a critical opportunity, Google seized it and pitched Android to carriers with a great hook – no fees except using Google as the default search tool. Android was announced in 2007 and due in part to its low cost, constant innovation and many partners, has surpassed even the iPhone in the smartphone marketplace. Google filled a void that Microsoft had left, with the added advantage that it does not charge for the OS but uses its search revenue to fund Android development.

There is a lot to like about Android, but the main goal seems to have been rapid proliferation. The tablet catch-up against the iPad has not been as rapid as with phones, in part because keeping a common OS going with multiple carriers and hardware builders, and limited control over app design, does not make it easy to match Apple, which has total control of its entire ecosystem. Just examining Android's large assortment of builders, developers and carriers can explain why it may take a year or more for a new Android update to actually reach users' devices.

Indeed, Google's long-term risk may be users' freedom to migrate at will to various Android versions, and carriers' and partners' freedom to adapt Android to their varying needs. The success of the Apple ecosystem has been the consistency and commonality of its apps, its user experience, and the App Store's strict app certification. But despite Google's efforts to standardize Android, its consistency is diluted, and may cause the Android world to be seen as multiple rather than a single ecosystem.

- **Microsoft**

  Microsoft made an early effort to provide a mobile Windows many years ago, but the company's current mobile ecosystem is based on Windows Phone 7, released in 2010, which has a new touch-based user interface (UI) called "Metro." Microsoft also sells tablets based on Windows (XP and Windows 7), but these never reached mainstream.

  On the apps front, while Microsoft has close to 70,000 apps, their app store has been shifting, in part due to the changes in its phone OS. Microsoft is now on its second app store, Windows Marketplace, which is replacing its Windows Phone Marketplace due to the incompatibility between Windows Phone 6.5 and Windows Phone 7.x. It is notable that other providers, such as RIM, which also is in the midst of major OS changes, has not changed its mobile app store.

In September 2011, Microsoft announced that Windows 8 would support both PCs and tablets by incorporating Metro and the familiar mouse-based Windows UI. Shipping dates for Windows 8 are still not determined, but Aragon estimates delivery in late 2012. This leaves Microsoft considerably behind, and competition from Google and Apple that are continuing to widen the distance.

With Windows 8, the Microsoft strategy is to leverage its massive Windows franchise and bring tablets into the fold as another class of PC. When this new OS comes to market, Microsoft will have three operating systems; Windows 8, Windows on ARM, and Windows Phone 7. The next version of Windows Phone, Windows Phone 8, is expected to be a significant architectural change that will adopt the same kernel as Windows 8.

There are many things (processor support, wireless integration, video support, security) that need to be in Windows Phone 8 to enable it to compete against the original iOS design, common kernel, and common development environment. Microsoft's unfolding strategy with multiple Windows products has the potential to create a powerful combination that spans smartphones, both ARM and x86/64 tablets and Windows PCs. Microsoft's ability to deliver this unification with quality and a timeframe competitive with Apple and Google is the larger issue given their track record.

Given these factors, Aragon estimates that Microsoft is at least 36 months behind Apple in tablets and smartphones, largely due to delays in creating a scalable OS with the intuitive ease of use that users now demand. Nevertheless, Microsoft is racing to get Windows 8 to market.

- **Research In Motion**

  RIM was the dominant supplier of enterprise smartphones for over a decade, but is now under siege from Apple and Android. Its initial tablet, the Playbook, was a market failure despite high technical reviews, partly because of its strong similarity to the iPad. Moreover, RIM does not have the ecosystem to compete, and has had to cut its prices.

  Today RIM is modernizing its mobile OS and it offers two versions: its smartphones run on the classic Blackberry OS but its Blackberry Playbook tablet runs the Playbook OS based on QNX, a Unix derivative that Rim purchased in 2010. RIM is in the process of making all of its devices run on a version of QNX, now dubbed Blackberry 10, but it appears that many of its new phones will not be available until the second half of 2012.

  Given the success of iOS and Android devices, RIM is playing catch-up and has continued to lose market share. Throughout 2011 RIM struggled with strategy, product schedules and financial performance and saw its stock price plunge. RIM's success

continues to hinge on its success with enterprises that value the secure email service. With the success of Apple's integration with Microsoft Exchange Active Sync the BlackBerry email value proposition is diminishing.

- **Other Players**
  Other vendors offering partial mobile ecosystems include Asus, Barnes and Noble, Cisco, Dell, Hewlett Packard, Huawei, Lenovo, Nokia and Samsung. See Section 2 for details.

1.3 Managing the Mobile World

Enterprises need a mobile management strategy that can securely manage devices, control the distribution and use of enterprise applications, and securely protect corporate information. The tools to help enterprises manage this are changing rapidly. Enterprise app stores will be necessary to enable customized app selection, control of users, and support for mobile users through business policy. In addition to private app stores, mobile device management (MDM) and mobile application management (MAM) provide means to manage mobile investments.

MDM and MAM come from different aspects of the same management issues and are converging rapidly toward a consolidated approach for integrated mobile management. The varied and evolving multiple needs of the business will demand multiple approaches and multiple tools. The longer it takes to put a strategy in place, the more uncontrolled devices will proliferate. Banning them is not an option.

The Path Forward
Making the most effective decision for the business requires consideration of multiple perspectives. The devices themselves are only a small part of the equation, as the ecosystem each provider is capable of enabling and growing will be the greatest determinant of value and success. When planning for mobile devices, enterprises need to examine the mobile ecosystem, and consider each provider's ability to innovate, provide frequent (at least annual) OS upgrades, extensive apps, and rich capabilities for managing mobile applications and devices.

Summary
In this new era of computing, apps take center stage and the OS becomes less and less intrusive. Tablets started this revolution and new apps will help enterprises make their people more productive. Aragon predicts that tablets will become pervasive in enterprise, education and other markets (pre-school, consumer electronics, service industries) to a degree that dwarfs the PC market today. As computers and people get better at interacting, tablets of various sizes will be part of daily life in ways that phones don't offer. In the US, most households and individuals will own several.

1.4 Key Findings

- Future software development will take a mobile-first focus
- The tablet era will change how people interact with computers
- Apps that run on tablets will change consumer electronics
- The lifecycle of major mobile OS updates is every 12 months
- Mobile ecosystems are the key criteria for evaluating products and providers
- Apple is now a key mobile supplier to the enterprise
- Consolidation of mobile ecosystems will occur
- Enterprise app stores are a priority for managing mobile users
- Mobile device management and mobile application management will converge

1.5 Planning Assumptions

Section 1

- Through 2014, Apple will continue to be the dominant supplier of tablets, mainly due to the strength of its mobile ecosystem (see page 10).

Section 2

- By 2013, voice will be one of the dominant user interface methods on phones and tablets, and artificial intelligence-based intelligent digital assistants will surface (see page 22).
- By the end of 2014, 60 percent of enterprises will deploy tablets for their mobile workforce (see page 24).
- By 2014, annual tablet volume will exceed annual PC shipments (see page 26).

Section 3

- Through 2014, Microsoft's Windows 8 tablet share will be less than 10 percent (see page 42).

Section 4

- 85% of large enterprises will market a customer-focused microapp by 2013 (see page 60).

Section 5

- Through 2014 Apple's iPad will remain the leader in total apps built for the tablet environment (see page 64).

Section 6

- By 2013 most enterprises will use private app stores to manage their non-consumer apps (see page 72).
- By the end of 2015, 80 percent of businesses will have defined bring-your-own technology programs (see page 75).
- MDM and MAM will consolidate into integrated mobile management by 2014 (see page 78).
- By 2014, due to BYOD demand from users, enterprise IT groups will spend more time on information, application and device management than on procuring and configuring computers and tablets (see page 79).

Section 2: The Tablet Era

Since 2007, a new way of computing has quietly emerged: handheld devices, always on, always connected, always with us. Mobile isn't just about devices and carrier charges, it's a new paradigm and it touches everything. It is revolutionary enough to engulf enterprises that don't get out in front of it, but seeing it holistically as an ecosystem lets enterprises put it into perspective.

Enterprises, like individuals, often get caught up in the consumer hoopla that surrounds the "smartphone" market. However, the developments that really matter go beyond the devices and affect the elements that surround them. Aragon calls this environment the *mobile ecosystem*. While the hardware will continue to be refreshed, the success or failure of a particular initiative will not rest on the hardware itself, but the continued innovation and evolution of this ecosystem. Aragon has identified five essential components of it that enterprises should pay attention to:

- Multi-device operating systems
- Microapps
- App stores
- Content and content stores
- Device platforms

This Strategic Report will review each of these areas in detail. No vendor today can be successful without a significant offering in each of these areas, realizing that for hardware platforms there are two models at play.

2.1 Mobile is the New Normal

Computing in the workplace entered a new era just a few years ago, when users started getting powerful, reliable smartphones with applications – "apps" – they had never seen or used before. As the phones gained computing power and the apps gained breadth and functionality, personal computing without a traditional PC became a reality.

While smartphones started the change, tablets took it to a new level when developers realized that clever apps could make a tablet or smartphone do things that only dedicated hardware used to do: things like "be a compass," "be a flashlight" or "be a nurse and monitor my heart rate while I jog."

2.2 The Rise of the Tablet

At the beginning of 2010, most people did not think of the iPod Touch, which is

identical to an iPhone without the phone function, as a computer. So, when a scaled-up version of it was introduced as the iPad tablet, the public concept of a computer changed overnight. There were stunned reactions and stores were stampeded.

The introduction of the iPad and the intensity of the consumer response to it caught many off guard – including Microsoft, which saw the whole scenario but could do little to stop it. After the shock wore off, most PC and phone providers started to take action. In just the first three months after the iPad was released in April 2010, there were six different announcements by competitors (see Figure 2).

The only vendor that was in a position to immediately react with the necessary system software was Google. By September 2010, Google and its partner Samsung had the Galaxy Tab on the market.

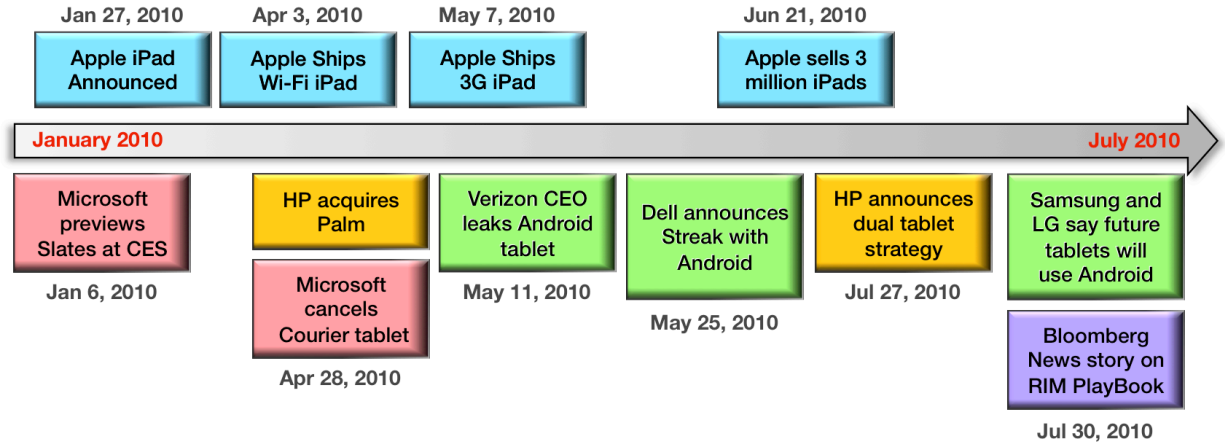


Figure 2: Timeline: The Emergence of the Tablet

2.3 The Tablet Era is Here

Tablets represent all the reasons we are moving beyond the keyboard-based PC. The mobile aftermarket offers hundreds of ways to enhance a tablet (e.g. keyboard cases, styli, Bluetooth peripherals). Tablet apps will be the standard way to access content (news, TV, movies) and to control devices (TVs, PCs, game consoles, etc.). The remote control will give way to an app. Comcast, Netflix, Slingbox, Time Warner Cable and others already provide such TV apps. With these apps, your tablet just became your new all-in-one – and it will go much further than just controlling your TV.

Regarding content (news, TV, games and movies), the publishing industry is still figuring out the eBook/eMagazine business model and distribution strategy. Clearly, tablets will play a huge role in how we consume news. News Corp is jumping at the opportunity with *The Daily*, a paid application that gives you daily news for $39.99 for a

two-year subscription. Others news sources such as CNN, The New Yorker, The New York Times, The Wall Street Journal and Time Magazine also have apps. More than 150 magazines are listed in the App Store Newsstand.

It doesn't stop there. You can now use an iPhone to control a PowerPoint presentation on a PC, more as a way to demonstrate how change is occurring than anything else. An iPad app allows the touch-based device to control a Mac OS X computer. Automotive manufacturer Hyundai Motors now provides an actual iPad as the owner's manual for its Hyundai Equus car.

In the near future, look for much more than just owner's manuals, magazines, movies and remote controls. Tablet apps are exploding and the demise of dedicated consumer electronics hardware has begun. More and more games are being tailored for tablets. How much money will game controller firms throw at hardware in the future?

2.4 The Tablet Takes On The Personality Of The App

Mobile devices, especially tablets, have clearly diverged from traditional personal computer design by incorporating a "mobile platform personality." This enables more than a presentation user interface. The microapp exploits mobile device features like touch, location, motion and voice to create an immersive experience adapted to the user's goal, location and circumstances.

In essence, the device takes on the personality of the app (see Figure 3), becoming a meeting tool, video player, remote control, dictation recorder, etc. Sensing capabilities (such as GPS, camera, gyroscope and accelerometer), multiple input modes (such as touch, motion and voice) and voice as well as visual output enable new applications to engage users, immerse them in a process, and then transform the device for the next activity.

Seen in this way, the tablet and its apps become the new all-in-one: an infinitely configurable device. But it is the apps that do the work; future consumer selection criteria will be less about the tablet itself, and more about the apps that run on it. The river of tablet apps is already a torrent (several million created in a few years), but it is about to become a flood.

Figure 3: Mobile App Personality: Optimizing User Engagement

2.5 Touch And Voice Are Just The Beginning

The rapid growth of smartphones and tablets has created an overwhelming demand that enterprise IT must respond to. The mobile revolution has driven personal devices into the workplace, and has spawned new use cases suited to these new platforms. However, the implications go well beyond support for "bring- your-own-devices" and the importance of mobile ecosystems.

Touch Drives Acceptance and Use

Once the impact and value of touch in the hands of those with no computer skills was seen, the movement from all forms of mobile phones to touch-based smartphones was dramatic. Certainly the power of the devices to run a wide range of apps was a strong incentive, but the way in which touch was implemented to create an intuitive and engaging experience was the biggest driver of the sector's explosive growth.

The difference between just implementing touch as a feature and really doing it well is transformational. Apple was first mover in tablets with the iPad, but even given time to make up ground. The competition has yet to create an alternative that can keep pace with Apple's momentum.

Next Generation of User Experience

The keyboard and mouse brought huge improvements in usability and productivity over command interfaces, but they still were an artificial and intermediary barrier between people and their systems and information. With touch and voice the user can become more directly immersed in the technology and the information it presents. Mobile devices, in particular the iPad and other tablets, have become the preferred way to do things that previously required a PC, notably web browsing, consuming content, shopping and social networking. Instead of just providing more-efficient tools like the mouse and keyboard, this highly transparent interface technology allows our mobile systems to more directly augment human activity and essentially become digital companions.

A defining aspect of mobile devices is their ability to tightly unite software functions with features of the hardware so the device takes on the personality of the app. By exploiting the app's personality they can mimic and replace other dedicated devices like a check scanner, a camera, a book reader or an insurance adjustor. Touch and voice are powerful enablers of this distinctive transition from task process to user experience, and additional features for sensing, input and output in more naturally human ways will continue to expand appeal.

Voice-Powered Smart Virtual Assistants

The introduction of voice interaction combined with intelligence to interpret queries, solve problems and handle tasks will increase the attractiveness and success of mobile devices. Voice combined with advancing artificial intelligence capabilities will broaden how people use computers to get things done. Touch- and voice-powered devices create an experience that more directly connects people with their digital environments and make the experience engaging and appealing.

Voice redefines how people interact with computers, even more than the mouse did. The ability to vocally enter commands, execute searches, or perform dictation is not new, and is available even on desktop systems. What is new is a smart assistant that combines voice recognition with natural language processing, an engine to derive meaning and context, intelligent selection of cloud-based resources to fulfill requests, and the ability to learn. This combination empowers can handle complex requests to access multiple systems or databases and provide a consolidated response.

Touch, voice and virtual assistants let users interact more naturally and intuitively with their virtual world, just as they would with the natural world. Rather than navigating systems and manipulating information with an external mouse, the new interface paradigm provides a personal connection directly to the content and the computing environment (see Figure 4). This reduces the learning curve for users, but it also removes much of the distracting overhead from each interaction (the need to look at a

screen, for example), making any process more efficient and transparent.

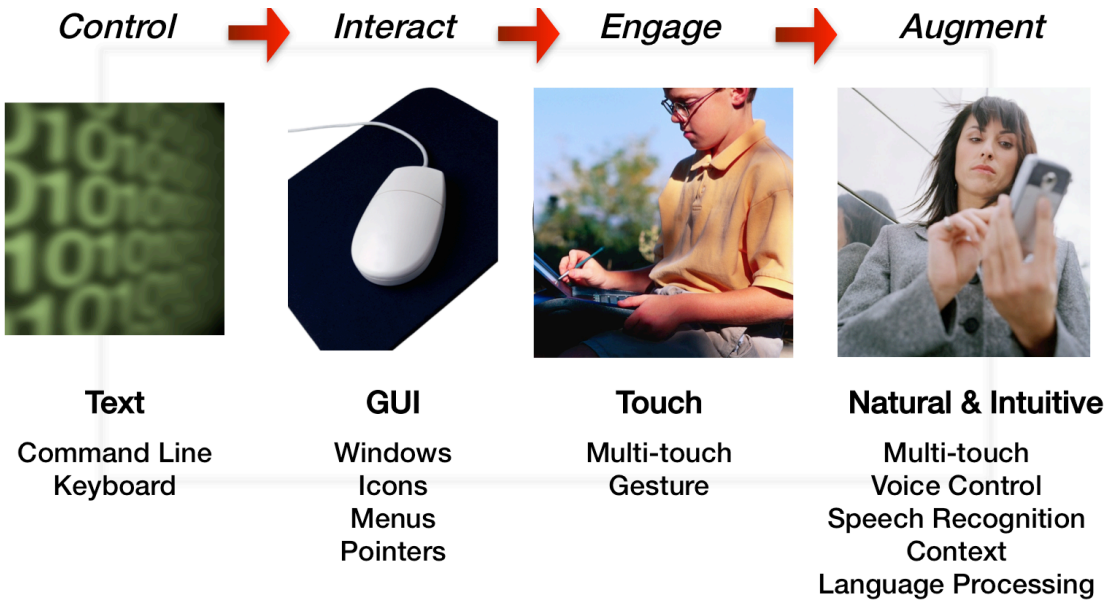


Figure 4: Generations of User Experience

One factor that has retarded adoption of meta-processes like decision support, business intelligence and even search has been the difficulty of navigating complex systems to enter queries, manipulate intermediate results and hone in on answers. Virtual assistants will excel in the same realms that are being addressed by microapps – target a narrow task with a specific objective, and take it directly to completion with a single simple command. Instead of opening the reporting application, selecting summary reports and choosing the desired timeframe you merely speak "what are the top five problem accounts in this week's plan", or "give me tomorrow's sales forecast update".

Delivering a user experience that is both more natural and personal in nature will be a significant force in continued expansion of mobile device usage. What is currently a differentiator is the drive toward simplicity and engaging experience provided by the iPad versus a strategy of providing a more customizable platform and PC-like operating systems. Attempting to enable the tablet to be a more fully functioning PC will be appealing mainly to technologists, but less so to the consumers that find simplicity and consistency more compelling.

Feature and function have been key selling points and marketing focus. While still important, successful products must also effectively create experiences in which capabilities seem like natural extensions and not afterthoughts. Users have grown accustomed to weak or even cumbersome enterprise systems, but the ease with which

new smartphone and tablet apps can be learned and experienced spells the end of the mediocre user interface.

Planning Assumption: By 2013, voice will be one of the dominant user interface methods on phones and tablets, and artificial intelligence-based intelligent digital assistants will surface.

Touch and voice are not merely features; they are the foundation for creating the next wave of systems with heightened usability and more immersive experience. Enterprises need to study the human-factor implications of this new interface paradigm, and begin to develop the skills to integrate them into their applications.

2.6 Replacing a Laptop with a Tablet

PC unit growth has slowed, in part due to the success of tablets. While once the PC was the only cost-effective choice for nearly all computing jobs, other devices are as suitable or even more suitable for a growing number of tasks. Although tablets cannot completely replace general-purpose PCs, they have become the preferred devices for a growing range of applications and use cases. This research note explores the idea of making a tablet the primary device for a user.

Apple's iPad and the avalanche of competitive tablets following it provide the tipping point for entering a post-PC era. More fully functioning PCs in tablet form, with pen or stylus input, have been around for years but continue to have niche utility, mainly in vertical applications. However, redefining user interaction using touch has significantly improved the user experience, and the ecosystem around the tablet (content, apps and peripheral devices) now makes it a competitive tool for end user computing.

Where once a PC was the only choice even for casual or simple needs, a new class of more specialized and more convenient tablets is taking over those uses. The key to shifting momentum toward tablets has been their focus on the consumer market, with elegant and intuitive touch interfaces and tightly focused function-specific apps.

In specialized situations and custom use cases, the tablet's highly portable form factor has been useful for insurance claims, inventory tracking, real estate, medical, and package delivery applications. The same is now happening with the new and expanding selection of tablet devices, but the use cases now apply to every consumer and the devices are very broadly affordable. The value propositions that made tablets and apps popular in the consumer space translate directly into business applications, and the breadth of business use cases is expanding. Mobile professionals in general are quick to adopt tablets and sales teams are finding tablets capable of being game-changing across their entire job. Healthcare and education are becoming growth

opportunities, and tablets for executives provide highly portable and elegant interfaces for communicating and keeping tabs on the business with reporting and mobile business intelligence.

The significant trend is not that one device is replacing another, but rather the end of the enterprise mandate that each user rely on one device for most of their computing needs. High-end users have been given multiple desktop and laptop systems, and millions of users have company-issued smartphones in addition to their company-issued computers. However, tablets have given nearly all workers the ability to use, and the confidence to demand, work connectivity at will, anytime, from anywhere. Tablets provide a blend of convenience, portability, connectivity and power that makes them a user's ideal go-to device for on-the-go work.

The Basics of a Tablet at Work

Tablets are not suited for every use and function that conventional PCs can perform, and some built-in limitations may make them a poor choice for certain tasks. Key considerations include the smaller screen size, lack of built-in mouse and keyboard, and less power for complex tasks and full multitasking. Even these limitations are shrinking in impact with the accessories like Bluetooth keyboards, and by the rapidly advancing power and function that continues to be introduced.

On the software side, the ease of building apps and tailoring them to specific needs lets users customize and personalize their tablets more than most laptops (operationally, not cosmetically), making them more intuitive to use and easier to integrate into the owner's ongoing daily life. For example, an app designed to aggregate information quickly and easily from many sources and store it in a company archive can be the machine's key value for one group of users, while others may prize an app that provides voicemail notices for upcoming calendar events.

The peripheral options are just appearing; more are expected every week. To use a tablet as an everyday workhorse, we recommend accessorizing it with a Bluetooth enabled keyboard. This makes it feel much more like a laptop and solves the input problem. In a stationary situation like a home office, a larger dock with a display and other options can create an even more capable computing experience.

Top PC Replacement Use Cases

Tablets are exceptional for accessing content, either multiple forms of media on the device, web content on the Internet, or enterprise data on corporate networks. By themselves, they can handle a lot of tasks very well, and with a keyboard can tackle relatively complex computing needs. While tablets with a keyboard will be a viable approach for some users, others will prefer to keep their tablet sleek and simple and use a separate laptop device for the more complex work.

Generally, mobile workers, or those who need ready access to basic communication and computing functions away from home and their main work locations, should consider making a tablet their primary device. Users who need more complex processing, access to enterprise applications, sophisticated document or media editing, or require particular PC software such as Microsoft's Office suite, a tablet will be a supplement and not a replacement.

Professional Use Cases

In business, there are many opportunities to leverage tablets to significantly improve productivity or transform how work is done. There are especially strong use cases for many professional roles, as well as general use cases for traveling, attending meetings, staying connected when away from the office and casual access in various personal settings.

Planning Assumption: By the end of 2014, 60% of enterprises will have tablets deployed for their mobile workforce.

- **Sales & Service**: An ideal use is for sales, service and support professionals. The truly productive sales professional is constantly making sales calls, following up with account visits, giving presentations, handling email, creating or tracking orders, and using social networks to connect. A tablet handles these tasks extremely well, and its portability and long battery life are perfect fits for being constantly mobile and at customer sites. With an additional keyboard, even handling more complex tasks like creating proposals or entering orders can be done effectively.

- **Service Industries:** Many service industries are using tablets to completely change how significant parts of the business are done. In restaurants, servers can use tablets to display menus, showcase images or videos of food items, show videos of food preparation, and take orders and process payments. Airline pilots can use a tablet to replace paper documents, simplify preflight planning, and provide in-flight information. Courseware and other learning apps are being implemented on tablets to replace more expensive fixed kiosks for training service professionals.

- **Healthcare:** In hospitals, doctors and nurses can have patient and reference information at hand as they move from room to room, and can update patient records immediately. Doctors can use videos and diagrams on tablets to share instructions and educational information in place of printouts, and administrators are replacing paper registration forms with tablet apps for patient information.

- **Executive Use:** Executives themselves often introduce tablets into the executive suite. Tablets can help busy executives connect more productively to essential business processes and activities, with a much flatter learning curve to embrace new capabilities. In many cases the PC is too complex and cumbersome to use effectively, but executives can have a tablet always at hand, always on, and receive immediate updates and alerts to their most critical needs. For example, senior managers can get up to the minute notice of trends and events across all areas of their ERP system.

- **Other Professionals*:*** For other professionals the use cases are just as compelling. In a busy office with lots of meetings, the tablet is far better than a laptop for taking meeting notes, checking email or IM, or even making a quick presentation. Because the tablet can become a visual dashboard, looking through tightly focused apps to monitor projects, financials, or transaction activity, it is becoming indispensable for managers and executives.

Preferred Tool for Meetings
Tablets are becoming the preferred tool for managers and professionals who spend hours in meetings. Being no more cumbersome than a notepad and not dependent on access to power, tablets work well for checking email and taking notes in meetings. They are also increasingly used as presentation devices, and can easily share documents and other reference material to support meeting objectives. With an optional keyboard, even more extensive editing can be handled effectively.

Traveling Light
Tablets have a nearly perfect form for heavy travelers. Being lightweight, small and not built with a large keyboard and screen makes them more convenient to pack and more suitable for working in flight. Their long battery life and network connectivity are strong assets for working at airports where space and power are limited. If access to email and lightweight document editing are the most complex requirements on a trip, a tablet can allow the laptop to be left behind. Slightly more intensive document handling can be made less of a challenge by including a keyboard accessory. If you need heavy computing power, intensive document creation and editing, or direct connection to printers, disk drives or other peripherals the tablet will likely come up short.

Staying Connected Away From Your Office
Professionals are accustomed to being connected at any time, and in many instances this is a job requirement. Smartphones have provided the key links to email and voice connections, but increasingly, people need to monitor other applications and activities that are too large or cumbersome for viewing on small screens. Any time when the user is away from the office, whether at lunch, having a meeting down the hall or across town, most things can be better handled using a tablet.

Casual Access, Personal Settings
Laptops and personal PCs at home have enabled continual connection to the business. A large percentage of tablet use at home takes place on the couch, at the dinner table, on the patio or even in bed. Creating an informal, ad hoc and simple way to check email, follow through on a response, or monitor progress in a workflow, inventory or other business process adds significantly to business effectiveness without overly burdening people away from the workplace. Fast startup times, simple interfaces and apps, and ease of handling allow tablets to excel in keeping the work intrusion at home minimized. When a few minutes to check on an activity or a project is all that's available, a laptop is an inconvenience and smartphones often deliver too little content on their much smaller displays.

Introducing and Managing Tablets in the Workplace
Tablets don't have to be anarchically tolerated "bring-your-own" devices, nor should they be banned or feared. Tablet procurements can be planned and implemented like any other IT provisioning project. Some common-sense guidelines:

- Survey business units and analyze work processes to identify optimal use cases and easy-to-justify "low-hanging fruit."
- Consider tablets as the primary device option for basic users who do not require complex applications or processing.
- Focus on professional use cases with the best-fit, especially sales, service and support, and mobile professionals.
- Don't expect large opportunities to displace existing PCs with tablets; rather expect many opportunities to improve productivity by providing tablets as additional devices.
- Plan to provide access and support services for a workforce connecting to the business with multiple devices and form factors.
- Investigate use cases for specialized tablet apps that leverage the portability and form factor.

2.7 The Growth of Tablets Over The Next Five Years

Sales of tablets seven inches or larger are poised to grow faster than laptop PC sales as the Tablet Era kicks into gear between now and 2016 (see figure 5). The use cases in the enterprise will accelerate as businesses find more use cases as Tablets replace laptop PCs in general workplace use.

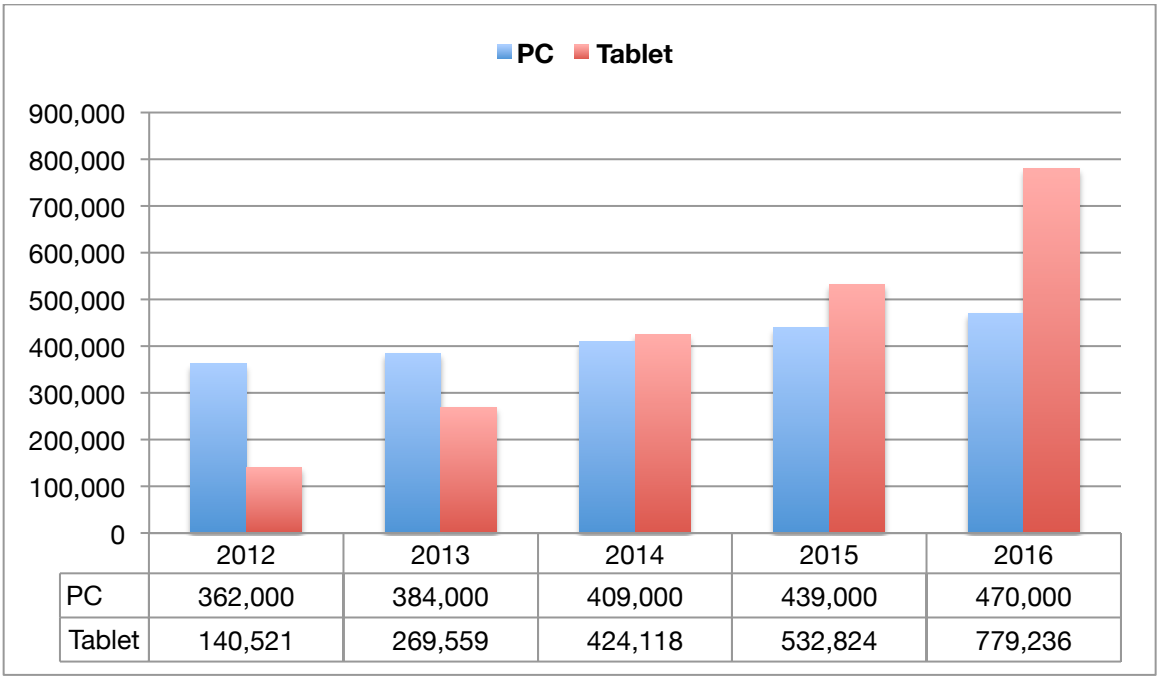
Planning Assumption: By 2014, annual tablet volume will exceed annual PC shipments.

Aragon anticipates that outside of the workplace and general consumer adoption, the biggest growth will occur in education. The rise of the digital, interactive textbook will

be one of the most revolutionary changes in how children learn. Apple's new interactive book authoring tool allows for rich media (videos) to be added to the content of the book. Digital textbooks, combined with a modest price drop for tablets will make a compelling business case for schools to invest in tablets.

Within education, the segment that will grow fastest will be K-12 in developed nations, as learning content becomes more digital and interactive and as tablets decrease in price, making them affordable for schools and parents. While this growth will start slowly in 2012 and 2013, it will accelerate quickly in 2014-2016 and beyond.

Even at current prices, children are already using smartphones and tablets, and the surprise segment is children under 5. As content grows, children will use these devices not only at home for entertainment but at school, too. The growth of multi-media e-books will help to fuel this, and by 2016, tablets are poised to be double the size of laptops due to the use by both children and other nontraditional uses, such as interacting with consumer devices such as home theaters, appliances and cars.



	2012	2013	2014	2015	2016
PC	362,000	384,000	409,000	439,000	470,000
Tablet	140,521	269,559	424,118	532,824	779,236

Figure 5: The Tablet Forecast: 2012-2016 (thousands of units)

Section 3. The Multi-Device OS

3.1 Overview

The stakes are very high for smartphone and tablet providers. Smartphones are poised to out-ship "non-smart" feature phones, and the tablet market has gone from zero to 55 million iPads in two years. Success in this segment has more to do with the software, particularly the operating system, and the ability to use it on multiple devices, than on any particular features of the hardware. Key aspects of this strategy include sharing code across devices to reduce cost and complexity, providing a common development environment, and offering a consistent and familiar experience for the many users who have both types of device. Aragon calls this a *multi-device operating system* or MOS. In this MOS era, Apple has jumped to a lead with Google a fast follower.

The strategic nature of operating systems is often lost on people. On the simplest level, an OS just controls the hardware and the software processes within a system: handling user input, the display, communications, process scheduling and so forth. However, this gets more difficult when an OS has to work on many different devices. Today this means smartphones and tablets that have a lot in common. Soon, however, it will include many more devices with increasingly diverse shapes, sizes and designs.

3.2 The Race is on: Refresh Rate and Upgrades

The commonality of devices starts with the operating system. In many respects, the iPad is just a larger version of the iPhone, due to the common OS. For enterprises that create apps, having one OS for multiple mobile platforms is a significant benefit both for manageability and for developers. For one thing, it means managing just one set of updates that can be scheduled synchronously. Another key concern is the reliability and stability of the update itself. Enterprises that depend on mobile devices as development platforms should become part of the OS provider's developer program so they can test new releases of the OS before they go into production.

Upgrading the OS regularly for both bug fixes and enhancements is important both for innovation and to ensure that the OS stays up to date. Most critically, making sure that the upgrades happen flawlessly (with minimal to no IT support) is important. Enterprises need to look at this area carefully when evaluating vendors. Vendors should provide a roadmap that shows how often upgrades and updates are planned.

Today, few vendors have matched Apple in this area. Especially in tablets, providers are struggling to catch up to the iPad's large lead. Other providers must be able to

match Apple's release schedule and rate of capability growth to establish competitive credibility.

3.3 Google vs. Apple

In the MOS market, the battle between Apple and Google goes back years. It demonstrates how high the stakes are and how large the investments have been in the overall ecosystem.

The race started in 2003 when Apple introduced its iTunes music store and started online content distribution. By 2005 Google had bought Android and started work on the Android OS. Apple is known to have invested roughly $150 million to develop the iPhone, which it announced in January of 2007 and shipped by June of that year. At the same time, it made the first applications available via the iTunes App Store, which millions of users were already familiar with. It was an instant hit.

Later in 2007, Google countered by introducing an Android SDK, a developer program, the Android app store (now Google Play), and a series of carrier partnerships. The company offered Android free if the carriers used Google as the default search engine on their phones, and this model garnered quick support.

A significant difference between iOS and Android is the level of integration between the hardware and software packages. Apple designed and controls both its hardware and operating system, and has maintained strong compatibility between iOS and the underlying devices from release to release. With Android, Google receives both benefits and challenges through its open strategy and the various hardware manufacturers that implement Android.

The open strategy for Android means there has historically been limited oversight of the apps provided. Recently Google has begun to create guidelines and templates for design of apps and devices, but does not exert control. This is a big difference between Google and Apple. As part of the core terms and conditions for participating in the Apple ecosystem, iOS developers are held to high standards, and apps that fail to meet them will be rejected or removed. Although considered restrictive by some, Apple's strict curating minimizes inappropriate content and malicious or poorly designed apps. Although not a complete protection against malware and other attacks, the controls significantly reduce the risk of these threats. Figure 6 shows the history of the Google vs. Apple battle.

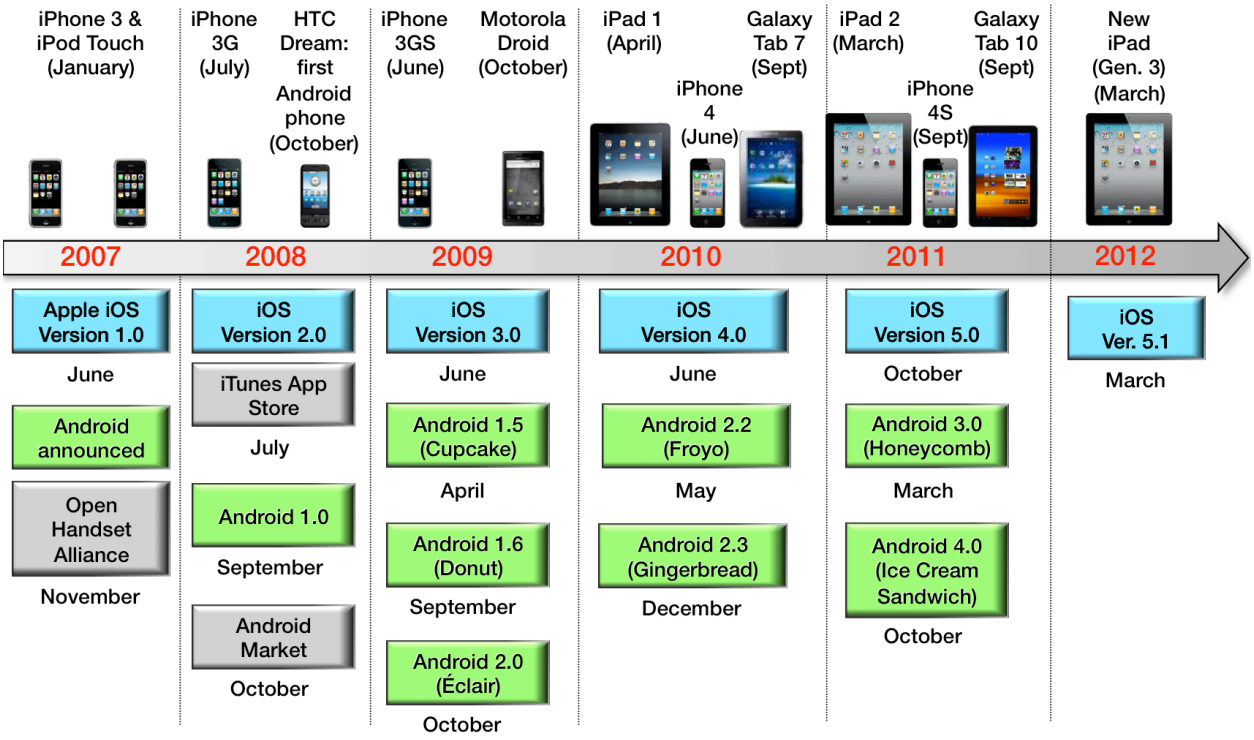


Figure 6: Multi-Device OS Wars Between Apple and Google

3.4 Apple – iOS

Apple started work on a multi-device operating system over ten years ago when it announced OS X for the Mac computer line. iOS is a mobile OS that was derived from its big brother, OS X. Both are based on Apple's Darwin platform with contributions from Next (which Apple acquired in 1997) and Berkeley (BSD) Unix. Darwin consists of the Mac OS X kernel, BSD libraries (e.g. virtual file system, network stack and process model), and BSD command environment.

iOS has been on the market since 2007, when the iPhone was introduced (see Figure 7). Today it powers the iPhone, the iPod Touch (mini-tablet), AppleTV and iPad. This makes life easy for users to keep their apps and content synchronized. Apple has consistently delivered a major new release every year since the first iPhone shipped, and this consistency is the benchmark to measure other vendors against.

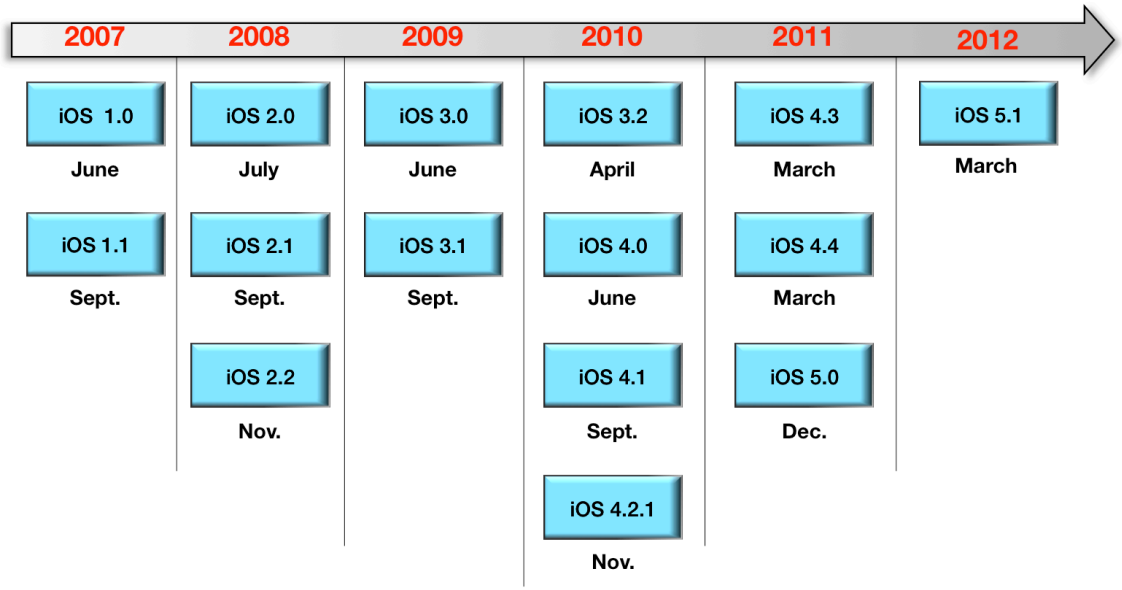


Figure 7: Apple iOS Release History

Not only is iOS updated regularly, but the quality of each release has also been enterprise grade. Users do not have to go to IT very often for iOS support. Apple has proven to be a reliable and stable producer of a mobile OS that supports multiple hardware platforms with its own track record of reliability and stability. This gives Apple a significant advantage, in that future features and developments can be leveraged across multiple platforms, cutting cost and improving consistency.

The issue facing other providers is, "How many development teams can work on multiple systems?" Even with multi-device development environments and the expected leverage from using HTML5, today enterprises can still gain advantages from using the native environment (e.g. Objective C for iOS). These can result in improved performance, and more engaging user experience. For most vendors, this starts to take a toll. From now on, enterprises need to look carefully at the OS and the platforms it supports. Looking at an OS as multiplatform capable is a new way to evaluate a provider.

3.5 Google Android

Google has done a solid job in becoming a formidable mobile competitor to Apple. Google recognized the mobile platform trend early, bought Android Inc. in 2005, and in 2007 offered the Android OS to the Open Handset Alliance, a consortium of handset manufacturers looking for a platform that could challenge Apple's iOS.

This has been an opportunity seized by Google, and Android has filled the huge gap left by Microsoft with its late focus on the exploding mobile market. Android quickly

became the OS of choice for many handset and tablet manufacturers. Other providers that failed to act are still scrambling to catch up. Indeed, Android has surged past Apple's iPhone to take the lead in smartphones.

Two of Android's key advantages have been that Android was open, and that it was free for manufacturers to use (as long as they made Google Search the default search engine). However, the openness has also been a potential disadvantage for both users and Google, by allowing hardware manufacturers to fork Android into multiple variants that have begun to reach a disruptive level of inconsistency.

Still, Google has done very well in this market, going from zero share to the lead share in less than 4 years. However, this share includes multiple variants of Android, representing a fragmented distribution of devices with varying features and futures (see Table 3). Google has developed a converged path, with its newest version, Android 4 (Ice Cream Sandwich), aimed at unifying the OS strategy.

Version	Code Name	Release Date	Percent of Active Devices
Android 1.5	Cupcake	Apr 2009	0.4%
Android 1.6	Donut	Sep 2009	0.8%
Android 2.1	Éclair	Oct 2009	6.6%
Android 2.2	Froyo	May 2010	25.3%
Android 2.3 – 2.3.2	Gingerbread	Dec 2010	0.5%
Android 2.3.3 – 2.3.7	Gingerbread	Feb 2011	61.5%
Android 3.0	Honeycomb	Feb 2011	0.1%
Android 3.1	Honeycomb	May 2011	1.1%
Android 3.2	Honeycomb	Jul 2011	2.1%
Android 4.0 – 4.0.2	Ice Cream Sandwich	Oct 2011	0.4%
Android 4.0.3	Ice Cream Sandwich	Dec 2011	1.2%

Table 3: Distribution of Active Android Devices by Version
(Data Source: Google, March 2012)

Android 4 (Ice Cream Sandwich) is a unified operating system that supports all types of mobile devices, including smartphones and tablets. It started shipping at the end of 2011. Many new features have been added, creating an increasingly powerful platform, but the most significant is the convergence of tablet and smartphone versions into a single OS. Although some variations among different devices will persist, this convergence gives Google a significant boost in competing with a mobile ecosystem, where common forms and universal functions are important elements of the design

philosophy.

An issue related to the openness of Android is the diversity that occurs when implemented on different devices by different manufacturers. Google has only recently begun to address the variability of interface and user experience that has resulted. Google's Android Design group is increasing its focus on consistency across this very diverse population of smartphones and tablets. In 2012 the Android Design group began providing guidance to Android developers, including in-depth guidelines for style and user interface, and templates to use as "quick starts." While this will create some improvement, the guidelines are optional, and so far, Google has no program to manage or monitor the consistency or commonality that results.

Android's openness allows many different vendors to enter the device market. This stimulates innovation, increases freedom of choice for users, and thus expands the market. However, it also allows each release from each provider to be a separate and different product. This is in no small part due to the wide-ranging diversity among hardware products enabling considerable differentiation.

Moreover, because Android has to be customized for each piece of hardware, carriers and manufacturers often choose to support different versions of the Android operating system, and to be selective about when (or never) to support upgrades, particularly for older phones. For instance, each handset maker and each carrier spends time and money adding its own custom code. There is typically a considerable delay before each "new" version actually reaches end users. As a result, many Android devices are one or more major OS versions behind after only a year of service. These factors increase the diversity of devices and OS versions that enterprises need to support, unless they mandate a narrow hardware selection for workers.

Even with an officially "universal" version of Android, compatibility issues will inevitably surface. Google has kept pace with Apple on releases but has not been as consistent in maintaining common feature sets between phones and tablets (see Figure 8). Few devices fully support Android 4, and its power and memory demands may keep it permanently off most hardware built before 2011. Unless they are prepared to replace much of their mobile hardware, IT groups will have to support at least two versions of Android for as long as it takes to amortize their older devices.

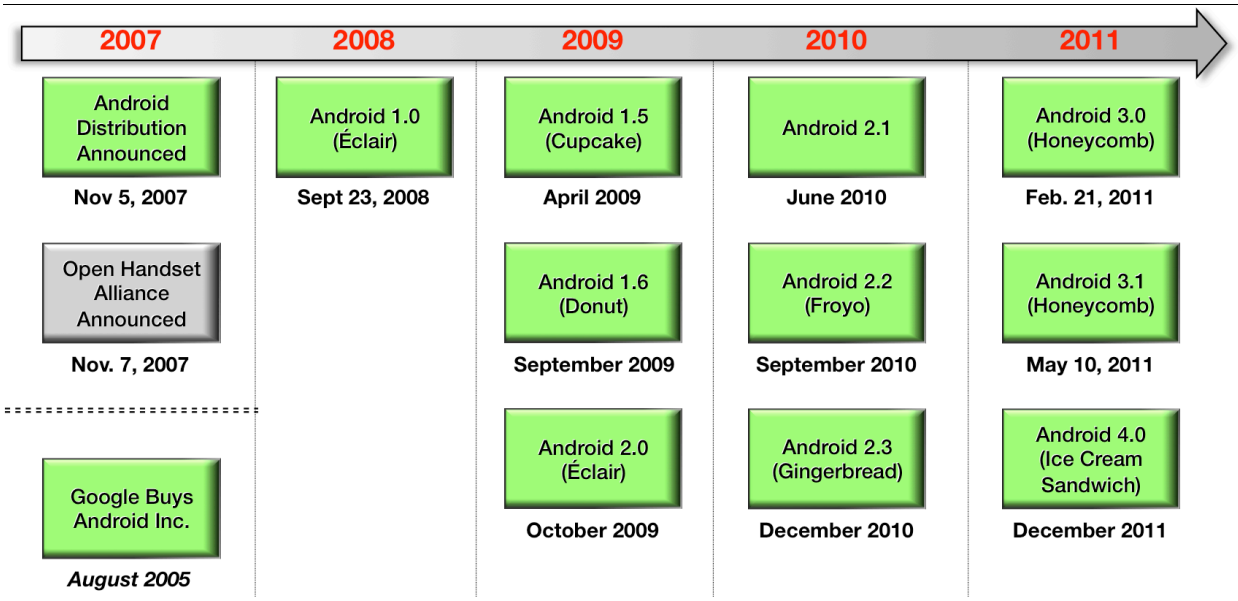


Figure 8. Google Android Release History

The multiple Android versions, together with the open nature of the app environment, will continue to add complexity and risk to enterprise mobile strategies. One way that enterprises are protecting themselves is by moving to private app stores to better defend against malware, and to gain greater control of the environment, the software inventory and its distribution (See Section 6 for more on Private App Stores).

To go head to head with Apple in the enterprise, Google needs to sand down Android's sharp edges until it reaches Apple's level of near-invisibility to users. This will lower support needs and improve productivity by letting workers focus on their human goals and not on "driving" the system.

3.6 Microsoft

Microsoft has been in the mobile market longer than anyone, but has fallen significantly behind the two mobile OS leaders, Apple and Google. Microsoft remains in the midst of a relaunch of its Windows Phone 7 effort, and is at the same time overhauling Windows for PCs and tablets. Windows smartphones have been moderately successful, but the company has not leveraged this in the tablet market. Overall, Microsoft has not yet become a full-fledged competitor in the mobile tablet and ecosystem race.

In evaluating Microsoft's MOS approach, it today is essentially a mobile phone strategy with limited tablet presence with Windows 7, and a future based on Windows 8. Windows Phone 7 is the current mobile OS in Microsoft's line (see Figure 9). It implements the Metro style user interface and characterizes the future of user

experience in Windows.

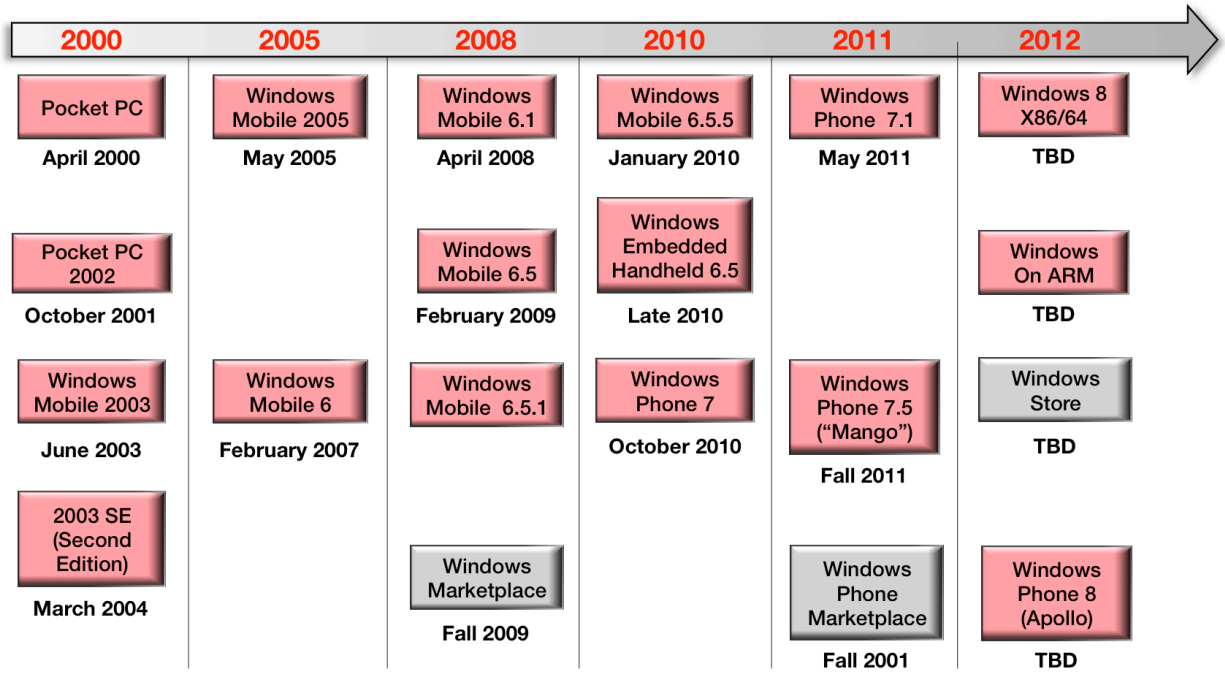


Figure 9: Windows Mobile Release History

Microsoft is not competing in tablets other than with its Windows 7 x86/64 offerings. The market for mobile has shifted significantly since Microsoft initially attempted and stalled out with their early consumer tablet effort. The MOS approach has gained significant momentum, and the extraordinarily rapid growth of tablets caught Microsoft off guard as it was tightening its own focus on driving and maintaining consistency with Windows.

Today, for select applications such as Sales where signatures need to be obtained from clients, Windows 7 Tablets are not viewed as mainstream. Several OEMs do offer tablets that run the desktop version of Windows 7, for use where Windows applications and compatibility are essential, and where industry-specific or ruggedized devices are needed (e.g., medical, construction, delivery). This constitutes Microsoft's initial penetration into the tablet market, and the company is intent on leveraging its desktop dominance as it moves deeper into the mobile space.

A major challenge for Microsoft is time to market. The Windows development cycle now averages three years between major releases (see Figure 10), with Windows Phone recently showing improvement and the potential for an 18 to 24 month cycle. However, this is in contrast to Apple and Google releasing a new major version every year.

Microsoft appears to have brought out its preview releases of Windows 8 with a shortened cycle, but it will need to significantly improve its timing to bring its release schedule in line with Google and Apple. The risk of failing to shorten this cycle is high. Microsoft has three operating systems to manage, with WOA being an entirely new OS and Windows Phone undergoing another architectural change.

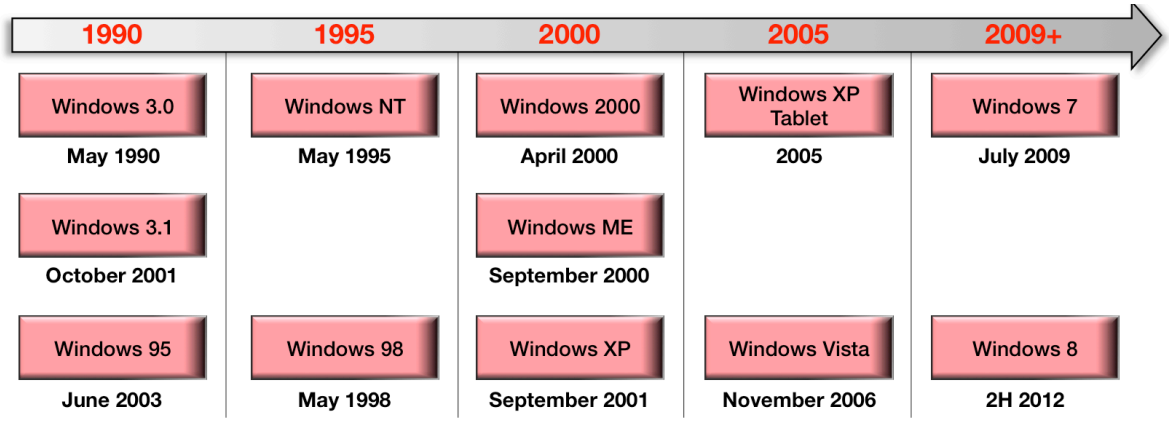


Figure 10. Microsoft Windows Release History

Tentative Tablet Moves

In 2009 Microsoft was close to producing an advanced consumer tablet, the Courier, which was based on a non-Windows OS. At that time Microsoft decided to cancel that project, and instead to bet on its ability to make Windows a competitive mobile operating system. Instead of being in front of the massive growth of consumer tablets Microsoft is well behind the leaders and finds itself in a reaction mode, needing to play catch up.

Microsoft's PC dominance is proving to be both a benefit and a hindrance in the mobile arena. With its stature in the enterprise, Microsoft gets a lot of interest and attention even when its products have more limited capabilities than the leaders. However, the company's short-term road map delivers only partial solutions to the problems of interoperability between the desktop and mobile environments, which is Microsoft's core value proposition for its mobile strategy.

Windows 8: Salvation or Confusion?

Microsoft's Windows operating system is in the midst of one its biggest ever overhauls. Windows 8, the next version of Microsoft's flagship, is currently in a consumer preview beta, and is expected to ship in Q4 2012.

The cornerstone of Microsoft's Windows strategy is establishing a competitive position in the tablet market while creating a cohesive strategy around its client operating

systems for different form factors. Its strategy is designed to provide a Windows OS for both PCs and tablets, and on both ARM and Intel processors.

Accomplishing this will result in Microsoft providing three different operating systems: Windows 8 for PCs and x86/64 tablets, Windows Phone 7 for smartphones, and Windows on ARM (WOA) for ARM-based tablets (see Figure 11). As a result, the app ecosystem will be fragmented with different device types aimed at differing use cases and an environment in which additional development effort will be required to deliver apps across all four environments.

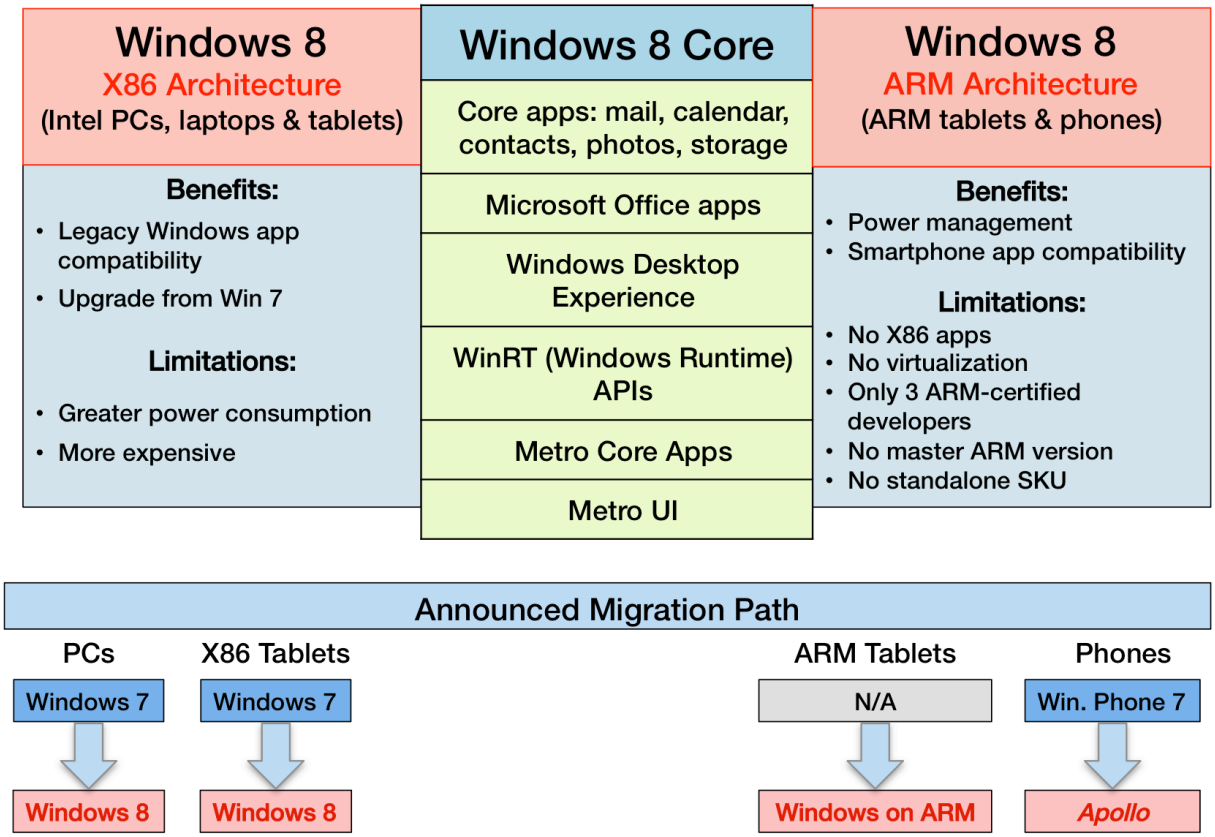


Figure 11: Microsoft's Multiple Windows Strategy

Microsoft is making a risky play for the tablet market. Its tablet strategy is bifurcated, aiming to both protect its enterprise Windows franchise while seeking to take on the consumer market with a new OS. With three different OSs, Microsoft will be challenged to make its initiative work on these multiple code bases on a competitive timeline.

Although Microsoft will have three operating systems, the initiative for Windows offers substantial consistency. Across PCs, tablets and Windows Phone, Windows 8 offers a

common user interface in Metro, common built-in core Metro apps, WinRT as the foundation APIs for developers in each environment, the ability to use the familiar Windows Desktop experience, and desktop versions of Microsoft Office (Word, Excel, PowerPoint and OneNote). Windows Phone 7 is the official OS for Windows Phone, but that environment is expected to be upgraded with a Windows Phone 8 version, code named Apollo. It will run Windows Phone 7 apps, and is expected to undergo a change at the OS kernel level, resulting in a common base with Windows 8.

There are limitations to Windows consistency. The WOA tablets will not run legacy Windows applications, or have a virtual or other implementation of any other OS. Windows 8 x86 tablets will have the ability to run legacy Windows applications, and with Metro can have a similar set of apps and user experience to the WOA tablets.

Although this is a bifurcated strategy for Windows, creating different paths for ARM and x86 devices, it positions Microsoft to leverage is enterprise Windows installed base and at the same time open up a competitive front with Apple and Google for consumer tablets.

The OS will incorporate both the “classic” mouse-based Windows PC interface and the touch-based “Metro” user interface introduced in Windows Phone 7 (see Figure 12).

Figure 12: Microsoft Metro User Interface

The Metro experience is a new style started with Windows Phone 7. It will be the

common user experience style to be used across all Windows environments, and aimed at being the Microsoft tablet and touch interface. Across PCs, tablets and phones, Metro style apps are tailored to the individual device characteristics and built for touch. Built using tiles and active updates of underlying apps and information, Microsoft is aiming to differentiate Windows from the more static icon-based approach in previous Windows versions, Android and iOS.

The Windows Desktop model and experience continues as the basis for strategic Microsoft apps including Office. Windows 8 will enable both Metro and Windows Desktop models to be used (see Figure 13). This enables Office and other applications to be leveraged, but the differences in the dual approach to user experience may add to user confusion.

Figure 13: Accessing Metro and Desktop Experience Styles

Compatibility across a Windows family for both mobile and PC environments is Microsoft's target differentiator. However, Windows 7 legacy applications will only run on Windows 8 PCs and x86 tablets. WOA tablets will not run legacy Windows apps, and will depend on a robust developer community creating new Metro apps. With nearly 600,000 iOS apps and more than 450,000 Android apps, this is a large hurdle. In other words, Microsoft has created a common UI for phones, tablets and PCs (the "Metro" interface), but has not yet created a competitive MOS.

Microsoft's New Tablet Strategy

Microsoft is currently a non-factor in the tablet market. Their tablet strategy is a dual strategy that has significant risk, aimed at simultaneously competing with the iPad and Android tablets while enabling a full Windows experience.

At the heart of Microsoft's strategy are a number of important underlying elements: the Metro style interface, the Windows desktop, Office productivity apps, developer environments, x86/64 applications, and consumer tablet apps. While the Metro User Interface will enable a similar user experience across these device types, there will be differences between the x.86 and ARM application support and differences in development environments. This will cause enterprises to pause and/or delay decisions about PC migration.

With Metro style apps, Microsoft must establish a compelling experience capable of shifting consumer attention from Android tablets and Apple's iPad that are successfully driving market growth for tablets. Where Microsoft has an advantage is in its ability to deliver a consistent user experience from the PC to the tablet and smartphone, using Windows and Metro, which is not matched by others.

Having the ability to create a common experience across this breadth of device types will be attractive to enterprises. However, there are major hurdles for Microsoft to overcome. These are three different code bases on different architectures requiring substantial core OS change, and one (WOA) is entirely new. Issues of different code bases and tools and uncertainty regarding production delivery timing will slow enterprise progress.

Additionally, Google's Android and Apple's iOS are gaining footholds within enterprises, and that increasing acceptance as part of the technology toolkit dilutes the influence of Windows consistency. Regardless of the issues and delays, the ability for Office, including Word, Excel and PowerPoint, to run on PCs, tablets and phones will be a strong attraction for many enterprises.

Enterprises with a strong Windows-centric strategy will have Microsoft options across all form factors, but there will be key differences. Windows 8 for the PC provides migration and compatibility for Windows 7 users: Windows 8 will run Windows 7 apps, and create the similar Windows 7 desktop. For tablets, enterprises that want to maintain Windows legacy support will need to steer towards Windows 8 on x86/64 for Intel and the Intel Tablets.

Microsoft's success will depend on it ability to compete in the consumer market and

for this they are counting on their mobile partner Nokia, which will offer ARM centric Windows 8 products: both Nokia Windows Phone 8 phones and Windows ARM based tablets. This is the competitive hole Microsoft seeks to address, and its approach is to provide consumer tablet apps on ARM devices that offer portability, speed and long battery life, and x86/64 devices that will provide compatibility with the Windows 8 desktop and be able to run consumer tablet apps.

By keeping the core tablet OS aligned with Windows, Microsoft also hopes to keep control of its enterprise franchise by extending its existing licensing agreements. The problem is that the value of the OS has become commoditized. Enterprises will gain little benefit by continuing to pay for OS functions that others offer for much less, and Microsoft will have to alter its licensing model to remain cost-effective as a supplier.

Aragon advises enterprises to review their license agreements for Windows. Microsoft will be in the tablet game, and has the potential to regain a solid standing in market share. But their traditional economic model is under pressure as manufacturers thrive in an open Android world. It may be time for a fundamental renegotiation.

It is the consumer side of the mobile ecosystem that will continue to dominate market growth through 2015. While Windows 8 will allow Microsoft to begin gaining traction in enterprises looking for standardization and relief from the proliferation of personal tablets and phones, it will not substantially increase their market share before the end of 2013.

Where this works in Microsoft's favor is between tablets and PCs. Windows 8 apps will run in both of those environments, and will deliver an advantage the other mobile ecosystem vendors cannot match: support and migration path for the massive Windows PC installed base. This approach allows Microsoft to leverage its huge Windows installed base, while creating compatibility through new Metro apps that are developed.

Time-to-Market Issues Remain

With Windows, Microsoft has historically operated with approximately 3 years between major new releases. For Windows Phone, since 2007 there have been improvements, but the time to new version is between 18 and 24 months. When compared to the 12 month or less cycle from both Apple and Google, Microsoft will be at a significant disadvantage following this path.

Aragon estimates that Microsoft is at least 36 months behind Apple and Google in tablets and smartphones, largely due to delays in creating a scalable OS with the intuitive ease of use that users now demand. Without substantial improvement in this OS release cycle, Windows will continue to lose ground as iOS and Android deliver

new versions annually. This represents a significant risk to the Microsoft tablet initiative.

If Microsoft can speed up their OS development to catch up with the mobile trend, their effort to unify Windows across the full range of computing devices will reposition them competitively as a "full-service" system software provider. This will require a substantial change in Microsoft's historical development cycle time, but it will be worth the effort.

Building Competitive Market Presence

Having fallen behind in its mobile strategy, Microsoft has a lot of ground to gain on Apple and Google. Windows 8 for tablets and PCs will be attractive to enterprises, but it is not likely to enjoy significant growth before 2013 due to limited traction in consumer markets. The dual tablet strategy is fraught with risks. Will enterprises want to run both flavors of Windows on tablets and is their any benefit to doing so? Will the ARM tablets be able to compete in the consumer market against Apple and Google, who have been more nimble and quicker to innovate and deliver upgrades?

However, the strategy to unify Windows Phone with Windows can uniquely position Microsoft to align with the current priorities of the enterprise. As Windows Phone and Windows become more common, Microsoft can leverage its Windows Server products, such as SharePoint and Exchange, with Azure and other cloud services to create a strongly integrated "anytime, anywhere" enterprise ecosystem. This strategy will succeed only if Microsoft's enterprise customers migrate to Windows 8 for their PCs as well, since earlier versions of Windows will not support this cross-platform integration.

Microsoft must improve the reliability, integrity and pace of its OS releases, which so far have not been in line with what Google and Apple can deliver. Bringing its cycles closer to those vendors' 6-12 months while continuing to improve initial build quality will demonstrate Microsoft's ability to adapt to the radically different computing environment of the future.

Can Microsoft Get Back on Top?

Although Microsoft will have many options when it finally deploys Windows across all form factors, its delay in getting to market has already allowed Apple and Android to establish strong competitive positions. Microsoft is not likely to dethrone either of them soon in the phone market, nor will it have a significant impact on the tablet market until at least 2014.

Planning Assumption: Through 2014, Microsoft's Windows 8 tablet share will be less than 10%.

3.7 Research in Motion (RIM)

Research In Motion (RIM) was the dominant supplier of enterprise smartphones for over ten years. Its signature product was the BlackBerry phone/PDA, which was arguably the first smartphone. It provided critical business functionality not available elsewhere, and its trademark characteristics, such as secure and robust email combined with a great keyboard experience, drove strong enterprise adoption and fueled BlackBerry's early lead.

Now, however, the company's core franchise is under siege from Apple, Android and the many smartphone providers, plus the rapid growth of new high-speed data networks from the large wireless carriers. RIM's initial response was to release some touchscreen BlackBerry phones, followed by a BlackBerry tablet, the PlayBook (see Figure 14). The PlayBook was originally crippled because it had to be tethered to a BlackBerry phone. You can continue to use the tethered approach, or you can use the new email capability provided in PlayBook OS 2.0.

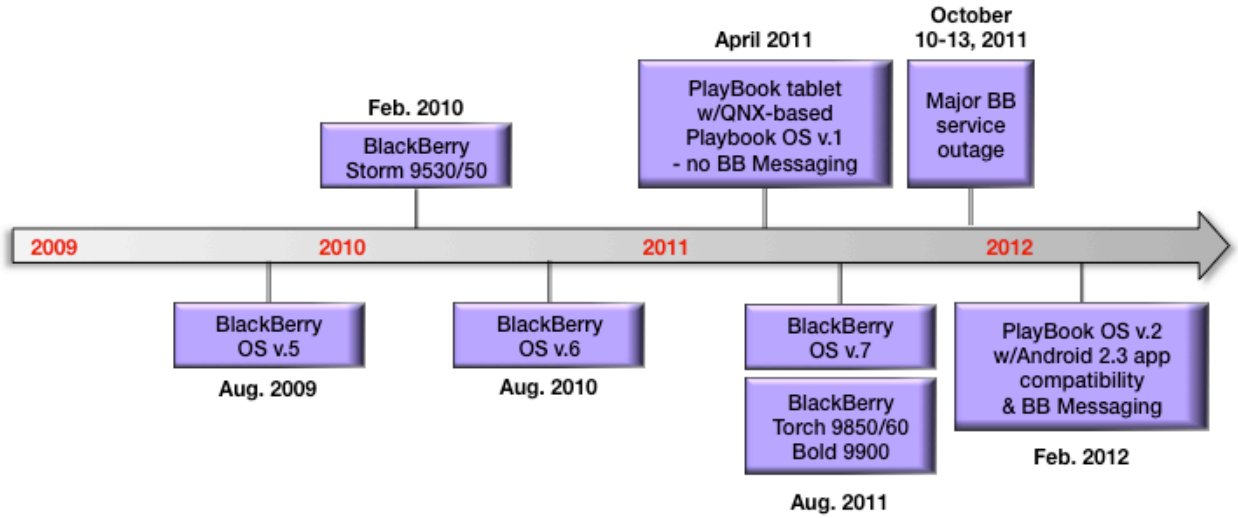


Figure 14: BlackBerry Release History

Another challenge for RIM is modernizing its mobile OS. Today RIM has separate operating systems for its phones and its tablet. BlackBerry phones run on BlackBerry OS versions 5, 6 and 7, and in the fall of 2012 will have the new QNX-based operating system, BlackBerry 10. The BlackBerry PlayBook runs PlayBook OS 2.0. The tablet OS is built on QNX, a Unix-like microkernel operating system that RIM purchased from QNX Software Systems in April 2010.

This problem goes deeper than the tablet itself, and requires attention to a key feature

of the BlackBerry network. Each user's information can be made secure, but RIM's network only allows one hand-held device to access each individual's account. The natural PlayBook market is BlackBerry users, but the need to use tethering to sync the most essential part of the BlackBerry value set has been a major obstacle to market acceptance for the PlayBook.

RIM is just getting started with tablets, and sales so far have been mainly to BlackBerry phone users. The first version of native PlayBook messaging and email support that does not require tethering to a phone is part of the new PlayBook OS 2.0 that began shipping in February 2012. RIM's lack of initial email support for the PlayBook and delay in getting this capability delivered has created additional challenges. In the market vacuum, users have adopted iOS or Android devices, and enterprise acceptance of them has diminished the advantage RIM once owned.

Software delays have also plagued RIM. Major updates, including the new BlackBerry 10 operating system, are not expected until late 2012. Although significant progress will result, RIM's struggles have allowed competing consumer products to erode their market leadership. A further issue is the pace with which RIM has been able to deliver new releases. Apple has established a cadence that both Google and Microsoft find challenging, and RIM have even farther to go in this respect. It will need not only to deliver PlayBook OS 2 and BlackBerry 10 on schedule, but also create a development and delivery cycle that is competitive.

RIM's app store is Blackberry App World, which supports both BlackBerry and PlayBook apps. Like most providers, RIM will use over-the-air updates to provide system upgrades. A dearth of consumer apps was an early problem, and RIM has enabled support for Android apps as part of their app strategy.

RIM's strength has been its focus on enterprise needs, particularly secure and reliable messaging. This focus continues to provide value in RIM's core business market. Enterprise-class messaging and a managed approach to enterprise deployment and management of mobile devices and apps provided RIM's competitive advantage. However, the consumer success of other mobile platforms has significantly eroded the value of this strength for RIM. The balancing act between investing in user experience and manageability has been one of RIM's biggest difficulties. While a secure, manageable and locked-down mobile environment is valuable to businesses, the consumer-driven priority for apps and user experience has become the driving force.

3.8 Amazon

Amazon has been building its content ecosystem for years as a Web retailing pioneer with an enormously popular online bookstore. In 2007 the company introduced the

Kindle e-reader and began to market electronic books that could be downloaded through the store or over the air directly to the Kindle.

Amazon now offers a full line of Kindles designed specifically for book reading, with black-and-white reflective screens. In 2011, however, it introduced the Kindle Fire, an Android-based color LED tablet that goes well beyond an e-reader, supporting video and a range of Android apps. The Fire is a 7-inch tablet, while not positioned for business work, is well equipped for reading, watching movies, listening to music, playing games and web browsing.

The Amazon content ecosystem features 19 million movies, TV shows, songs, books and apps. It is one of the few content ecosystems with the size, quality and consumer interest to attract users. In addition to the vast content inventory it also has a growing app store with a large library of Android-based apps (see Figure 15).

Amazon's years of online commerce experience will help grow this app store. Not all Android apps make it to the Amazon Appstore, as they curate every app for the Kindle Fire and aim for creating the best possible customer experience. Amazon makes it easy to find, buy and download software, and customers find them reliable and trustworthy.

Amazon's primary impact is in its ability to distract attention from the main enterprise ecosystem players. With the strong initial sales of the Kindle Fire, Amazon has eroded a portion, albeit a relatively small one, of the greater market for tablet devices. Its ability to drive very large volume and attract developers to a growth consumer market for apps has the potential to divert or steal developer support from one or more of the others.

Figure 15: The Amazon Appstore for Android and Kindle

Aragon expects Amazon to expand its tablet line and offer larger tablets, such as a 10-inch model more suited to business and education use. We also expect Amazon to continue undercutting Apple's prices, even if it means taking a loss on the hardware to do so.

3.9 Others

Besides the main five mobile ecosystems providers discussed above there are many other providers that have ingredients of an ecosystem. Most participate as elements of one or more of the major ecosystems and have partial but not complete mobile ecosystems.

Vendor	MOS	App Focus	App Store	Content Store	Devices
Asus	Android, Windows 7	Android	N/A	@Vibe	Tablets
Barnes and Noble	Android	Android	Yes	Yes	Nook line
Cisco	Android	Android	AppHQ	N/A	Cius
Dell	TBD				TBD
Dell	Windows 7	WP7	Limited	No	Dell WP7 smartphone Tablets
HP	Web OS	Web OS	Yes	Limited	HP Slate
Huawei	Android	Android	Limited	Limited	Three tablets
Lenovo	Android, Windows	Android	Limited	N/A	Tablets
Motorola	Android	Android	Android App Store	N/A	Droid (and other) smartphones Motorola tablets
Nokia	Windows Phone 7, Symbian	WP7, Symbian	Nokia Store, WP7 Store	N/A	Smartphones only
Samsung	Android Windows	Android	Samsung Store	Limited	Smartphones and tablets

Table 4: The Other Mobile Ecosystem Participants

ASUS

Asus is primarily known as a hardware manufacturer. It offers Android and Windows (Eee Slate B121) based tablets and has developed some innovative designs that feature detachable keyboards.

Asus offers content storage called Mystorage, with "unlimited storage" for $39.99 a month. Asus has a game store at gamepark.asus.com. Asus also offers a content store at mycloud called @vibe, which offers music, games, radio, live TV, recorded video and e-books (for Windows 7 and XP only).

Asus is primarily a device provider but is working on an overall ecosystem. Enterprises would need to adopt a private appstore approach.

Barnes and Noble

Barnes and Noble is not a name that comes up often in Tablets, but they have quietly built an Android based Nook series of tablets and a competent online app store. Barnes and Noble also offers a solid set of apps and content through its content ecosystem and its growing app store.

Like Amazon, Barnes and Noble is an experienced online purveyor of content and apps. While most of the apps are consumer oriented, the Nook devices are android

based and can support most of the android apps offered in other stores.

Over time we see these consumer tablet providers offering more consumer content such as bundled magazine subscriptions. We could also see them offering a lower tiered set of tablets targeted at learning and education.

Enterprises that are looking for value tablets should look at the Nook but they may also want to consider a private app store.

Cisco
Cisco has also entered into the game with an Android device called Cisco Cius™ and an app store, Cisco AppHQ™. The Cius was released in 2010 as a videophone that can videoconference with Cisco's office IP endpoints as well as Cisco TelePresence systems. It offers H.264 videoconferencing, web-conferencing with Cisco WebEx™, Enterprise Social Software with Cisco Quad™, instant messaging and presence with Cisco Jabber™. It supports other conventional tablet features, such as email and web browsing. It is priced considerably higher than competitive tablets, with a list price for Cius of $1500. It also has an optional docking station.

AppHQ opened August 2011. Access comes standard with every Cius device. This is an unusual venture for Cisco, which is known for network infrastructure, not application software, and has very limited consumer presence. AppHQ is focused on business apps for the enterprise market. It offers Cisco's own collaboration apps and Android apps from Android marketplaces or that are custom-developed for the Cius. Every app published to Cisco AppHQ undergoes Cisco validation testing for security and functionality. Cisco's AppHQ Manager™ builds upon Cisco AppHQ and allows enterprises to build their own private app stores without custom coding. Cius users may also have access to Google's regular Android market, Google Play.

Cisco has very good visibility and reputation in the enterprise due to its experience in networking and security, but it may have to work hard to sell itself as a supplier of Android apps for non-Cisco devices. Some differentiator for the store, such as high security, fast downloads, or exceptional ease of use would help Cisco establish a new reputation as a software supplier.

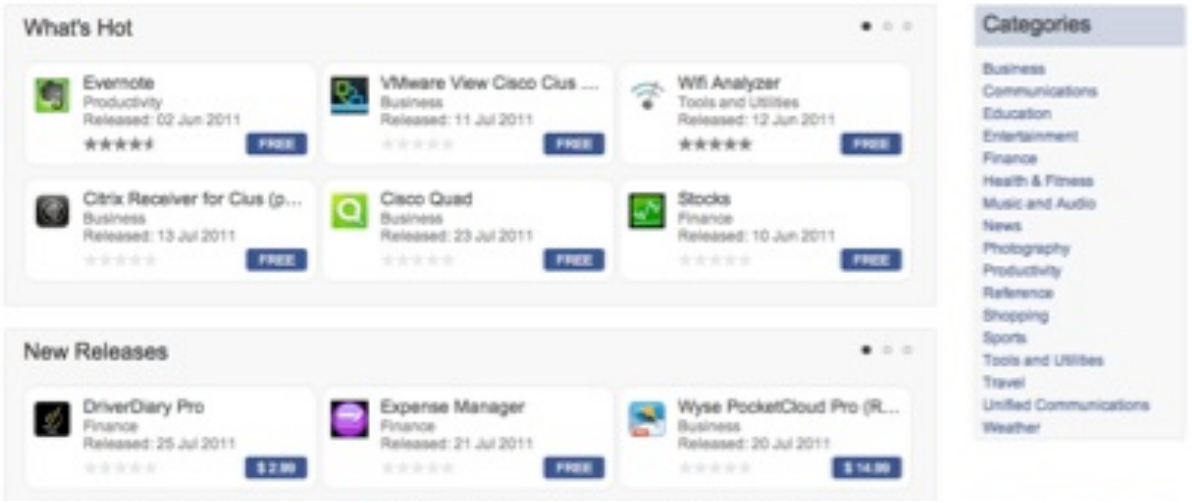


Figure 16: Cisco AppHQ App Store

Dell

Dell made an early entry into large-format Android devices with the Streak 5 phone and the Streak 7 tablet (both are now off the market). Dell is now back to partnering with Microsoft and has two new Windows Phone 7 phones, the Windows-based Slate tablet and a convertible Windows laptop/tablet based on a netbook chassis. The company is waiting for Windows 8 to map its further strategy. So far, it has not invested in a mobile ecosystem, but it does offer mobile device management.

Hewlett Packard

HP acquired Palm in 2010 for US$2.1 billion, quickly rushed out a new tablet, and then immediately retrenched after sales failed to take off. During that time, HP also replaced its CEO and announced it was placing webOS, its mobile OS, into open source.

HP's initial effort with webOS and tablets was short-lived. The Touchpad, intended to be a serious iPad and Android competitor built for webOS, started shipping in the US a year later, in July 2011. After just over six weeks, the Touchpad was discontinued, along with HP's webOS-based Palm smartphones. HP took a US$3.3 billion after-tax charge in its 4Q11 earnings related to ending the webOS device business. HP kept its very successful Windows-based PC business, and put webOS into open source.

By handing webOS to the open-source community, HP appears to be regrouping for a different assault on the tablet and mobile arena. When it bought Palm, HP was positioned to make a play as a leader in tablets as well as PCs. By aligning with Microsoft and letting the open-source community promote webOS development, HP can leverage its strength as a device manufacturer while it evaluates opportunities for future webOS products.

HP is continuing to put its support behind webOS, and has adopted a governance approach modeled on that of Apache and will use that licensing structure. The strategy is a long-term play, and is aimed at creating what HP hopes to become a more open, and thus more attractive, mobile OS than Google creates with Android.

An advantage for HP with webOS is that the population of Android licenses is currently comprised of multiple fragmented version of an OS only recently taking a more converged path. However, webOS also lacks even a small fraction of the Android market presence. Being able to differentiate on this point depends on the unlikely event that Google begins to make Android more closed than open, or that the Motorola acquisition gives advantage to its own home-grown devices that causes other manufactures to look elsewhere.

HP's approach has some promise. The company has seeded webOS into the open source community, and will build tablets for Windows 8 in 2012. Should webOS take root with developers and manufacturers, and grow the happy and vocal community of webOS users, CEO Meg Whitman has stated HP will build webOS tablets again. In the meantime, it will focus on its current role as a Windows tablet provider, expected to deliver two Windows 8 tablets in 2012. Although PH executives have said the company might release webOS tablets in 2013, we believe it is unlikely to occur that soon.

There is little short-term upside for users or developers. The webOS market has been slow to emerge, and its future now hinges on an open source approach not yet fully formed. Tools to better interest and attract more developer support are not expected until late in 2012. Where webOS has potential is with current Android device manufacturers who want to differentiate themselves from other Android providers, or who need software that is more truly open than Android can be.

Huawei

Huawei, one of the largest telecom providers in Asia, is growing globally. It offers Android based smartphones, tablets and an online app store. In the US Huawei distributes its devices via Metro PCS, T-Mobile and Best Buy, and appears to be having some success in the low end of the market. At the same time, Huawei is intent on building its brand as a high-end provider. In early 2012 it introduced a new quad-core phone, the Huawei Ascend D quad, and a 10-inch quad-core tablet, the MediaPad.

Huawei describes the Ascend D as "the world's fastest quad-core smartphone." Huawei uses proprietary power management, which the company says can cut energy costs up to 30 percent. The MediaPad is also a quad-core device, emphasizing Huawei's aim to differentiate with powerful devices.

The app store that we previewed, http://store.huawei.com/appstore/index.php , is somewhat minimalistic and focused on consumers more than businesses. Aragon expects this to change over time, but enterprises for the most part would not look to this store for app access until more apps appear there.

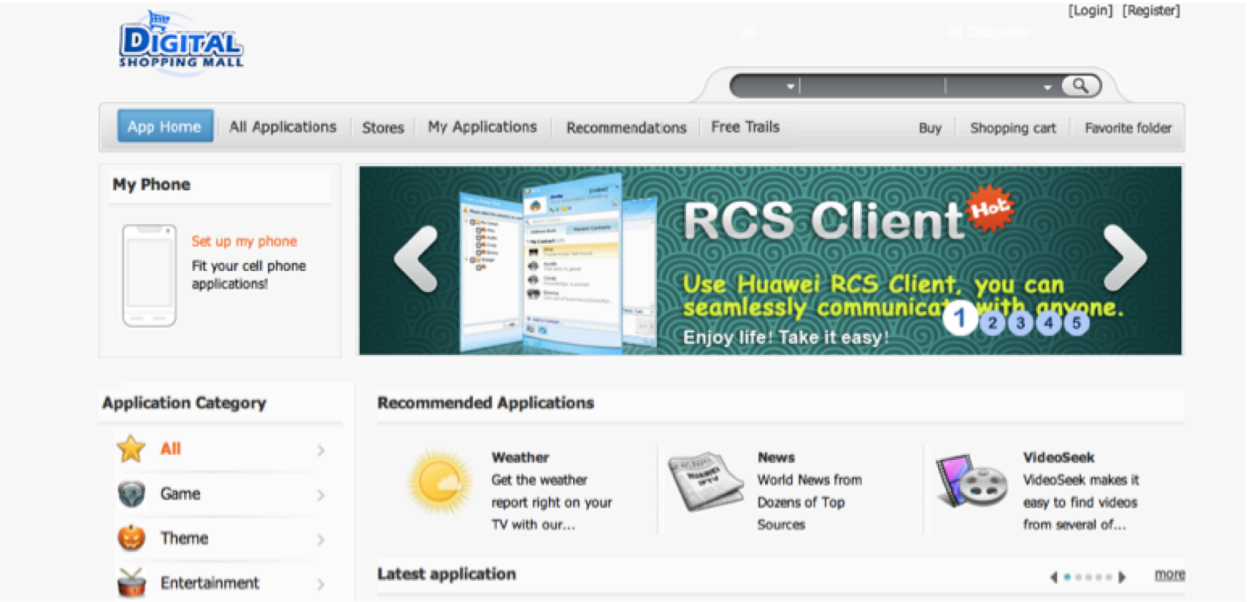


Figure 17: Huawei App Store

Lenovo

Lenovo targets business users with Android and Windows tablets. Currently it appears to be bridging between new Android tablets that it brands as IdeaPads and older windows 7 ThinkPads.

In a clever move that is sure to win fans, Lenovo preloads its tablets with seven different microapps including:

- Documents To Go (view and edit Microsoft Office and Google Docs files)
- PrinterShare
- Computrace Mobile (device tracking software)
- Accuweather for Honeycomb
- MacAfee Mobile Security
- Flex T9 (integrated keyboard experience)

Lenovo's app store is new and it appears to be in Chinese only:
(http://www.lenovomm.com/appstore/html/index.html).

Lenovo seems to be willing to test the waters with Android Tablets and it is adding more to them to attract their loyal business customers. As Windows 8 looms, we will

see if they maintain this approach or just go with a Windows 8 bundle.

Motorola

Motorola is a pioneer in radios and cellular phones and was one of the earliest converts to Android. Motorola Mobility is in the process of being sold to Google and as of February 2012, regulatory hurdles have been overcome in the U.S. and Europe with Asia remaining. Aragon expects it to be approved in the first half of 2012.

Motorola has popularized the Android movement in phones with its Droid brand, which first surfaced in 2009. In tablets, the Motorola XOOM launched in 2011 to limited fanfare. A competent tablet and the Google Experience Device for Android 3.0 Honeycomb, it has been hampered by unreliable Android updates. Android 4 (Ice Cream Sandwich) should be a welcome addition. Motorola has since rolled out newer tablets including the 8.1" and 10.2" Droid Xyboard tablets that, along with the XOOM, leverage the Google Play app store for apps.

Google also touts the security features on its phones, but the issue is more with the Google Play and its lack of malware certification. Enterprises should leverage Android phones and tablets with the deployment of a private app store.

While Motorola doesn't have its own store, it makes navigating the Google Play easier with a Top Picks section on the Motorola Website.

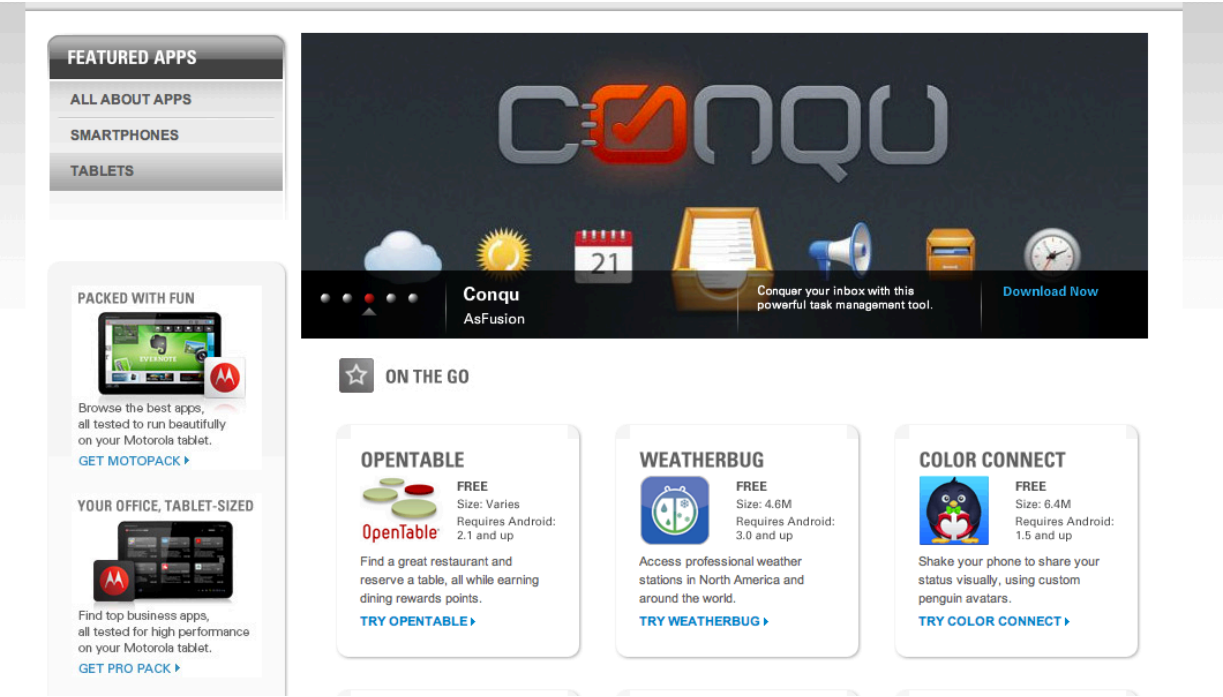


Figure 18. Motorola's App Storefront

Concerns about Google changing its open stance with Android have surfaced since the announced acquisition of Motorola. Google claims that Motorola will be run independently once the merger is approved and to us that makes the most sense.

Nokia

Nokia was once the world's largest supplier of cell phones, but it has been slow to mount a counter attack on the iPhone and iPad. In September 2010, it replaced its CEO with Stephen Elop, who most recently was an executive at Microsoft. Since Elop's arrival, Nokia has downgraded its focus on its Symbian operating system in favor of Windows Phone OS, which is featured in its relaunched Lumina smartphone line. Like other Microsoft phone partners, Nokia as yet does not offer a tablet.

For years, Nokia was the dominant provider of all classes of cell phones, including smartphones. However, when iOS and Android were introduced, everything changed and Nokia was slow to react.

Nokia's app store, the Nokia Store, has been around since 2009 and offers apps that run on Symbian based phones. Formerly called OVI (Finnish for Door), the Nokia store has been a success, with over 5 million downloads a day.

It appears that the main store for the Windows Phone-based Lumina will be the Microsoft store. Over time, this will give Microsoft more control over what Nokia does and relegate Nokia to the role of hardware-only manufacturer. This shift in strategic focus that puts Microsoft front and center in Nokia's life could make Nokia a takeover candidate. The company could also shrink over time, and allow other providers to displace it as a major supplier of cell phones and tablets.

Samsung

Samsung is one of the few vendors to challenge Apple in court over phone and tablet UI design patents, and one of the first to build a tablet after the iPad was introduced. The Galaxy Tab launched in September 2010, and Samsung now offers a full line of Android phones and tablets through several carriers. The 2011 tablets do not yet support Android 4.0 (Ice Cream Sandwich), and Samsung has not yet revealed which exact models will get the upgrade.

The Galaxy Tab line is largely provisioned from Google's Android Market, but Samsung also has its own app store, http://www.samsungapps.com/. This store offers a decent selection of apps and Samsung will likely focus on it more in the future.

Overall, Samsung is hedging its bets between Android and Windows but at this time is more heavily invested in Android. Samsung provided the devices for Microsoft's initial

unveiling of Windows 8 at it's Build event in 2011, and we expect strong support in response to commercial market success. After the arrival of Windows 8, we will have to see which direction Samsung leans.

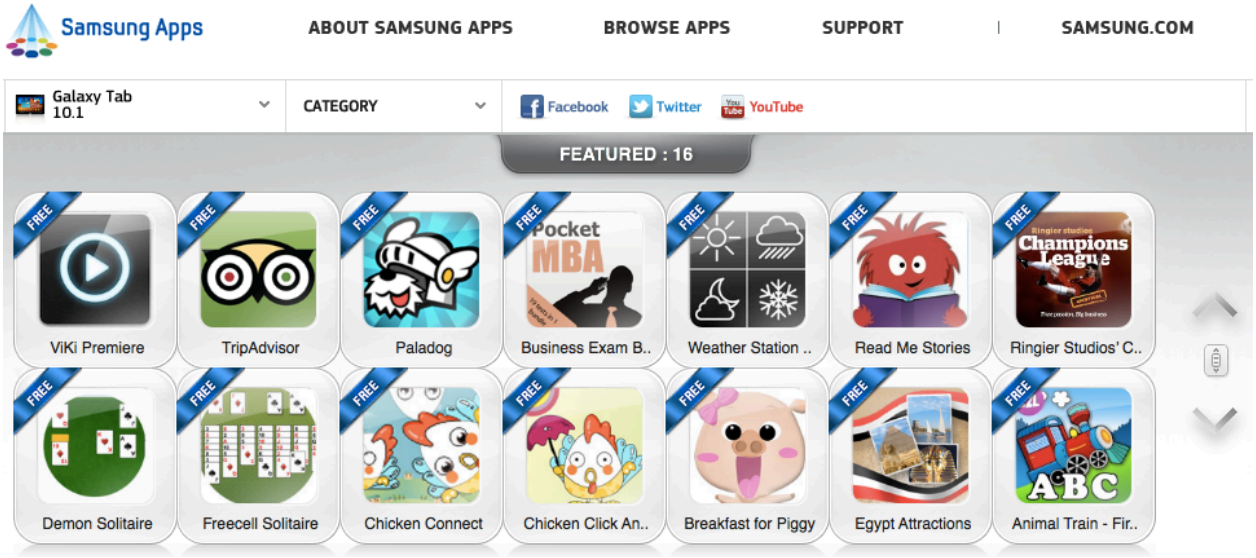


Figure 19 Samsung App Store

Section 4: The Rise of the Microapp

Microapps ("apps") are small software applications that run on a mobile device, such as a smartphone or tablet. They can be a full applications designed for the mobile environment, or scaled-down versions of software used on desktop or other platforms. They can offer self-contained functionality such as note-taking or calculation, act as highly specialized Web browsers, function as clients for larger and more complex applications like e-mail or social networking, or deliver some combination that falls between these extremes.

Though microapps are structurally similar to desktop applications, they share important characteristics with portlets; they are small and tightly focused on a single high-level business task. Examples include online meetings, conducting a bank transaction, booking an airline ticket or tracking a shipment or order. In enterprise settings, microapps often integrate data from many sources, leveraging web services to access applications such as CRM, ERP, a data warehouse or a social network.

Because microapps are small, can be written quickly, and use a compelling new distribution model, developers have flocked to them, and created nearly 2 million in the short time since smartphones were introduced. Many of them link to specific Web sites, wrapping the site's content in a device-specific form and format as well as business logic that drives the user toward completing the desired task on the site. Thus there may be multiple apps that engage with, say, Craigslist; one for buyers and another for sellers.

Many microapps also leverage the location awareness of mobile devices and include mapping functions, allowing users to, for example, "find the nearest Kinko's" or "find the pizza restaurants near me." This last would likely also make use of social interactivity by "crowdsourcing" customer and newspaper reviews from multiple other sources, along with the menu and other content from each establishment's site.

Increasingly, microapps present a new experience to users in which the device takes on the personality of the app. Instead of just running an application, the device "becomes" a check scanner, a camera, a book reader, a navigation system or an insurance claim adjuster. Because mobile devices are touch-sensitive and can sense their motion and position, they provide a more immersive experience than any kind of simulation in a traditional keyboard and mouse setting.

The microapps are generally distributed via an online app store, often controlled by the mobile ecosystem provider, the OS creator or the carrier. App stores benefit buyers by letting them find, evaluate, purchase and download an app in a single interaction, and by delivering revisions and upgrades automatically. They also let enterprises build

private, branded app stores within the public app store framework, with independent security, permissions and a managed inventory of apps created or selected for each company's workers and customers. This allows the enterprise to control part of the ecosystem and "own" the shopping experience.

For enterprises that create and sell either apps or content such as documents or media, the immediate, streamlined access that app stores provide to consumers is a benefit that can make or break a marketing plan. For consumers, ease of access is a buying criterion that will determine what app store they spend time in. Part of your planning should be making sure your product is in the right one so your audience can find it.

"Ordinary" enterprises that do not sell apps or content may think this new paradigm doesn't apply to them, but it does. Nearly every large company, retailer or any other enterprise that does substantial business on the Web can benefit from creating an app, even if it's only a free custom browser wrapper to help users navigate its own Web site. This minimal presence will get you into an app store and onto mobile platforms, reinforce your branding and facilitate online marketing and sales. Aragon predicts that by the end of 2012, 60 percent of all enterprises will have a microapp on the market.

4.1 From Big Software to Microapp

The characteristics that make apps attractive to consumers are also transforming the look and feel of business software. Enterprise applications for business are being augmented and in some case replaced by the new class of apps designed for mobile devices, just as mainframe software gave way to PC applications in the 1980s. Their ease of use and task focus appeal strongly to end-users, and developers find them easier to customize.

For IT organizations, this takes a little getting used to. Until Apple's App Store fueled an explosive growth of microapps, business software was always "big." Big blocks of code taking big blocks of time to develop, running on big machines requiring big payments to big vendors. Applications that could double in price with more big investments in time and expertise to customize, deploy, manage and maintain them.

For developers and app vendors, the changes were dramatic. Portlets and mashups were already having an impact, but microapps have changed the rules completely. Development cycles are shorter and the software itself is smaller, less costly to acquire, simpler to install, and readily accessible to the individual consumer. The shift to apps is starting to be felt in the overall computing landscape, as tablets make inroads on notebook PCs.

4.2 Computing Will Never Be the Same

For nearly 20 years, personal computing was defined by applications whose identity reflected the OS that they ran on. Windows programs were Windows-like; Mac programs were Mac-like. PC applications were incredibly lightweight and agile compared to the mainframe software they replaced, but compared to the pace of change in the app world, PC innovation moved at a slow pace, partly because the tools, ecosystems and rewards were scarce and expensive.

Microapps are at the leading edge of a fundamental shift in computing. They are becoming the de facto way to access content (news, TV, movies, Web sites) on a tablet or smartphone and to control other devices such as TVs, PCs, game consoles and more). The smartphone or tablet and its associated apps are poised to become a new kind of "all-in-one" platform that can change its personality based on the apps' ability of to expose and leverage features of the device.

Accessibility and ease of use breakthroughs have brought computing to entirely new groups of individuals. Touch and voice are enabling much more immersive experiences, and make it possible to merely pick up the device and begin to use it. The voice digital assistant with natural language processing combined with deep analytics and access to the nearly limitless information is enabling apps to help people answer questions and solve problems. As the ability to converse with the digital assistant grows, apps will redefine how humans interact with computers.

4.3 The New All-in-One

The creativity that developers have unleashed has triggered a surge in app development and a surge in what apps can offer to users. The mobile device and its associated apps can become the new all-in-one device, able to change personality based on features and the ability of the apps to expose them.

This personality characteristic is helping to keep demand for tablets high. Mobile device features continue to expand, from higher-resolution displays to NFC and Bluetooth 4.0 support (see Figure 20). Microapps tightly integrate mobile device features into a seamless user experience that is often better than provided by dedicated devices.

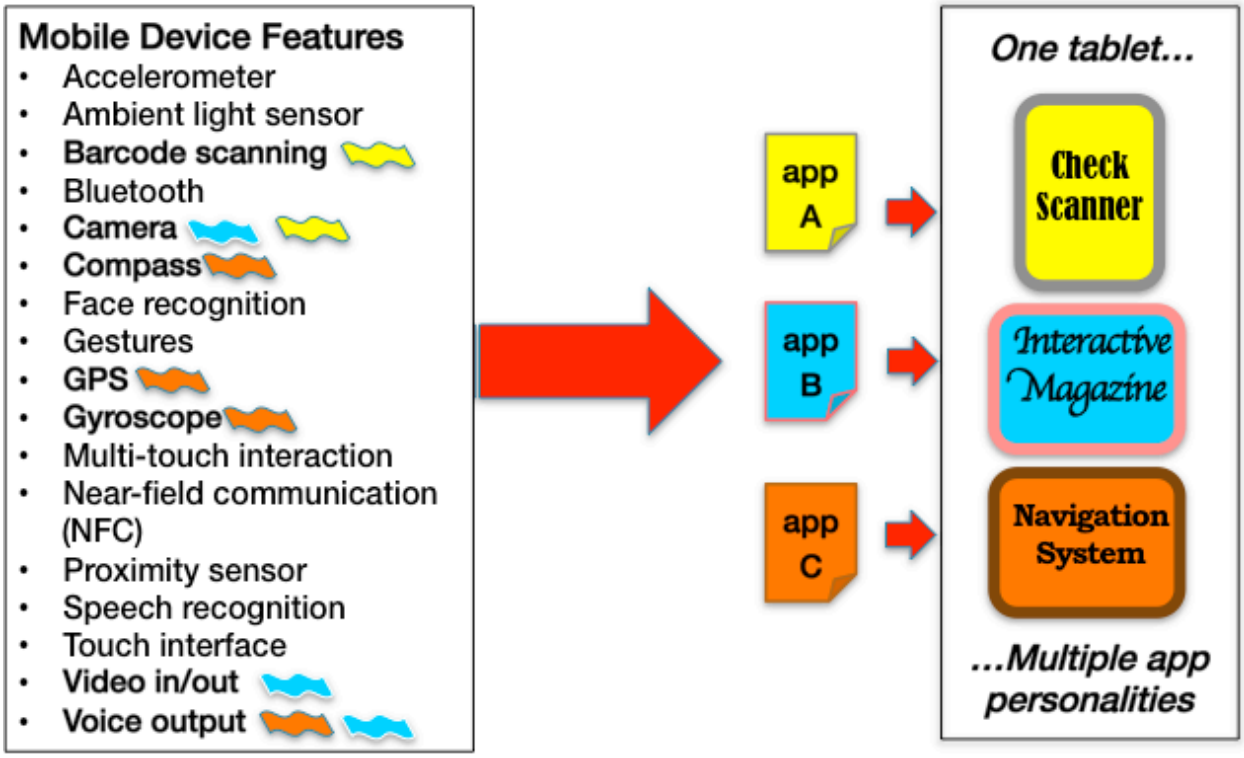


Figure 20: Mobile Device Features: Enabling App Personality

These capabilities are winning with consumers, and behind that success are forces that change how people will use computers of all kinds. The app experience has become so simple and compelling that it redefines how many things are done. Examples include viewing videos, reading digital content, and handling insurance claims. In essence, the device becomes an extension of the app it is delivering to optimize the user experience.

This new interface paradigm creates a significant shift away from the personal computer as a client model. Rather than creating a rich and complex interface where the user navigates, the microapp delivers focused functionality to address much more specific user needs. This simplicity and the creation of immersive experiences, become intuitive for users who then expect – indeed rely on, this distinctive interaction style. Incorporating more innovative ways to extend the experience, such as intelligent voice interaction, is the future of computing. Users will no longer accept traditional interfaces that do not engage them, and this is already affecting user response to both licensed and internally developed enterprise software.

4.4 Task Specific

A key characteristic of an app is that it is task specific: it focuses on one thing and

does it well. It might allow you to take a picture of a check and submit it, join a meeting, or chat with others. Microapps that try to do too much often suffer. Focusing the app on doing a few things right is the best approach with the highest probability of success.

Consistency (Usage, Navigation, Performance)
Ease of use goes without saying and so does consistency of behavior. Mobile Ecosystems are dictating app behavior by having app approval processes to see if the app conforms. But outside of that, users are rejecting apps that are slow or hard to use or just don't work. And these judgments spread like wildfire. Ratings on apps are immediately posted in the online marketplace so enterprises have no choice but to put out apps that work and are easy.

Users and enterprises are voting with their wallets, and the sale of millions of iPads has taken a toll on netbook and laptop sales. Apps on tablets and smartphones give users more engaging and immersive control, compared with what they can experience with a PC. Users like the different engagement style they enable, and they want more. Laptops are already beginning to include features like touch and gestures to make them act more like the tablets that are replacing them today.

Above all, users want consistency. Apps need to work in a reliably consistent way, and need to have ease of use and the consistency of the ease of use as key attributes of the overall application. Failure to do so means failure of the microapp. The key take away is don't rush your microapp into production, test it and then test it some more.

4.5 Economics

The economics of apps appeal to buyers in one simple way: for those who are used to buying PC software, prices are incredibly low. About a third of app store products are free. The next tier ranges from a dollar or two up to $20 or so, with a big bump at $9.95. The "pro" software, the kind that costs $500-900 on a PC, will be $50-100; ten percent of its PC price. App prices may not be this low forever, but they will always be substantially less than their PC counterparts.

Many apps come in scaled-down versions and premium versions. It is common to offer a free scaled-down version of an app, particularly if it is really an advertisement for the business or service. The premium version or "upgrade" carries a price that can be paid directly through the device and delivers more features and better service guarantees.

Currently, apps are purchased one time and then the user gets upgrades. We expect enterprise software companies will attempt to pass on client access licensing for apps as they have for PC software. We advise clients to avoid this.

4.6 Microapp Lifecycle

Microapps have shorter development cycles because they are task-specific, not multipurpose applications. App development is a new priority for the enterprise, but the focus and the strategy of a microapp should be set well before development begins.

Apps also need a refresh and upgrade plan, in part because the low barriers to entry create more competition, and also because the apps need to take advantage of the continually evolving ecosystem. For example, some of the first apps to launch for the iPad were Web conferencing apps. Most of them focused initially on joining a meeting and supported audio but not video. Version two of those apps added new functions for meeting leaders as well as video (in part because Apple added a camera to the iPad 2).

4.7 Enterprise Application Strategy

The enterprise issues for microapps arise from three increasingly disruptive perspectives: personal devices and microapps at work, externalized business presence, and microapps as part of an enterprise software strategy.

Initially, the consumer nature of microapps created management and support problems around personal devices at work. This increased demands for access to networks, reports and data sources from the devices being purchased by managers and executives. This effect has also created a wave of users who are far more technically savvy than any generation before. Users increasingly expect their PC applications to be as simple, usable and upgradeable as the apps on their phones.

The second perspective, external presence, emerges from the sheer number of app-running devices in the hands of consumers, and their proclivity to access everything that they possibly can. Businesses have an opportunity to engage their customers and prospects. Nearly every industry has compelling and engaging apps that become competitive differentiators.

Planning Assumption: 85% of large enterprises will market a customer-focused microapp by 2013.

Apps transcend these perspectives to become an essential and integrated element of enterprise IT strategy. Successfully leveraging consumer apps for outward-facing interactions will require new IT skills and resources. The mobile movement in the workplace demands that enterprises strive to engage their workers in a similar way.

Apps are a new generation of software that is here to stay. They have altered both the

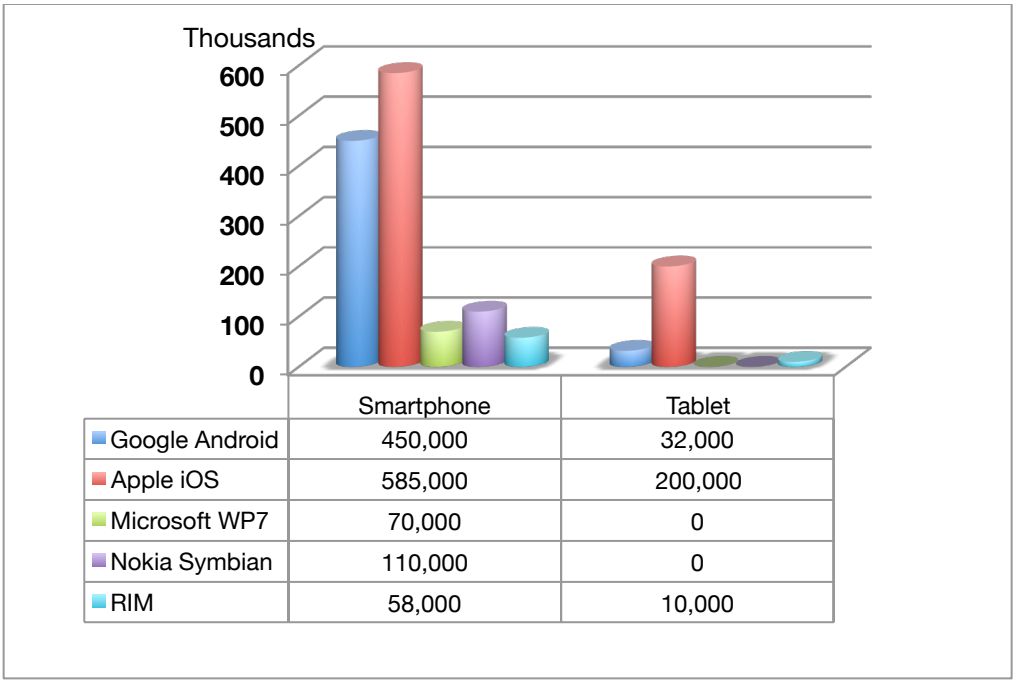
direction and priorities for enterprise software. The enterprise response should be to make apps part of their overall strategy to ensure that users can leverage the power of apps to do their jobs better, faster and more cost-effectively.

Section 5: The Public App Stores

5.1 Overview

The app store is a new way to distribute software that has become enormously popular in a very short time. It is important to understand the clout that each store has, since for business it is numbers of devices that start to focus development attention.

App stores provide several benefits to different constituencies. First, they make it easy for users to access a multitude of apps. At the same time they make it easy for developers to monetize their work. These benefits alone have spurred the creation of more than 585,000 applications in the iTunes app store, and a rapidly growing number in Google's Play store. As of January 2012 there are more than a million apps in the mobile app stores (see Table 5). However, the number of these aimed at consumers is far greater than the number of business apps (see Table 6).



	Smartphone	Tablet
Google Android	450,000	32,000
Apple iOS	585,000	200,000
Microsoft WP7	70,000	0
Nokia Symbian	110,000	0
RIM	58,000	10,000

Table 5: App Stores: Tablet vs. Smartphone Apps (thousands of titles)
(Data Source: provider app stores)

Application Type	iOS		Android		Windows Phone		RIM	
	Free	Paid	Free	Paid	Free	Paid	Free	Paid
Business	17,740	5,457	13,500	1,300	1,022	378	1,804	627
Productivity and Communications	5,974	7,100	6,800	2,500	7,665	2,835	837	675
Social	7,438	2,675	7,800	1,000	1,533	567	587	214
Navigation/Maps	3,179	5,377	9,700	4,200	3,066	1,134	416	577
Finance	7,311	3,568	5,200	800	1,022	378	902	264
Total	**41,642**	**24,177**	**43,000**	**9,800**	**14,308**	**5,292**	**4,546**	**2,357**

Table 6: Business Applications by Public App Store Provider (Partial List)
(Data Source: Vendors and other public sources)

This new business model has allowed a new generation of apps to be developed, and has unlocked the stranglehold that other vendors had on developer communities. Additionally, the app stores vary in user experience and in popularity. Although the major app stores each enable a powerful ecosystem, their strength is in the broad consumer market. For individual businesses, the opportunity this creates increased complexity, added support requirements, and increased security risks.

However, enterprises should consider this new resource a step forward in provisioning and application upgrades. It significantly reduces labor requirements for enterprises, and simplifies the difficulties of using tools such as desktop virtualization. The speed of app provisioning and the speed of upgrades are enough to justify using app stores for a rapidly growing number of enterprises.

A major enhancement is stores that allow enterprises to create their own private app store supporting their enterprise workforce, their external constituents, or both. As the use of mobile apps grows, both by internal employees and to engage customers, suppliers and partners, the allure of a private enterprise app store will also grow.

Although ease of provisioning and support are attractive, other ways of supporting the mobile explosion will also play a role and require consideration (see Section 6, “Managing Mobile Devices, Apps and Content” and Section 7, “Enterprise Strategies and Selection Criteria”). Aragon expects private app stores to be used by a majority of enterprises by 2013, but they will be only one tool for managing mobile systems.

5.2 Apple iTunes App Store

The Apple iTunes content store was launched in 2001, predominately as a music repository. It wasn’t until 2007 that the iTunes App Store arrived and by then Apple had

a lot of experience with many kinds of digital content. Apple has the most stringent app approval guidelines and this has helped to keep the Apple marketplace clean and professional.

The iTunes app store now has over 585,000 titles that include a large and growing set of business applications. Most consumer-oriented businesses (banks, restaurants, real estate, etc.) offer an iPhone or iPad app today. Where differentiation exists for Apple is in the large volume of tablet apps built for the iPad, with an industry leading 200,000 in its app store. The clear OS target and defined standards for how apps are to look and behave serve to create a more attractive market for developers.

Planning Assumption: Through 2014 Apple's iPad will remain the leader in total apps built for the tablet environment.

What is attractive to enterprises about this app store is that it is well managed and exercises significant quality control and oversight of its developers, so bad or malicious apps have a smaller chance of getting into the marketplace. The management oversight of Apple's app store is a significant differentiator that reinforces the public perception of Apple as a high-quality brand. Apple publishes "App Store Review Guidelines" for iOS app developers, which spell out the multitude of reasons that an app can be rejected or removed from the store.

Apple's oversight is aimed at making iOS apps safe, secure and appropriate for their intended audience. It covers not only functionality, but also how the apps behave. For example, apps are required to obtain user consent before accessing data on the device such as location, identification or any user information. Apps that are not well designed or tested, that attempt to download additional code, or do not follow Apple's user interaction and design guidelines will be rejected.

Apple's approach to proactively curating its app store is restrictive in many respects, and certainly does not allow developers the freedom they may find in other app stores. But because of these restrictions, the iOS app ecosystem is consistent, there is active focus on eliminating malware and viruses, and the entire app experience is well managed and predictable for buyers and users.

The sheer number of apps can be overwhelming but there is a good taxonomy and search function to find what the user is looking for. Increasingly Apple is making it easier to distribute apps via a sharing capability that represents its entry into the private app store market. Aragon recommends that enterprises getting started with mobile apps should evaluate an enterprise app store as part managing their mobile devices and apps.

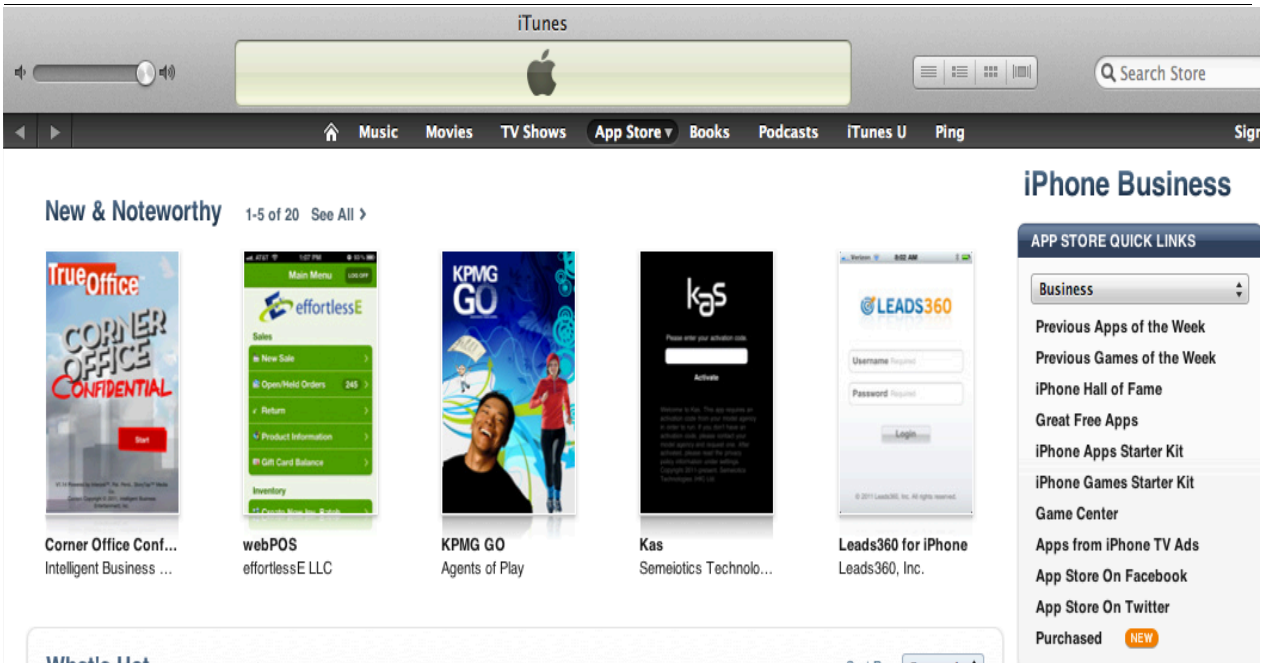


Figure 21: A Page From the Apple iTunes App Store

5.3 Google Play

Google's initial app store approach, Android Market, opened only a few months after Apple's iTunes app store. In March 2012 Google retired Android Market, replacing it with Google Play, establishing it to be the store not only for apps but also for music, books and movies. Google Play has become second largest app store, with more than 450,000 applications and a growing selection of music, movies and books (see Figure 22).

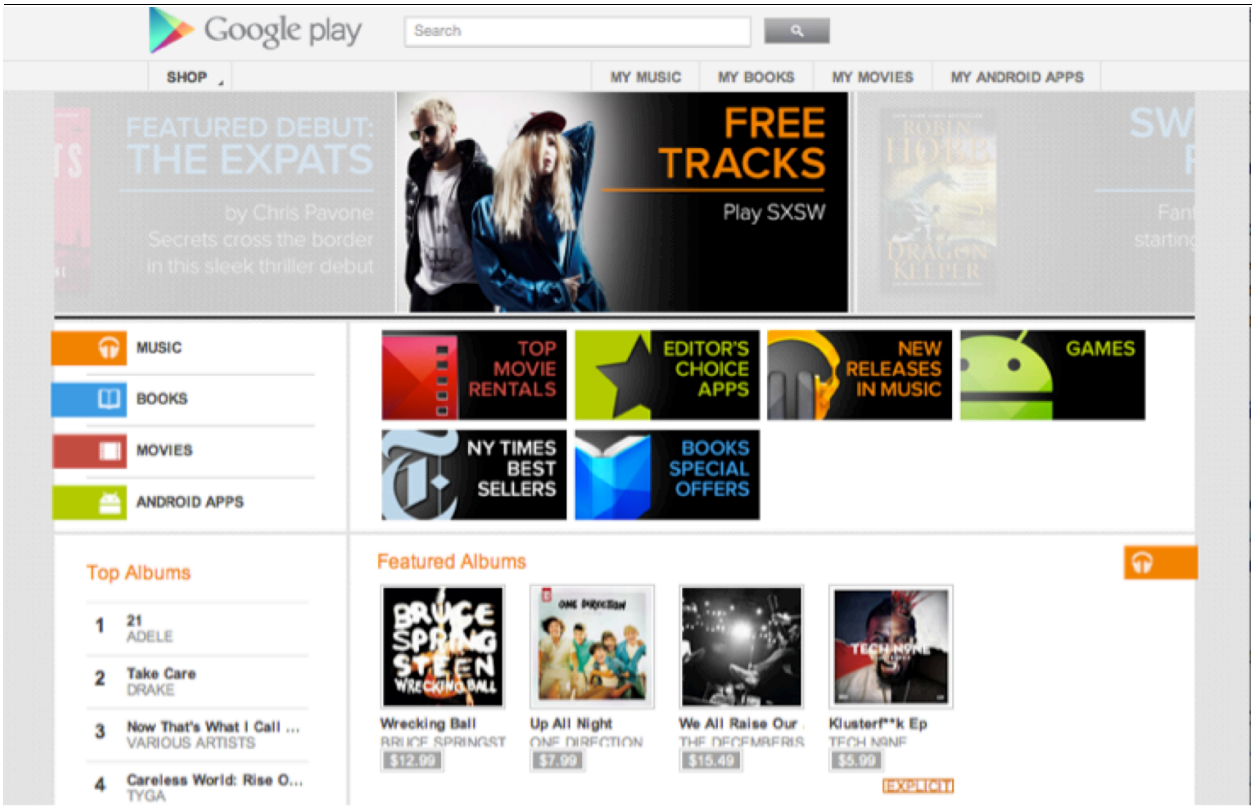


Figure 22: Google Play

Google's engagement with multiple carriers and manufacturers leads to multiple versions and variants of Android in use at any one time. With relatively minimal oversight across the breadth of devices, this means the Android inventory is fragmented into a complex family of devices from different vendors with varied features running many different versions of Android.

For developers, the least common denominator of features provides the greatest market opportunity, and there is a considerable lag in market penetration even when new versions are available. From a user perspective, the app store detects the Android version and will only display those apps that will actually run on the connected device.

Google has recently started to increase its oversight of the OS and now appears to be focused more on quality than on timing. There were problems with some early Android tablets, such as the Motorola Xoom, and this appears to have triggered the refocus. Google's effort through the Android Design group will help to improve consistency in how device features are supported and how the user experience is delivered.

Android's openness and Google's limited controls do provide a great stimulus for the developer community. Nearly anyone can publish an app to the Android marketplace

without active vetting or verification. The result has been rapid growth in Android apps, but also added risk. The level of malware has significantly increased in the Android environment. Android's openness is a vulnerability that malware and malicious content providers will continue to exploit. Aragon advises enterprises to consider wrapping Android apps in a secure app store where they can be vetted and validated before downloading.

As of February 2012 Google has begun to improve security in the Android Market. A new security service, Bouncer, is now used to scan apps before they are uploaded, and Google reports that that these sweeps have already produced a significant drop in malware. This is a new direction for Google, and one that is quite different from the enabling and open nature of its business strategy. In spite of this progress, enterprises remain leery of the security issues and continue to more frequently consider private app stores to gain better control of risk, particularly for Android.

5.4 The Microsoft App Store: Windows Phone Marketplace

The shifting sands of Microsoft's ecosystem strategy become apparent when you examine the changes in the storefront implementations. Windows Phone Marketplace is relatively new but it offers a growing selection of apps to choose from. The relatively new revival of Windows Phone, the very recent second update to Windows Phone 7.5 (Mango), and the ambitious and well-publicized Windows 8 roadmap have all made the uptake of apps from this marketplace relatively low. However, as of early 2012, Windows Phone Marketplace has over 70,000 applications, of which over two-thirds are paid apps. While small in comparison to the well-established Apple and Google app stores, the Marketplace's growth has been relatively fast.

However, Microsoft is a late entrant, and while the company is pursuing more mobile developers, it has a long way to go to catch up to the leaders. Microsoft's overall product strategy and ecosystem represents a significant part of this challenge.

Microsoft intends Windows 8 to be a major upgrade and a significant change to its Windows franchise that introduces to PCs and tablets the Metro interface of the Windows Phone devices. By designing in compatibility between tablets and PCs, Microsoft is playing to its strength, and to its strongest developer community.

However, by leaving the phone with a different OS and apps platform, Microsoft has restricted its ability to reach the same growth rate as Android or iOS. As Microsoft executes against its roadmap and begins to deliver Windows OS implementations for PCs, tablets and smartphones the app store will also change. Windows Store, which Microsoft has provided in an early version as part of its Windows 8 Consumer Preview,

will become the common app store for distributing Metro-style apps for all devices.

Another issue that could affect acceptance of any Windows app store is the extent to which Microsoft can demonstrate and guarantee a secure, high-quality ecosystem. Any quality issues in the core code will threaten the reliability of all apps and chase developers away. This is something that Microsoft cannot afford.

The app store experience itself is also an indication of Microsoft's intention, and the degree to which its response to the consumer driven tablet era is still forming. Along with Windows 8 Microsoft is creating the Windows Store that will be used to provide apps to all devices. However, this is an approach being formed in bits.

Prior to Windows Phone 7, Microsoft had the Windows Marketplace for Mobile to support Windows Phone 6. That marketplace is being discontinued in 2012, orphaning those phones as the Windows Phone Marketplace for Windows Phone 7 ramps up. With Windows 8, that marketplace is being supplanted as well, with Windows Store becoming the new app store.

This is volatility not being experience by Apple or Google, and reflects the degree to which Microsoft was caught off guard in the shift toward consumer-driven devices and the exploding tablet era and is undergoing deep change. While the strategy around Windows 8 has much promise, and will play to Microsoft's strengths and installed base dominance of both Windows and Office, it is still developing.

To be clear, the devices that now run Windows 7 cannot run the apps in either the Windows Phone Marketplace of the upcoming Windows Store. Although they run the full spectrum of Windows 7 applications, it is the microapp and the trend toward the use of targeted, highly task-specific microapps that is driving the success of the mobile app stores.

In addition, to support ARM tablets Microsoft is adding WOA to the Windows family

All that said, this marketplace has significant potential. It features:

- Login with Windows Live ID.
- Users can see purchase history
- Over the air downloads
- Installation can be done later

As of early 2012, Microsoft has identified a growing initial inventory of business apps, but still far fewer in even basic categories when compared to iOS or Android. With its more limited acceptance and ecosystem, business apps such as a native mobile client for business software such as salesforce.com are missing. Windows Phone 7 does

have Office Mobile for Word, Excel and PowerPoint, and also has a native SharePoint client.

Microsoft's future rests with Windows 8, and a new direction that includes a new app store and support for different form factors with different operating systems. We expect the Metro-style apps for Windows Phone 7 will be upgradeable to run in the anticipated Windows Phone 8, and be provided as part of the new Windows Store. Until Windows 8 reaches production in the market in late 2012 Microsoft is behind the lead created by Google and Apple, and is losing ground.

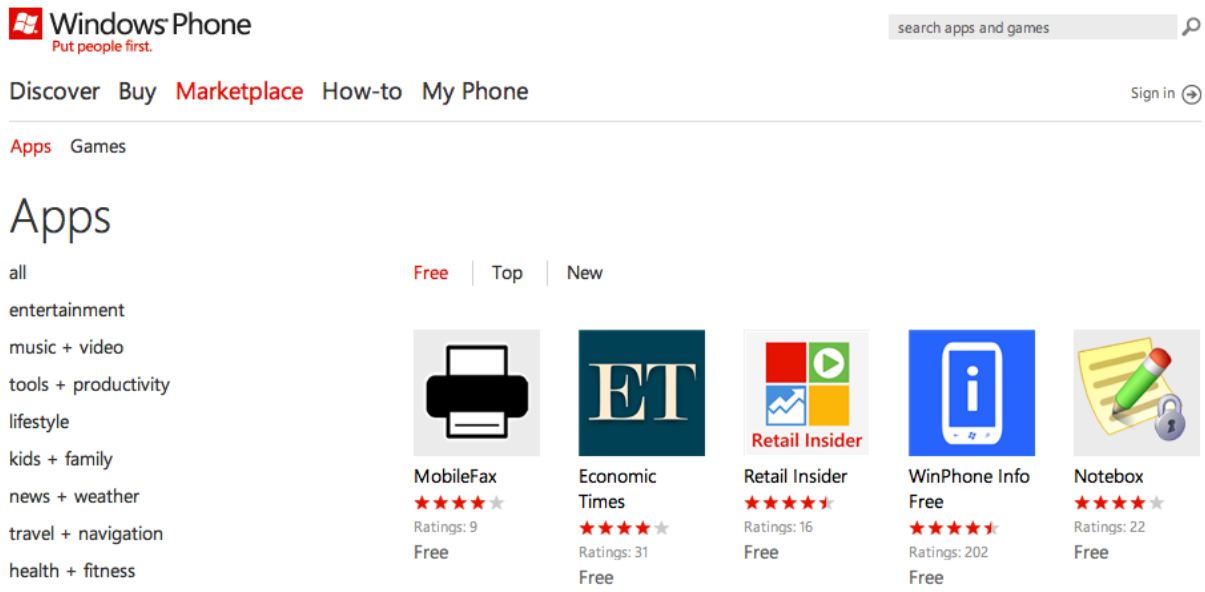


Figure 23: Windows Phone Marketplace

5.5 BlackBerry App World

With the BlackBerry, RIM was first to effectively align mobile devices and apps with the needs of the enterprise for secure and reliable email. However, RIM did not respond effectively to the consumer-driven nature of smartphone and tablet apps and has seen its franchise eroded by the massive demand for apps and email with more basic security. RIM has stuck to its enterprise focus while most of the competition has adapted to embrace the consumer focus of the market. The company is woefully behind in establishing presence, consumer mindshare, and developer attention.

Although it took RIM two years longer than Apple's iTunes app store, until 2009, to establish an app store that would provide provisioning and drive a developer ecosystem, RIM has done an acceptable job with its app store, at least for phones.

Throughout the OS transitions, RIM has successfully remained consistent with its app store, in contrast to the multiple starts from Microsoft.

The March To BlackBerry 10 (QNX)
While BlackBerry was one of the first mobile devices with app support, RIM is in the midst of a multi-device OS transition that may leave its 58,000 legacy apps without a migration path. After the BlackBerry Application Storefront went live in April 2009, it was renamed BlackBerry App World.

BlackBerry 10 will be RIM's multi-device operating system for all of its devices starting with its BlackBerry 10 smartphone launch expected in late 2012. There is a glaring lack of a clear migration path for current BlackBerry apps to this new OS, although a solid toolkit is provided to build new BlackBerry 10 apps. The runtime container provided for Android apps will make for relatively simple migration and support for those apps.

PlayBook: Looking For Apps
The first generation of PlayBooks has had limited number of apps as well as limited email functionality. The main users of the PlayBook have been current BlackBerry users, also reflecting RIM's initial target. With the introduction of PlayBook OS 2.0 in 2012 users have the option to use the tablet untethered from a BlackBerry, and acceptance has begun to slightly improve. RIM claims that it will put a renewed focus on tablets as it rolls out its second generation of the PlayBook.

In spite of having 58,000 total apps as of March 2012, on the business app front, Blackberry App World currently offers 1511 free and 528 paid business apps. Most of these are for BlackBerry phones. While they support a total of 2,295 PlayBook apps in the store, fewer than 200 are business apps. Of that total, paid apps are less than 20%.

In response to the app and app developer challenge, RIM has moved to revive sales by enabling BlackBerry devices to run Android apps. With the lack of business apps for BlackBerry this has potential to bridge the gap as RIM seeks to reassert itself with the new OS direction.

In the second half of 2012, as RIM prepares to deliver its BlackBerry 10 (QNX-based) operating system it faces the challenge of migration for its existing 58,000 apps. Lack of an effective path forward for these apps will alienate developers who are being recruited by the other ecosystem vendors with larger opportunities.

RIM's success continues to hinge on its success with enterprises that value the secure email service. With the success of Apple's integration with Microsoft Exchange Active Sync the BlackBerry email value proposition is diminishing.

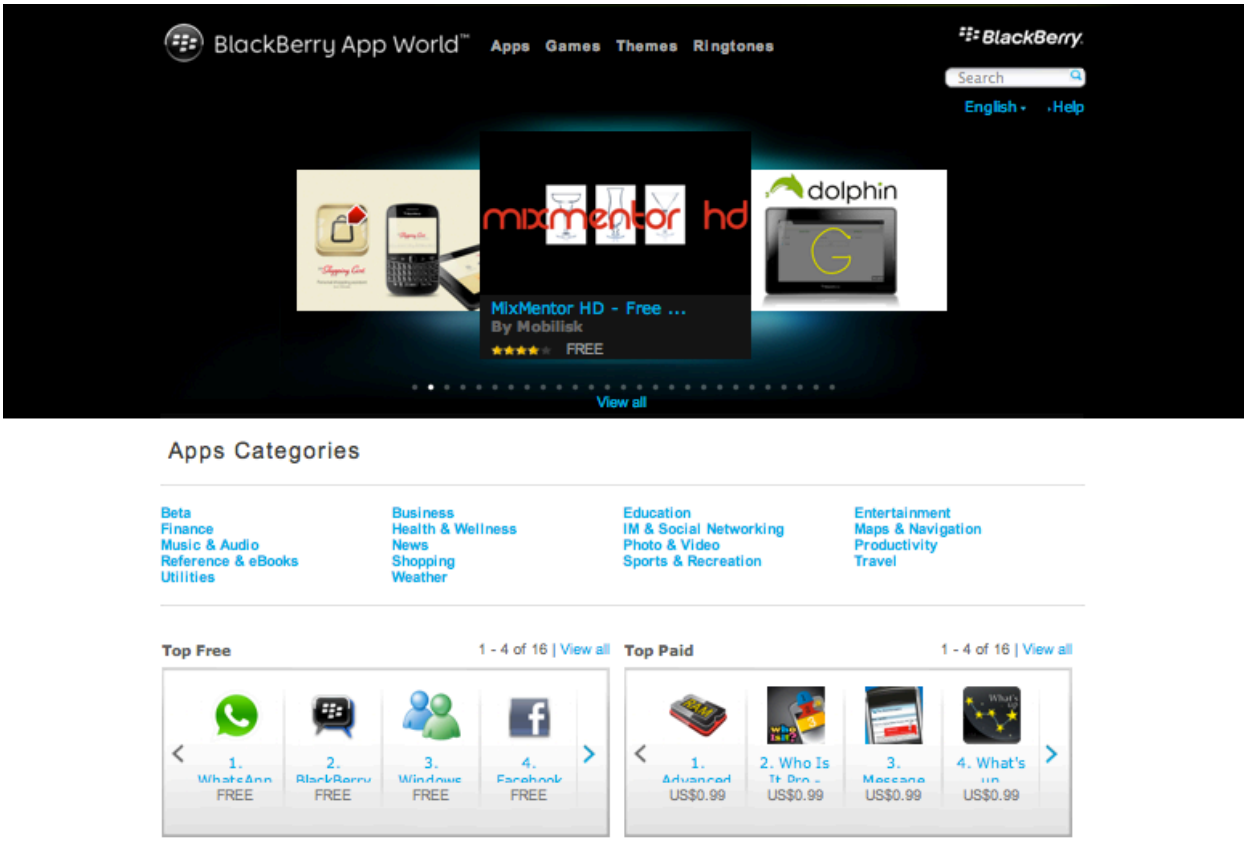


Figure 24 RIM Blackberry App World 3.1

Section 6: Managing Mobile Devices and Apps

From the outset, success with mobile devices has depended not only on the device itself but also on apps that are easy to use. As more employees bring their personal devices to work, mobile management rapidly grows more complex. Where once the enterprise had full control of all the hardware and software to be managed, today workers' diverse personal choices of devices and apps require a new approach and a new mindset from IT organizations.

The tools to help enterprises manage mobile devices are changing rapidly. Inspired by the major mobile ecosystem providers' expansive app stores, enterprises have begun using private app stores to manage apps for employees and for customers. These enterprise app stores recognize and support the business reality of multiple operating systems and multiple providers. They also offer dynamically customized app selection, vetting and curating, as well as enterprise-level security for multiple internal and external users, key ingredients not offered by public app stores.

Planning Assumption: By 2013 most enterprises will use private app stores to manage their non-consumer apps.

Enterprise app stores are only part of the picture. A storefront and the ability to distribute apps are merely the beginning of app management requirements for most enterprises. As providers respond to and the tools take on the ability monitor performance, track license compliance and implement mobile policy, those products become mobile application management. To address enterprise needs to manage all aspects of mobile use, the software approaches include two major categories: mobile device management (MDM) and mobile application management (MAM). In some instances just an app store will be suitable for enterprise deployment, but the dominant approach will build on a broader suite of functions to manage mobile apps. These two categories, MAM and MDM, will converge, combining application and device management into integrated mobile management.

More specialized tools address different subsets of enterprise needs such as mobile app protection and mobile app lifecycle management. Together, these tools allow enterprises to effectively manage mobile environments. The essentials include:

- App distribution and update
- Asset management and tracking
- Distribution of information and data
- Software licensing compliance
- Remote troubleshooting
- Location services
- Back-up and restore

- Managing mobile policy
- Security services
- Disabling lost or stolen devices

Managing Business And Personal Environments

The enterprise focus on mobile devices has been largely business-centric, created to provide consistent management and support for standardized mobile devices and optimized for business with some accommodation for personal elements. The principles behind mobile device management (MDM) began with this focus. The consumer-focused success of public app stores has driven a demand for similar easy-to-use capabilities within the enterprise, giving more attention to the end user. The emergence of additional features to address greater security, policy support and role-based control has resulted in a new category of mobile application management (MAM).

These two approaches, and the wide range of products and vendors that support them, fuel confusion between MAM and MDM, as well as a misunderstanding of the role and position of private enterprise app stores. As MAM and MDM evolve, they will tend to converge, and enterprises must evaluate each tool's capabilities to find the best approach for its particular needs. Table 7 provides a snapshot of the current balance of features and functions in the two categories:

Function	Features	MAM	MDM
App Store	Storefront for apps	X	
	Categorization, ratings, reviews	X	
	OTA delivery and update	X	
	Multiple OS support	X	
Managing Apps	User license management	X	
	App-level security	X	
	App policy enforcement	X	
	Personal versus business isolation	X	
	Role-based access and authorization	X	
	Analytics and usage tracking	X	
	Multiple OS support	X	
Managing Devices	Mobile data protection		X
	Separation of business and personal		X
	Inventory management		X
	Location services		X
	Asset management and tracking		X
	Device security services		X
	Device provisioning		X
	Multiple OS Support		X

Table 7: Approaches to Mobile Management Software

6.1 Private App Stores

The value of custom mobile apps for employees and customers has become readily apparent for a growing number of use cases. As enterprises deploy apps, they want to manage distribution, promote user adoption, and control releases and updates in ways that meet their specific needs, without adapting to the practices of a public app store.

Using some of the same features as the public app stores, enterprises can provide similar showcase and distribution capabilities. Enterprise app stores can support a custom mix of mobile devices. Many can handle Apple, Android, BlackBerry, and Windows Phone 7 apps, in contrast to the proprietary nature of each of the ecosystem vendor's public app store. Several third-party public stores, such as Handango, support multiple platforms and allow a configurable list of contributors to upload content for distribution to specific audiences, under specific circumstances, with specified levels of security and authentication. Enterprise app stores can also control which apps are available to their employees, including apps developed in-house as well as those available publicly. Some also provide the ability to lock individual devices to allow them to only obtain apps from the enterprise store.

The strength of this model is similar to that of the consumer environment. A simple app store environment provides information about the apps, perhaps including feedback from users, and simplifies download and update management. Over the air (OTA) software distribution makes it easy for users to keep their apps, and also associated data, current and maintained.

For IT organizations, the app store simplifies life-cycle management. Simply uploading apps or updates to the store initiates the process of distribution and refresh. A single method can support both company and personal devices, and apps running on multiple operating systems.

Feature	Purpose Overview
Storefront for apps	Simple to use and navigate interface to apps available for use
Multiple OS Support	Support apps for multiple mobile operating systems enabling enterprises to support enterprise and personal devices
App categorization	Organize and enable access to apps based on categories such as type of function
Over the air delivery	Distribute apps wirelessly without need to connect or tether to another control device
Secure authentication	Strong password and identity controls to enable secure access and personalized support
Push notification	Delivering notification to individuals of availability of new apps or their need to perform an upgrade
Ratings and Reviews	Ability to gather feedback on app function and usability in the form of ratings and qualitative reviews

Table 8: Private App Store Features (partial list)

6.2 Mobile Application Management (MAM)

The focus of MAM builds from the app store, and is aimed at controlling the apps: their use, configuration and security across the full range of the mobile device portfolio. Software distribution is an essential ingredient, and MAM includes app store functions.

In addition to managing the apps and their distribution to users, MAM provides the ability to secure access to and use of apps and company data according to defined roles and policies. App-level authentication and access controls help businesses develop policies and implement systems that protect their data while authorizing the right level of access for each worker to each app. MAM is also starting to incorporate security, role-based management, and authentication features found in MDM approaches as well.

MAM functions are important to businesses with growing app portfolios and widespread use of mobile devices. MAM is especially needed by enterprises that have embraced – or been overrun by – personal phones and tablets owned by workers. MAM can differentiate corporate apps and data from personal ones, and can secure and protect corporate assets without erasing or disabling a personal device.

Planning Assumption: By the end of 2015, 80% of businesses will have defined bring-your-own technology programs.

Feature	Purpose Overview
Multiple OS Support	Support apps for multiple mobile operating systems enabling enterprises to support enterprise and personal devices
App-level security	Control access, use and enable wipe for individual apps at the user level
User and license management	Monitor apps used and ensure licensing agreement compliance
Isolating or sandboxing apps and data	Enable individual business apps and data files to be separated from personal content, and enable audit trail
Role-based access and authorization	Control access and function based on job function and defined role parameters
App policy enforcement	Ability to define acceptable devices, uses, apps, expenses, etc. and manage defined policy
Analytics and usage tracking	Dashboards and reports to monitor usage, compliance, and volumes of data and apps

Table 9: Mobile Application Management Features (partial list)

6.3 Mobile Device Management (MDM)

MDM has been around longer than the other approaches to managing mobility. Aimed initially at helping enterprises control their growing investments in smartphones, MDM has become a foundation for managing and securing the growing portfolio of devices.

In contrast to an app store or MAM, MDM concentrates on the devices. Features such as configuration control, performance management, and over-the-air troubleshooting characterize MDM tools. The focus is on ensuring effective management of the device assets, and handling situations such as lost or stolen devices.

MDM offers the greatest ability to secure and lock down the devices in the enterprise. With the device-centric focus, however, initial approaches provided tight controls and limited the potential of personally owned devices participating in the enterprise network. As more and more personal devices appear in the enterprise, a management approach that can provide management and security without total control over those devices is becoming imperative.

Although MAM vendors have focused on this need to differentiate their offerings, the MDM vendors are expanding to incorporate many of the same capabilities. As this convergence and consolidation evolves, each business will need to align its specific mobile management priorities with the strengths of the multiple approaches.

Feature	Purpose Overview
Multiple OS Support	Support apps for multiple mobile operating systems enabling enterprises to support enterprise and personal devices
Device password management	Manage passwords and support policies for password complexity, changes, and monitor compliance and breaches
Remote device wipe or lock	Wipe device or apps and/or lock the device for security breach or device loss
Separation of business and personal environments	Define and manage personal and business apps, data and uses through separate systems and policies
Dashboard of all devices	Monitoring and reporting of all supported devices with status, usage and administrative view
Asset tracking and management	Visibility to all devices, their location and deployment
Over the air troubleshooting and support	Perform diagnostics and updates from central remote management, include push changes and updates

Table 10: Mobile Device Management Features (partial list)

6.4 Mobile Management Vendors

A large and growing number of vendors provide a widely diverse set of functions to address the breadth of enterprise needs for managing mobile devices, apps and security. Table 11 lists vendors from each main category that these functions fall into: app stores, MAM, and MDM:

Vendor	Product	Website	App Store	MAM	MDM
AirWatch	Enterprise MDM	http://www.air-watch.com	x	x	
Antenna Software	Antenna Mobility Platform (AMP)	http://www.antennasoftware.com	x	x	
AppCentral	AppCentral	http://www.appcentral.com/	x	x	
App47	App47 Manager/Enterprise App Store	http://www.app47.com/			
Apperian	Enterprise App Services Environment (EASE)	http://www.apperian.com/	x	x	
Appia	Appia Marketplace	http://www.appia.com/	x		
Apple	iOS Developer Enterprise Program	https://developer.apple.com/programs/ios/enterprise/	x		
BMC	Numara Cloud Mobile Device Manager	http://www.numarasoftware.com/			x
BoxTone	Enterprise Mobility Management (EMM)	http://www.boxtone.com/	x	x	x
Capricode Syncshield	Syncshield Advanced Mobile Device Management	http://www.capricode.com/			x
FancyFon	FancyFon Mobility Center (FAMON)	http://www.fancyfon.com/			x
Fiberlink	MaaS360	http://www.maas360.com/	x	x	x
Fixmo	Fixmo Sentinel	http://fixmo.com/		x	x
Good Technology	Good for Enterprise	http://www.good.com/		x	x
Google	Google Apps for Business	http://www.google.com/apps/intl/en/business/			x
IBM	Endpoint Manager for Mobile Devices/ Worklight acquisition	http://www.ibm.com/us/en/			x
McAfee	Enterprise Mobility Management	http://www.mcafee.com/			x
MobileIron	Virtual Smartphone Program (VSP)	http://www.mobileiron.com/	x	x	x
Mocana	Mobile App Protection	https://www.mocana.com/		x	
Motorola	Mobile Services Platform (MSP)	http://www.motorola.com/business			x
Nukona	App Center	https://www.nukona.com/	x	x	
Odyssey Software	Athena	http://www.odysseysoftware.com			x

Vendor	Product	Website	App Store	MAM	MDM
Partnerpedia	Enterprise AppZone	http://www.partnerpedia.com/	x	x	
RIM	BlackBerry Mobile Fusion	http://www.rim.com/	x		x
SOTI	MobiControl	http://www.soti.net/mobicontrol/			x
Sybase	Afaria	http://www.sybase.com/products/mobileenterprise/afaria			x
Symantec	Symantec Mobile Management	http://www.symantec.com/	x	x	x
Tangoe	Mobile Device Manager	http://www.tangoe.com/	x	x	x
Wyse	Trellia	http://www.trellia.com/			x
Zenprise	MobileManager	http://www.zenprise.com/	x	x	x

Table 11: Mobile Management Vendors

Mobile management is still in the early stages of development, and many of the vendors are small. Most tend to specialize in either the device or app management aspects, but several, such as Fiberlink MaaS360 and the MobileIron Virtual Smartphone Program, include capabilities across the spectrum.

Aragon predicts that the MDM and MAM categories will continue to converge and consolidate into integrated mobile management by 2014. Each vendor implements a different mix among the three categories; some specialize in narrow functional segments while others seek a comprehensive scope. For example, Fixmo Sentinel focuses on integrity management, risk management and compliance.

Planning Assumption: MDM and MAM will consolidate into integrated mobile management by 2014.

The MDM market is poised for consolidation. Smartphones and tablets are already mainstream, and will be commonplace throughout nearly all enterprises in 2012. Many large system and network management vendors are expanding into mobile. SAP was one of the early movers with its acquisition of Sybase, which added the Afaria MDM product. In January 2012 IBM acquired Worklight to expand its capabilities, and BMC acquired Numara with its Cloud Mobile Device Manager, which it had acquired with Fromdistance in October 2011.

Also in 2012, RIM announced BlackBerry Mobile Fusion, which will expand to support Android and iOS devices. Google is now increasing its presence in the segment, and provides basic MDM as part of Google Apps for Business.

Enterprises' mobile management needs are as diverse as the growing universe of vendors. Each enterprise should evaluate its own requirements, and determine how much and what kind of MAM and MDM it needs. Only with a clear definition of its goals and their business implications can an enterprise undertake a meaningful comparison

of vendors. Aragon will explore ways and means for enterprises to plan effectively, and we'll publish more detailed analysis of how well the vendors and products can satisfy those enterprise requirements.

Some vendors adopt more specialized ways to fill value niches in the rapidly expanding mobile universe. For example, Mocana is a small vendor that can add mobile app protection to individual apps, such as encryption, control of potentially sensitive features like cut-and-paste, or a password requirement. Other vendors address various elements of the mobile app lifecycle with tools for testing, performance monitoring and real-time reporting.

6.5 Bottom Line: Just Do It

Enterprises need a mobile management strategy to manage the fleets of mobile devices entering the workplace, to monitor and control the distribution and use of enterprise applications, and to protect corporate information and keep it secure. The devices themselves require security and management, the apps must be controlled, distributed and supported, and the entire ecosystem needs monitoring and protection.

The products to solve the varied issues of managing mobile devices and apps are evolving rapidly toward a consolidated approach integrating mobile management. Along the way, different vendors will emphasize their own particular strength, whether aimed at the apps or at the devices. Additionally, many enterprises have yet to undertake a coordinated effort to bring their mobile devices under control, and will initially need subsets of the entire range of integrated mobile management capabilities. Understanding the roadmap of this consolidation, the differing capabilities of providers across categories, and clear definition of the business needs and priorities are all essential.

Planning Assumption: By 2014 due to BYOD demand by users, enterprises will spend more time on information, application and device management on than procuring and configuring computers and tablets.

As mobile devices become de facto standard workplace computing platforms, more management issues will arise, and manageability will become a serious requirement for mobile planning and strategy. Multiple needs will demand multiple approaches and multiple tools. The longer it takes to put a strategy in place, the more uncontrolled devices will proliferate. Banning them is not an option. You need to manage them now.

Section 7: Enterprise Strategies and Selection Criteria

7.1 Overview

Enterprises are preparing to support thousands of smartphones and, increasingly, tablets. Many of these, owned by individual workers, have already entered the workplace without any IT plan or strategy for receiving them. For IT, responding to the connectivity, security and support challenges is an immediate need. To meet this challenge, IT has to understand and embrace not just the mobile devices themselves but the entire ecosystem that surrounds and supports them. IT organizations that do not understand what a mobile ecosystem is made of, and what supporting it entails, will find it impossible to manage and troubleshoot issues when they arise.

The good news is that managing mobile devices costs less than managing PCs; the bad news is the huge number of apps (over a million titles in the public app stores alone), the large number of very different devices, and the broad range of use cases. Not to mention that all these numbers are growing at an accelerating pace. Major advances have been made in making tablets and smartphones enterprise-ready, but they have not been made by every provider. This makes the issue of mobile ecosystem selection more critical than ever, since not all ecosystems are created alike and not all providers have the will or the desire to keep making advances in their ecosystems.

7.2 Sustaining the Ecosystem: Not For the Faint of Heart

A mobile ecosystem is an entity of considerable scope, involving hardware, software, services, e-commerce, wireless, security, system management and a host of other infrastructure elements. Not all mobile providers have the resources to build and maintain an active, up-to-date ecosystem that meets the needs of users and the enterprise. Even those who do may not be able to keep all elements in place at all times. Evaluating those that are of most importance to each enterprise, and understanding which ones have the most bearing on each provider's future will be keys to success.

MOS: Yearly Updates Are Now Standard
One consequence of the mobile market's consumer focus is a much shorter product cycle. Microsoft generally releases a new version of Windows every three years or so; mobile software updates occur yearly if not faster, along with regular bug fixes on an ad hoc basis. Tactical releases are generally done by a forced download over the phone network, a process controlled by the telecom carrier.

Close examination of vendor delivery track records can reveal a vendor's overall competitive agility, an important criterion in this fast-moving app-oriented market. Vendors should also be evaluated on how frequently they offer bug fixes, as well as the extent to which the patches actually fix the problem.

Innovation is also a driving factor. When evaluating ecosystems, look for the innovations that have come from each major provider. So far, Apple has been the innovation leader in the mobile space, but Google also continues to push innovation. Microsoft cannot be counted out, but it has a lot of catching up to do, and its time-to-market track record is not competitive in the mobile arena.

Managing Apps

App Stores: A private app store is in your future. Each enterprise will need to exert control over devices, apps, and security well beyond what the consumer-focused public app stores can provide. Workers will continue to download apps from the public stores, but enterprises need to create private app stores to deliver secure, proprietary, well-managed custom apps optimized for company-specific business processes. However, this is not a build vs. buy decision: there will be enough quality MAM vendors to avoid the costly distraction of building your own app store.

Managing Devices

Managing hundreds or thousands of diverse mobile devices, with diverse system software, built by diverse manufacturers, from diverse telecom carriers – many of them owned (and possibly modified) by diverse individual workers – is not a trivial challenge. Securing the apps that have access to corporate data is critical, as is being able to erase the devices remotely in case of loss. MDM is exploding to meet this need; Aragon expects the category to be bigger than PC device management. Managing mobile systems is a growth segment for new entrants and the titans of infrastructure and operations management, as they expand to encompass mobile apps and devices.

Innovation

Innovation is often subjective, but Apple has clearly led the pack in mobile hardware, delivering new capabilities in every major release since the iPod. Google has been a fast follower and also has had its share of new capabilities. Indeed, Android systems have at times been more advanced than the same generation of Apple devices – at least until the next release of iOS levels the field again. However, when it comes to deep innovation – the paradigm shifts that change the game – Apple continues to be the leader.

When evaluating a prospective supplier, it's important to determine whether the vendor is an innovator or just a follower. Some indicators are:

- What is the growth rate of new applications (i.e., are developers enthused)?

- How many new hardware features can apps take advantage of (e.g., USB 3 or Bluetooth 4.0)?

7.3 High Level Evaluation Criteria

When considering mobile devices, enterprises need to look carefully at the ecosystems that surround them. The ecosystem is more important than the hardware. The criteria below reflect what has been covered in this Strategic Report.

Major/Minor Evaluation Categories	Percentage
Multi-Device Operating System (MOS)	**25%**
• OS Upgradability	10%
• Annual Upgrades	5%
• Innovation Factor	5%
• Support for Multiple Form Factors (MOS)	5%
App Store Support	**20%**
Microapp Support	**20%**
Devices	**20%**
Manageability	**15%**

Table 12: Mobile Ecosystem Evaluation Criteria

Detailed Evaluation Criteria
Buyers can adjust these weightings to fit their needs, but Aragon feels that the mobile ecosystem is a key criterion that must be seen with a critical eye.

Mobile Ecosystem Evaluation Criteria
- **Multi-Device OS 25%**
  - ***OS Upgradability – 10%***
    - Is the OS upgradable, and does the carrier plan to do so?
    - Can an end-user perform an upgrade without support from the IT Helpdesk, the vendor or the carrier?
    - Does the vendor have a policy of supporting older devices with its newer versions of the OS
  - ***OS Annual Upgrades and regular bug fixes -5%***
    - Does the vendor have a track record of annual updates to its MOS
    - Does the vendor deliver a reliable OS and are bugs fixed regularly and made available to end users

    - Does the vendor address security flaws in its bug fixes
  - ***Innovation factor (new features added annually) -5%***
    - Does the vendor have a track record of innovation?
    - Does the vendors developer program encourage innovation?
    - Is the Vendor investing in R&D to support Innovation in Software?
    - How many new features delivered in each of the last major releases count as innovations?
    - How many patents has the vendor applied for?
  - ***Support for multiple devices (Smart Phone, Tablet) -5%***
    - Does the OS support multiple devices, such as tablets and phones?
    - Can apps developed on the OS be used across multiple classes of device?
    - Will new versions of the OS run on older model devices?
- **Mobile App Management- 20%**
  - Is the public store provisioning apps that are malware free?
  - How does the public app store validate app contributors?
  - Are updates to apps vetted in the same manner as new apps (e.g., malware certification)
- **Microapps -20%**
  - What is the selection and availability of apps that are available in the app store?
  - What is the quantity of apps available for business use?
  - How easy is it to develop apps for the mobile ecosystem in question?
- **Devices -20%**
  - Support for core features?
  - Consistency of hardware features across devices (home button)
  - How often are devices refreshed (1x a year minimum)?
  - Does the device have a competitive set of features?
  - Does the device work reliably over standard wireless networks?
  - Is the device easy to update by users, without IT intervention?
- **Managability-15%**
  - What are the capabilities of the MDM providers for the MOS?
  - How well can the provider reliably support multiple devices and operating systems?
  - How frequently are updates provided when a new OS is supplied to an ecosystem?

7.4 Summary

We have entered a new era in computing: the tablet era. The revolution ensuing is comparable to the introduction of the PC, with a new paradigm of human-computer interaction expanding use cases and making computing even more accessible to everyone.

The defining characteristics include not only the devices and new form factors, but also a new generation of user experience, and the mobile ecosystems that will power innovation. Mobile ecosystems are the key enabler of success, and all five ingredients play a significant part in provider viability:

- Multi-device operating system (MOS)
- Mobile devices with different form factors and engaging user experience
- Availability of extensive microapps and strong developer support
- An app store for selection and distribution
- Content and content stores that attract large consumer markets

Five major players have carved out a place in the rapidly evolving market, each with different capabilities: Apple, Google, Microsoft, RIM and Amazon.

Apple has the lead, and has established the competitive bar. By owning the entire experience, including the hardware and software, Apple has been able to create a highly unified and integrated user experience around solid innovation in interaction styles.

Google, with Android, responded rapidly and has become a strong competitive force. Android has taken the lead in overall licenses, establishing an attractive market for developers and apps. However, Android is behind in tablet apps and the fragmented nature of Android versions is serving to diminish overall impact and consistency of function and experience. Google has set in motion a unification strategy with Android 4, but limited control over the details of user interface and hardware implementation continue to dilute its potential for a truly unified user experience.

Microsoft is significantly behind, and has not yet become a factor in the tablet market. Its ecosystem is only now emerging, and is a bifurcated approach aimed at protecting the enterprise Windows market and competing with consumer tablet appeal.

RIM responded slowly to the consumer priorities for tablets and apps, and has lost its early lead in mobile. With its updated PlayBook tablet and plans to deliver a unifying OS in 2012 it has potential to maintain enterprise presence. However, it is likely to remain a small component of the overall tablet market, especially as Microsoft begins to establish its presence in the enterprise with Windows 8 in late 2012.

Amazon has carved out a segment in tablets aimed at e-books and low-end devices. Its impact is being felt by taking a portion of the market and attention from the others, but its overall impact will remain a niche and at the lower cost and more limited device end.

The microapp is changing the face of software. Small, highly focused applications that are quickly developed and rapidly deployed and updated are the new model being driven by mobile.

A defining aspect of mobile devices is their ability to tightly unite microapp capabilities with features of the hardware so the device takes on the personality of the app. By exploiting the app's personality they can mimic and replace other dedicated devices like a check scanner, a camera, a book reader or an insurance adjustor. This approach will continue to expand use cases, including home automation and integration into cars.

Delivering a user experience that is both more natural and personal in nature will be a significant force in continued expansion of mobile device usage. Increasingly the most successful tablets emphasize the function while keeping the computing and OS in the background. New interaction styles using touch, voice and gesture have established a new wave of simplicity and usability. The simplicity and integration of the human-computer interface will be instrumental in accelerating acceptance and growth of this approach to computing.

Tablets are encroaching on traditional PC turf. Other than Windows tablets that are fully functioning PCs, tablets have not been direct PC replacements. However, there are growing use cases where tablets are a better solution than traditional PCs, and when supplemented with a keyboard and mouse tablets can take the place of a laptop in certain situations. The significant trend is not that one device is replacing another, but rather the end of the enterprise mandate that each user rely on one device for most of their computing needs. High-end users have been given multiple desktop and laptop systems, and millions of users have company-issued smartphones in addition to their company-issued computers. Tablets provide a blend of convenience, portability, connectivity and power that makes them a user's ideal go-to device for on-the-go work.

The market for tablets is expected to continue to grow rapidly. As use cases expand into education, games and automotive applications the opportunity is exploding. Tablets will become the predominant approach for delivering learning and courseware. Combined with expansion of smaller form factors and declining costs over the next five years, we are forecasting more than 750 million tablet devices by 2016.

An essential element for enterprises is their ability to manage the explosion of tablets and mobile devices. The enterprise app store is a must for gaining control of the apps to be provided for the workforce. This emphasis will expand, with enterprises requiring an integrated mobile management approach that addresses the mobile apps and mobile devices and incorporates both those that are corporate and personally owned.

Enterprises need to look at mobile systems from three perspectives:

- People doing work in the workplace
- Leveraging apps to help drive the product or service being offered.
- Recognizing that users will have more say in what apps they feel will help them do better work.

Those developing enterprise strategy and plans should expect a lot of "spin" from the providers across ecosystems. It is important to avoid the urge to focus on well-crafted marketing messages and instead recognize the importance of the entire ecosystem. Devices and the user experience that is enabled will be important, but the healthier the overall ecosystem the higher the likelihood that it will be robust enough to withstand the growing competition.

The tablet era creates tremendous opportunities for business to enable new ways of doing business, and driving a new wave of productivity improvement in the workforce. It is important for the enterprise to have a strategy for prioritizing tablets into the computing framework, establishing the parameters for managing users, apps and devices, and integrating the bring-your-own device approach into the business. If this is not underway, the time is now to take control of the tablet era for your business.