

# Apple vs. Microsoft: Past, Present, and Future (with iPhone)

## A Complex Systems Perspective

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On June 29th, Apple will launch the iPhone. Many expect that the iPhone will revolutionize the wireless industry. The iPhone has features of the widely popular iPod, but, perhaps as significantly, the iPhone is very close to being a handheld Macintosh computer. It uses the Macintosh operating system OS X. For many years, Apple has been in direct competition with Microsoft and its hardware partners in the technology world. There are already cell phones that are based on Microsoft's Windows Mobile operating system. Why would the entry of Apple into the cell phone market revolutionize the market? Viewed in this way the iPhone is just the latest chapter in the PC versus Mac competition. In this article we review the historic competition between Apple and Microsoft, to see how Apple has come to be the cutting edge of innovation despite Microsoft's huge size and dominance in the PC operating system market. Our objective is to provide you with a complex systems perspective and understand the future prospects of this ongoing competition.

Our conclusion will be that the standard perspective of Apple's small market share giving it a competitive disadvantage is deceptive. For reasons we will explain, Apple has a strong competitive position today not only due to changes in new Apple products, but also due to the "maturation" of the PC market into a small number of major players. In the 1980s and 90s, Microsoft benefited from the competition between PC hardware manufacturers that made Microsoft's products successful without a need to compete in terms of software quality. Now that the hardware competition among PC vendors has been won, leaving only a few companies dominating the market, Microsoft is no longer shielded from competition with Apple. This means that Microsoft's monopoly strength in previous years today puts it at a competitive disadvantage. Moreover, competition on price among the PC hardware vendors gives them comparatively thin profit margins, which place them at a disadvantage in the hardware competition with Apple. Along with Apple's rapid innovation, this bodes well for the Mac in the upcoming installment of the PC versus Mac competition.

## Introduction

One of the great stories of the technology age is the competition between Apple and Microsoft, the Mac and the PC, for dominance in the personal computer industry. Apple develops both the operating system and hardware for the Mac, while Microsoft creates the Windows operating system and HP, Dell and other manufacturers provide the competing PC hardware. This competition has played out over 30 years. The story has been told and retold to learn lessons about technology adoption and free market competition, as well as what we can learn about the future. We will use this story to illustrate the application of complex systems, giving not only a new perspective on what has happened, but also predictions about what is still to come.

Let's start with what we mean by complex systems. It is a new approach to science, which studies how relationships between parts give rise to the collective behaviors of a system, as well as how the system interacts and forms relationships with its environment. There are fundamental concepts that apply to all systems. In this article, we will focus on the concept of evolution (explained later in the article).

Now, think of PC hardware/software manufacturers, sellers, buyers as one system. We'll start with a review of the Apple and Microsoft competition history. If you are familiar with

the history, scan till you reach Chapter VI.

## **Chapter I: Origins**

Microsoft was founded in 1975 by Bill Gates and Paul Allen. The company's first product was the BASIC programming language for early versions of personal computers, often called microcomputers. Over the next five years, Microsoft became the leading distributor of software development tools.

Apple Computer Corp. (recently changed to Apple Inc), was founded in 1976 (on April fool's day) by Steve Jobs and Steve Wozniak. Apple's first product was the Apple I, which is credited as the first fully assembled personal computer to be sold. After selling 200 of them, Apple launched the Apple II, which was simple and easy to use, in April 1978. Apple sold 100,000 Apple IIs by the end of 1980 and went public in the same year. As a result, computers, which had primarily been mainframes for corporate business use, became relevant to personal and home use. They had a lot to celebrate: a successful IPO, as well as market leadership in a hyper-growth market.

## **Chapter II: Competition**

However, things would change in coming years. IBM, the giant in corporate mainframe computers, was watching Apple's success and wanted to enter the personal computer market. IBM authorized a special team to bypass normal company processes to get "something" to market as soon as possible. The special team decided to use parts made by other companies, creating an "open architecture." Among these companies they used an Intel manufactured processor and hired Microsoft to develop an operating system (OS). Gates bought an existing OS (QDOS) and tailored it to IBM requirements renaming it MS-DOS. IBM launched the IBM PC on August 12, 1981. Many businesses bought it because of the strength of IBM in the world of the business computer market. The open architecture enabled other companies (Compaq, AST research, HP, NEC, Zenith, Epson, Olivetti, WYSE, Tandy, Packard Bell, AT&T, and others) to build "IBM Compatible Personal Computers," or PCs for short, that were cheaper and worked the same way. These companies competed with each other. Because of its cheap price compared to other options at the time, MS-DOS achieved 85% market share by 1984. This made it the standard, and the experience of using a computer was largely the same on any PC that ran MS-DOS. In comparison Apple was a "closed" system (i.e. only Apple could produce its personal computers). In 1984, Apple brought the Macintosh computer to the market, introducing a graphical interface with windows, a mouse for pointing and clicking, and other innovations. While embraced by some, the computer did not gain wide acceptance. Meanwhile, the market share of PCs grew. In 1985, Steve Jobs was sacked.

## **Chapter III: Decline of Apple and Dominance of Microsoft**

After Jobs departure, Apple's market share remained high in a few parts of the market, particularly desktop publishing and education. Simultaneously, the overall market continued to grow. By 1990, Apple sales reached \$5.6B, which was about 8% of the total market. On the other hand, the PC had market dominance. Apple continued to improve hardware and software, but so did the PC manufacturers and Microsoft. Microsoft adopted the graphical user interface and through progressive versions of Microsoft Windows, particularly Windows 3.0 in 1990, and Windows 95, narrowed the "ease of use" gap between PCs and Macs. There were a large number of PC vendors who offered products at different prices with different hardware features. As a result, low end PCs were available for much cheaper than the least expensive Macintosh.

In the coming years Apple introduced many innovative products like the Powerbook 100 (one of the first laptops), Apple QuickTake (one of the first digital cameras), Apple Newton

(first personal digital assistant), etc. None of these new Apple products were lasting commercial successes. In the first quarter of 1996, Apple announced a loss of \$69M and layoffs. In 1997, Apple had 3% worldwide market share. As the Macintosh market share declined, many software developers stopped development work for the Mac.

Microsoft also recognized the potential of the application market and started developing applications, originally for Apple's OS. Its familiarity with application development helped Microsoft to develop Excel and Word. When the main competitors WordPerfect and Lotus 1-2-3 were delayed in being adapted for Windows, Microsoft's applications on Windows became more widely used. It then bundled the applications at a discounted price, creating Microsoft Office, which eventually displaced the competitors as the standard for business use.

Despite the dominance of Microsoft, the users of Macintosh computers continued to claim that Microsoft software was poor, and not only was Apple's OS easier to use, but also better for many purposes. They became known as the Apple loyalists.

## **Chapter IV: The Rise of Apple**

Steve Jobs became CEO of Apple again in 1997, a few months after Apple acquired NeXT, a company founded by Steve Jobs that developed a computer oriented toward academic and technical users. In 1998, Apple introduced the iMac which supported "plug and play" peripherals, such as printers, that were designed for Windows based PCs. Furthermore, it also outsourced manufacturing and started following standard interfaces like the USB port. While other PC companies were cutting R&D budgets, Apple increased it. To position itself as different from other PC brands, Apple promoted itself as the hip alternative, launching many innovative products—iMac, Power Mac, Apple Cinema display, etc. Although successful among a small base of Apple loyalists, the market share remained at about 3%. These products may have helped to stop the loss of market share, but certainly did not increase it significantly. On the OS front, Apple launched its new operating system, OS X, which was considered a breakthrough at the time. However, many independent software vendors did not develop applications for OS X.

In November 2001, Apple launched the iPod, a portable digital music player. Originally it only "synced" with Macs, but in August, 2002 it was also introduced for PCs using Windows. In conjunction with the iPod, the iTunes Music Store was introduced, revolutionizing the music market. With iTunes, users could convert their CDs to digital format, download songs for \$0.99, burn them to a CD, or copy them to an iPod. In October 2003, iTunes was made Windows-compatible. Within three days of the launch, PC users had downloaded 1M copies of free iTunes software and paid for 1M songs! Apple continued to rapidly innovate many versions of iPod: mini, shuffle, nano, video, etc. Within three months of Video iPod launch, Apple sold 8M videos. By January 2007, Apple had sold almost 90 Million iPods and now they comprise about 48% of Apple's annual revenues.

Apple has striven to make the Macintosh central to many aspects of a "digital lifestyle." They've aimed to incorporate creativity, entertainment, and, more generally, to integrate hardware and software into all aspects of life. Apple has created the applications iPhoto, iDVD, iWeb, etc. and has bundled them in the iLife suite for Mac users (similar to the Office suite by Microsoft for business users). Additionally, Apple is extending this digital lifestyle through hardware, including iTV, and the upcoming iPhone.

In another major shift, Apple abandoned its long-standing use of PowerPC chips made by Motorola and IBM in favor of Intel microprocessors, the same as those used in PCs. Apple started shipping "Intel Macs" in January 2006. This eliminated one of the distinctions between Macintoshes and PCs from a hardware perspective, allowing them to compete on equal footing in processor speed, and making the hardware cost of the processors no longer a differentiators in price. This change also led to an additional bonus for those who

considered switching to Macintosh computers. The new version of OS X on Intel processors allowed switching to a mode where Windows could run, enabling users to work with their Windows applications, switching back to OS X when they wanted.

Other features of OS X continued to advance through four major revisions. The most recent provided advanced search functions, and effective programs for mail and browsing (Safari), among others. In the meantime, Windows went through a difficult upgrade process with many delays in the release of a new version of Windows. Only recently has Windows Vista appeared, receiving at best mixed reviews after its 5 year development.

For the past few years Macintosh sales are outpacing PC growth. In fiscal Quarter 1, 2007 which ended December 30th, Apple shipped 1,606,000 Macs representing 28% year over year growth: almost double what PC growth was during the same period. The largest growth in market share has been in the US, but growth has also occurred internationally since 2004.

Microsoft has competed with a number of other players, winning a competition over the Internet browser market with Netscape, competing with Google over WWW search, and competing in the game console industry with Sony and Nintendo. Microsoft has also less effectively competed with Apple over music downloads, and MP3 players.

## **Chapter V: The Maturation of the PC market**

The maturation of the PC market can be summarized by observing that Dell and HP have become the dominant players. In the fourth quarter of 2006, HP had about 17% and Dell had about 15% of the global PC market. Along with the other top five PC makers, these companies held 50% of the total PC market. Consistent with the original concept of PCs as providing a relatively consistent experience across vendors, an important aspect of their strategy has been competing on low cost PCs that are otherwise undifferentiated. Dell reduced costs by exclusively selling directly to consumers and businesses. HP's large share of the PC market arose from their purchase of Compaq in 2002, which had bought Tandem Computers, and Digital Equipment Corporation (DEC).

## **Chapter VI: Complex Systems (CX) Perspective**

Now, let's apply a complex systems (CX) perspective in order to understand the story so far.

We are going to focus first on the idea of an "open system" as it has been used to discuss the Microsoft and Apple competition. Frequently, Microsoft is credited with success because it has an open system that allows many companies to make hardware for the operating system it produces. This is contrasted with the "closed system" that Apple has. There is some truth to this idea. Indeed, the idea is rooted in the reason for the success of free market economies—competition under the right circumstances leads to improvement. There is a similar and perhaps more general concept of competitive improvement, evolution, which is studied extensively in CX. To explain, we will start with defining evolution.

Biological evolution is a process by which populations of organisms are transformed over time. Organisms do not change individually; rather the changes occur between one generation and the next. Different individuals have different traits. Still, more than one individual can have similar traits. Some of the individuals reproduce more than others, and some end up surviving to maturity more than others. Because traits are hereditary, the relative rates of reproduction cause the faster-reproducing and better-surviving types to dominate other varieties over the course of many generations. This process is called natural selection. Evolution is typically considered to be a biological process, but here we are considering it more generally.

In a market economy, there are many possible things consumers can buy. For example, different makes of personal computers. Because they offer different features, people will choose to buy some more than others. As a result, the ones that are bought more frequently provide more resources to their manufacturers. Additionally, customers will talk about which ones they like and dislike. Over time, some grow in popularity and others shrink. We might think about the market share like part of the population of a type of biological organism.

What is important for our purposes is that when there is competition, there is a tendency toward improvement, at least as measured by how popular a product is. Since there are a number of possibilities to choose from, the ones that are chosen by more people are more successful by this measure.

In biology, mutations cause variations in the population, resulting in progressive improvement over time. Like mutation, innovation in the economy of personal computers causes computers to vary between manufacturers, and over time. This leads to changes in market share as people choose the ones whose innovations lead to improved computers. Both in biology and in economics, the ones that have a larger population (market share) have an advantage in growing even bigger market shares. This happens for a number of reasons. In economics, one of the key reasons is the economies of scale, which allow larger companies to make their products cheaper.

This seems straightforward, but there are a few issues that we need to understand in the case of Apple vs. Microsoft competition.

*1) Competition in only part of the system:* The open system idea means that PC manufacturers compete with each other, causing their products to improve from the point of view of the user. In particular, they improve by reducing their costs and increasing their capabilities (speed, memory size and so on). However, this competition does not impact the desirability of the product that Microsoft produces. It only affects the desirability of the hardware. Microsoft benefits from this competition because it has an effective monopoly on one part of the product, while the part that is competitive and improves itself over time, is due to other companies. We would therefore predict that the product of Microsoft would not be very good because it is not the subject of competition. This is not entirely true, of course, since there is competition with Apple. This competition, however, is relatively weak because of the strength of the hardware competition. This is consistent with the widespread claims that Microsoft's operating system is not as good as Apple's, even though Apple has a smaller market share.

*2) Maturation of the market:* The existence of an open system only leads to benefits if the competition is actually taking place. As discussed in Chapter V, the maturation of the PC market to a situation where there are only two dominant players means that there is very little actual competition today. This lack of competition means that the improvements are not as strong as they used to be in comparison with the Apple "closed system." Moreover, despite the so called "closed system" of Apple, Apple actually has others manufacture their products, with components that are similar to the components of PCs. Apple also uses multiple suppliers who compete against each other. This means that Apple selects from the best of the component manufacturers and assemblers in order to make their products. This includes the choice of Intel processors (which are competing against AMD), as well as other components such as memory chips, disks, screens and so on. While it is true that Apple's selection of manufacturers is not exploring various options in terms of the final product, as does the "open system" model, it still uses the competition of that market to a great degree.

*3) Creation of new species:* With evolution, the PC has resulted in variations that are different enough to be like distinct biological species—gaming consoles, PDAs, smart phones, etc. Companies use their strength to introduce new varieties both to gain sales in

new markets and to protect the market they currently dominate because variants serve functions similar to the original. Today, the main use of PCs is Internet access. However, one can access the Internet from smart phones, PDAs, and from gaming consoles. Microsoft used its strength in software to compete with Sony/Nintendo gaming consoles and to compete with Palm/Blackberry/other smart phones by launching X-Box and Windows Mobile software. If Microsoft loses in these contexts it is also at risk in its core market. Apple's iPhone starts by serving a dual purpose; to protect Apple's dominance in the portable music player market and to gain market share in the smart phone market. Moreover, as an Internet device it will increase Apple's strength in the Internet access market. Today there are over 3 billion cellphones in the world and 1 billion PCs. Most of these are not smart phones but, clearly, a successful move in the smart phone market will increase the strength of Apple in its personal computer business.

Overall, the current situation is that the traditional competitive disadvantage of Apple has decreased because there are fewer competitors in the hardware PC market. On the other hand, the weakness of Microsoft due to a lack of competition on the software side (particularly the operating system) works in Apple's favor because it has previously used its strength in the OS to compensate for its competitive disadvantage on the hardware side.

## **Chapter VII: Conclusions and predictions**

Historically, Microsoft used its monopoly power for dominance. What helped it was that it was working with the hardware side where there were many competitors. Today, however, there aren't many and this doesn't shield them from direct competition. From an evolutionary perspective, Apple has a new ability to compete because of the reduced internal competition among PC hardware manufacturers, and the weak competition from Microsoft on the software side.

Markets only improve their products effectively when there is actual competition. This competition makes them immune to new "external" invaders.

In the PC marketplace, competition between hardware manufacturers was the reason for the success of Microsoft's monopoly, despite its weaknesses. When we consider Apple's competition with Microsoft and PC manufacturers, we see that the hardware side of the competition only involves one or two or three (HP, Dell), while the software competition is a one-on-one (Microsoft vs. Apple) competition. The software one-on-one pits a strong competitor (Apple) against a weak competitor (Microsoft). Moreover, on the hardware side, lower profit margins weaken the PC manufacturers compared to Apple.

Apple is using its software platform superiority and hardware innovation to launch the iPhone, which should be considered a small-form-factor Macintosh with some special hardware and software. It uses OS X, which is the same operating system used in the Macintosh. Expanding into cell phones in this way uses Apple's existing base to compete in a new and quite large market. Hence, the evolution of Mac into a new form factor (a new life form).

Thus, we expect Apple will continue to increase its market share and dominance in the software rich-iPhone and Macintosh-platforms. If Apple's market share grows enough, the current Microsoft strength in its large market share may very well become unstable and collapse.

*Additional topics to discuss in future segments:*

- Open source as a basis of OS X.
- Internal innovation at Apple.
- Selfishness and altruism in markets, the role of low profit margins and viability.

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