

Consumer Demand Drives Innovation and Integration in Desktop Computing

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Abstract

Success in the computer desktop market is all about reading and responding to consumer demand. Although desktop competitors look at common clues for consumer preferences, they respond based on unique technology and new business models. Traditional, thick-client desktops from Microsoft, Apple, and Linux will feel competitive pressure from the thin-client, on-demand model offered by new competitors like Google.

The rise of the on-demand desktop will forever change the concept of the desktop market. Centralized services can instantly add new features, integrate across applications stored on the server, and enable collaboration among connected users. Thick-client competitors such as Microsoft, Apple, and Linux will have to ratchet-up their feature integration efforts just to stay in the desktop game.

The Customer is (still) Number One

The market for desktop software is highly competitive—companies that fail to add new product features will lose market share. When it comes to satisfying consumer demand for desktop features, the question is not *whether* to add new features, but *how*. Competitors—large and small—use different approaches when adding new features, depending upon technical architecture and business models.

The process of adding new features to desktop software is no different than for other products and services. Producers discern consumer preferences and determine how to best use their available resources to satisfy demand. The result is often a product with more features and greater usability. These features are new additions that are either specifically created for that product or combined and integrated from existing products.

The computing industry adds features in way that is similar to how automobile manufacturers have made improvements over decades of new models. Air conditioning, satellite radios, and GPS navigation are among features that car makers have added—often as standard features. Auto makers took their cues from consumer demand demonstrated by after-market purchases and installations.

In addition to responding to explicit consumer demand, companies also add features to differentiate their products from competing desktops and to generate new revenue opportunities from current customers. Makers of mobile phones, working in concert with carriers, added text messaging, music and video capabilities.¹ Consumer response has been overwhelmingly positive, creating a win-win situation in which manufacturers

benefit from increased sales and carriers invest to meet growing demand for data communications services.

Makers of automobiles and cell phones responded to consumer demand, largely by integrating new features with their product lines. However, as the two case studies below illustrate, the failure to add new features can be fatal, even for a market leader.

Case Study: *Nintendo 64*

Nintendo provides an example of how a company can lose market share when it fails to integrate new features into its product. From the mid-1980s to mid-1990s, Nintendo was the leader in the home video game console market. However, when it released its 64 bit console in 1996—the Nintendo 64—it made a costly miscalculation. It stuck with ROM cartridges, an older technology, when its competitors went with the newer CD-ROM drives.

While the ROM cartridge had its advantages, including its durability and fast load times, it had severe disadvantages against the CD-ROM. CD-ROM drives allowed for increased storage and therefore more complex games with better video enhancements. Moreover, CD-ROM discs are much cheaper to manufacture and distribute, resulting in lower costs to third party game publishers.

The cost of producing an N64 cartridge was far higher than producing a CD.² Because of the higher profit margins found on CD-based platforms, many game developers began to develop games for Nintendo's competition. In a single video console generation, Nintendo went from first to distant last in the set-top box gaming market.

Case Study: *Palm Pilot*

In 1996, a startup company named Palm pioneered the market for the PDA (Personal Digital Assistant). Their Palm Pilot handheld device came with an integrated operating system and was finely-tuned to consumer demand, by including personal productivity tools like a contact manager, word processor, and spreadsheet. Palm later added a feature for infrared beaming of contacts between Palm Pilot users, responding to customer demands for an easier way to swap electronic business cards.³ When it added cell phone capabilities, Palm seemed destined to dominate the growing PDA market for a long time to come.

But in 1999, Palm's leadership was threatened by a new PDA that added wireless email – a feature that was highly valued by Palm's target customers.⁴ Within a few years, RIM's Blackberry became the leading PDA, with its built-in email and thumb-friendly tactile keyboard.

Nintendo and Palm were late to recognize clear signs of consumer demand for new features, and it cost them their market leadership. Market leaders, even those whose innovations created the market in the first place, cannot afford to rest on their laurels.

How Desktop Vendors Determine Consumer Demand

The desktop software industry identifies demand by understanding five main areas: add-on products, purchases of hardware, competing products with greater or fewer features, consumer surveys, and product reviews and commentary.

1. Downloads and Installs for After-Market Software Products

Measuring demand for add-on products—those features that are available on a standalone basis—is one way for software manufacturers to understand consumer behavior. Consumer downloads and store purchases of software are easily quantifiable and indicate preferences for certain features.

Information on top downloads is available at such sites as Download.com.⁵ Download statistics for add-on software for a host of products, such as browsers, word processing software, and media players, provide clues about features that developers should add to new versions of their products. As a result of consumer concerns toward spyware and security, industry listened. For instance, Download.com lists 233 products on the market that address adware and spyware and 210 antivirus programs—three of which lead the top-10 list of most popular downloads.⁶

Furthermore, the amount of in-store purchases of products such as Symantec Anti-virus, Microsoft Picture It and Adobe Photoshop provide information not just about each individual product, but also about overall consumer demand for certain features.

Vendors often offer multiple add-ons for common products. For example, Google and Yahoo! offer toolbars that have been downloaded by millions of Internet Explorer users. As a result of this demand, Mozilla Firefox has integrated a quick search toolbar into its browser that can be used for Google and Yahoo! search and for searching a number of other websites, including Amazon.com, Dictionary.com and Wikipedia.

Most Popular Downloads

1. ICQ
2. Ad-Aware SE Personal Edition
3. LimeWire
4. AVG Anti-Virus Free Edition
5. BitComet
6. ICamfrog Video Chat
7. BearFlix
8. WinRAR
9. Avast Home Edition
10. WinZip

Source: Download.com, downloads for week ending May 6, 2007

2. Purchases of Complementary Hardware Devices

Hardware product sales provide indicators to software companies about consumer trends. Because hardware and software are often tightly intertwined, software companies can enhance the consumer experience by adding features and preloaded drivers that improve hardware compatibility, ease of use, and maximize the features of hardware devices.

As an example, sales of digital cameras indicate that software companies should develop photo viewing and editing software. Demand for portable music players, such as the iPod, signify that consumers will need software on their computers to play and store audio files. Printers, scanners, and digital video recorders all require drivers and other specialized software to communicate with computers and other software products.

3. Popular Demand for Competing Products

Companies successfully compete when new features are appropriately tailored to the desires and needs of consumers in ways that trump their competitors. Industry players determine demand for new features by observing sales trends for competing products with greater or fewer packaged features.

Companies continuously integrate new features into their products. Apple markets the current version of its operating system, Mac OS X Tiger, by focusing on new features:

Explore more than 200 new features that will change how you use your computer. Discover how the innovations in Tiger work together seamlessly to give you a more enjoyable and functional platform for anything you do with your Mac.⁷

Apple touts its Mac computer as being ready “right out of the box,” because Apple includes so many features that increase ease of use and interoperability. The company is airing a popular TV commercial that compares the Mac to a Windows PC, claiming that Mac users can edit movies, create websites, and use its built-in camera without any user configuration.⁸ Apple compares its Mac to a Windows PC, whose owner must download drivers and read manuals before he can use the same features.

A product’s ease of use “right out of the box” depends, according to Apple, on the features inside the box—the software in the computer, that is. Companies that modify and distribute Linux also understand the value of product features to enhance the consumer experience.

Ubuntu is an integrated Linux desktop operating system and the fastest growing of all Linux distributions. There are an estimated eight million Ubuntu users.⁹ Version of 7.04 of Ubuntu Linux (Feisty Fawn) can be downloaded with *thousands* of applications that come bundled with the Linux operating system.¹⁰

Ubuntu’s popularity recently caused Dell to offer it for sale preloaded onto PCs. Dell had set up a Web site called “IdeaStorm” for customers to provide input into what products they wanted.¹¹ Dell said it would start preloading Linux on some of its laptops and desktop PCs in response to “overwhelming feedback” from users who filled out surveys on Linux preferences.¹²

In addition, demand for new features can be predicted by observing sales of computer desktops that come with fewer features. As history shows, offerings lacking features will be less attractive to new consumers. Furthermore, existing customers will not upgrade to a product that lacks enough new features to justify the cost and effort of upgrading.

For example, Microsoft ships a Europe-only Windows Vista N, the version of Microsoft’s operating system that does not include its Media Player. The previous version, Windows XP N, began shipping in June of 2005.¹³ No computer maker had shipped a single computer equipped with the media player-free version of Windows XP, and Microsoft claims that total sales of the stripped-down version are just 0.005 percent of overall Windows XP sales in Europe.¹⁴

4. Consumer Research

Companies conduct intensive market research on their current and future products through consumer surveys, interviews and focus groups. The results of these surveys

are often proprietary and carefully guarded, yet are undoubtedly reflected in new product announcements.

Industry pays attention to unmet needs of consumers. For instance, one recent industry survey asked consumers the following question: How concerned are you with computer viruses?

According to the survey, more than half of the respondents say their security concerns are rising—particularly among those who have experienced breaches. Consumers are also willing to take action: 40 percent have actually stopped a transaction online, on the phone or in a store due to a security concern.¹⁵

Not surprisingly, software companies have begun to integrate anti-spyware protection into their offerings. Symantec, once an anti-virus vendor, now offers a suite of spyware and firewall products to address security concerns and vulnerabilities. Microsoft has included anti-spyware protection in its Windows Vista operating system.

5. Commentary and Product Reviews by Industry Analysts

Commentary by industry analysts provides valuable insights to software designers. Product reviews—positive and negative—both affect and reflect consumer preferences and purchasing behavior.

Software product reviews generally include commentary on security, reliability, usability and new features. It is this latter category that is often the driver for a reviewer's recommendation for the product. All consumers are interested in new features. And for most consumers, the reason to upgrade depends almost entirely on the value of new features. Upgrades for existing users are *optional*, so consumers need a discernible benefit that is above and beyond what they already have.

Software designers scour product reviews for intelligence on what features should be included in new product releases. Recent reviews of the upcoming Apple Mac OS X Leopard, due out in October 2007, applaud such new features as Voice Over, iChat, and iCal. Regarding iCal, the review states that:

*Finally Apple is lifting calendaring up a notch. With the new multi-user iCal and its group calendaring, combined with iWork 07 and enhanced Mail, many small businesses will find no need at all for Microsoft Office.*¹⁶

Market leaders like Microsoft track reviews to help ensure that their current products don't go the way of the Palm Pilot or Nintendo 64.

Pre-release reviews by industry analysts can persuade consumers and producers to focus attention on particular new features with unproven demand. For example, "collaborative computing" is widely touted as the defining feature that's likely to differentiate desktop competitors.¹⁷ It's not obvious that real-time, online document collaboration would satisfy consumers better than the current means of sharing documents and tracking changes. Accordingly, while analysts' hype for new features is often based upon perceived consumer need, it is only a prediction until validated through actual demand or deeper levels of consumer research.

Moreover, software companies are attentive to post-release product reviews to see if its new features missed the mark. Indeed, product reviewers will lambaste a company if it fails to include the right features, even if those features come from other companies'

products. For example, one review of Ubuntu Linux praises its bundle of software but goes on to complain that Ubuntu lacks some “must-have” third party tools:¹⁸

*Firefox is the default Web browser in Ubuntu 6.06...but it has no plugins installed. None at all -- not even the SVG plugin. That means spending a half hour or so finding and downloading the Java, Flash, PDF, RealPlayer, and Windows Media plug-ins if you want to have a complete Web experience.*¹⁹

How Desktop Competitors Respond to Consumer Demand

How do desktop competitors respond to clues and cues about demand for new features? That depends upon their architecture and business models and how end users and other developers need and expect to access the features. Three such models are examined below: operating systems; operating systems installed by independent computer makers; and on-demand desktops hosted on remote servers.

1. Makers of Operating Systems

When they add new features, the makers of operating systems (e.g., Microsoft, Apple, and Ubuntu Linux) are trying to serve the different needs of two distinct sets of customers.

First, the makers of operating systems strive to satisfy end-users, with their demand for easy and instant desktop access to the latest and greatest tools and programs. End users, for example, want to find an audio and video player on the desktop—right out of the box. To be sure, end users may replace or supplement the included media tools with other products, but the clear expectation is that the buyer of a new computer should be able to play a CD or DVD without having to download or install additional software.

Second, desktop operating systems are also platforms for independent software developers. Desktop vendors must therefore distribute features in forms that developers can use within their own products. For example, third-party developers rely upon operating system features to access hard disks, download files, print documents, load images, etc.

These features are typically “exposed” to software developers via application program interfaces (APIs) that a developer can call upon as a seamlessly integrated capability of their own application. Users of a word processing program, for instance, expect the software to work with any available printers. The word processing developer accomplishes this by calling APIs for printer management and formatting options.

For developers of particularly complex software, having a core set of “exposed” features improves development efficiency, lowers time-to-market, and reduces support costs. Nowhere is that clearer than for computer games, where programmers once had to write their own specialized programs just to make their games display properly on the screen. This led to each programmer writing nearly identical code to accomplish tasks common to all games. To help game developers, Microsoft with DirectX, and Linux/Macintosh with OpenGL, created a way for programmers to call functions that would always be installed, and would always work consistently. These APIs were created to meet the needs of “programmer as customer.”

APIs create a kind of “software ecosystem” in which any programmer can innovate. Independent programmers—most often small companies—provide customers with third-

party features that operate on platforms from vendors such as Microsoft and Ubuntu. The combination of features included with operating systems and available from third parties increases the utility of the platform and thereby benefits consumers.

2. Operating Systems Installed by Independent Computer Makers

Only Apple makes and distributes the Mac and the Mac operating system, so Apple controls its users' experience (to the extent that users can ever be controlled). However, when makers of computers and operating systems are separate entities, they have a different level of control over how new features are integrated and packaged.

Computer makers such as Dell, Gateway, and Sony package their hardware with operating systems and software from other companies, most commonly Microsoft but also Linux distributors such as Red Hat and Ubuntu. Computer manufacturers can negotiate a deal with Microsoft to ship Windows with their computers and may influence which features appear in the software's final version—but Microsoft ultimately controls what features it includes in Windows.

PC makers, however, have other ways to control the user desktop experience. They can “monetize” the desktop space on their computers, by selling placement to third-party providers of software and services. In addition, PC makers often purchase or license additional software tools for their desktops to meet consumer expectations when the computer comes out of the box.

Working in concert and in competition, makers of computers and operating systems determine the features that users initially see on their desktops. But neither the PC makers nor Microsoft can control a users' initial experience to the same degree as Apple.

3. On-demand Desktops hosted on Remote Servers

A new way of computing may well replace the current model of computer makers working with operating system and software vendors to deliver the user desktop. It's known as “on-demand”, “just-in-time”, or “server based computing.” This desktop architecture, first advanced by Sun Microsystems and Netscape, holds that users need only minimal computing power and on-board software, since they access programs and data whenever and wherever they are via fast Internet connections.

Consider this scenario of a professional user of an on-demand desktop:

A sales executive is carrying a trim notebook computer loaded only with an operating system, a browser, and secure Internet connection tools.

When she needs to access her virtual desktop, she points her browser to a secure, shared service website.

After authenticating her identity, she's looking at an organized view of her calendar, emails and documents.

A menu on the side shows the latest versions of dozens of software applications available on the server.

She's invited to join an editing session with her colleagues to collaborate on drafting a proposal.

As her laptop battery fades, she switches to her mobile phone/PDA and instantly resumes her editing session--without having to save or transfer any files.

As broadband connections have become more ubiquitous, this scenario has become reality for many users. This evolution is blurring distinctions between operating systems, and packaged software, making everything on the desktop seem like a service that's provided just-in-time, fully integrated, and shared for easy collaboration.

This evolution is blurring distinctions among computing devices, too. On-demand desktops can be accessed via mobile phones, PDAs, ultra-light notebook computers, or any variety of Internet appliances. In the U.S. alone, telecommunications providers will invest over \$120 billion in 2007 to offer fast wireless access to owners of these browser-based devices.²⁰ And information services competitors are working together on projects like .mobi to improve the user experience of untethered desktops.

The on-demand, thin-client desktop could displace today's Apple, Linux and Microsoft desktop platforms just as the PC and Apple Mac displaced mainframes and minicomputers in the 1980s. Google CEO Eric Schmidt has referred to his company's tagline as "Search, Ads and Apps" – reflecting a "shift to an online lifestyle."²¹ Indeed, Google's Internet roots and leadership in providing online services uniquely well-positions it to advance this on-demand desktop.

Google's powerful search capabilities can analyze documents and data stored on its servers, providing collaboration features to groups of always-connected users. Moreover, Google's dominance in online advertising enables it to offer desktop services through a business model that's completely different from desktop vendors like Microsoft, Apple, and Linux.

Comparing Business Models among Desktop Competitors

Preceding sections explored how desktop competitors ascertain and respond to consumer preferences for new features. The software industry has a range of competing models for packaging and delivering new features with computers, operating systems, and software.

Today's desktop leader—Microsoft—has to compete with Apple and with Linux-based desktops distributed by companies like Novell/SuSE and Ubuntu, who allow users to download their free software. However, all three of these desktop models are facing competitive threat from on-demand desktops that may be free (supported by ads) or paid for through yet-to-be determined pricing schemes.

Competition from on-demand software may well result in a convergence – or at least collaborative partnerships – with different business models for developing desktop software. We've already seen one proprietary software company strike a deal with an open source software company. In November 2006, Microsoft and Novell announced a collaborative agreement to work together to increase the interoperability of their software products.²² And an Open Source Think Tank Report 2007 describes a hybrid proprietary/open source business model that will exist due to the rise of software as a service (SaaS).²³

The table below summarizes the different business models used by these four desktop competitors, in terms of product development, distribution, and pricing.

	Microsoft Windows Desktop	Apple Mac Desktop (OS X Tiger)	Linux Desktop (Ubuntu 7.04)	Google On-Demand Desktop
Product development	In-house developers create proprietary software	In-house developers and hardware designers create proprietary products and software	Modify and re-distribute open source software	Acquisitions and in-house developers create proprietary code
Marketing & Distribution	Retail, or from PC makers (e.g., Lenovo, Toshiba)	Retail or direct from Apple. Mac software is bundled with hardware	Self-serve download, or from PC makers (e.g., Dell)	Server-based applications on-demand
Pricing	Software is licensed to users	Software license is incl. with hardware	Free download; CDs optional. May charge for services	Free with ads; may charge for more storage

Comparing Software Features among Desktop Competitors

The major desktop competitors—Microsoft, Apple, Linux distributors, and Google—differentiate themselves in their business models and in the way they provide features. Windows, Apple, and Linux can integrate features into their operating systems (OS), or deliver them by packaging other applications with the OS. The current Ubuntu distribution of Linux, for example, “includes a hand-selected list of applications that the Ubuntu developers, community, and users feel are important and that the Ubuntu security and distribution team are willing to support.”²⁴

Google’s on-demand desktop is available from its ever-expanding website, where tools are offered *a la carte*, in the *Google Pack*, or hosted by Google as part of *Google Apps*.²⁵

The table below analyzes a range of features currently in high consumer demand and how three OS-based desktops and Google’s on-demand desktop are responding:

	Microsoft Windows Desktop	Apple Mac Desktop (OS X Tiger)	Linux Desktop (Ubuntu 7.04)	Google On-Demand Desktop
Music: playing, organizing, and transferring music files and CDs; integrating with portable players	Windows Media Player incl.	iTunes and QuickTime Incl.	Incl.	Real Player incl.
Video: playing and organizing video files and DVDs	DVD decoder not included	iTunes and QuickTime Incl.	Totem plays unencrypted DVDs	Google Video Player
Video: playing streaming video	Windows Media Player incl.	Quick Time incl.	Totem incl.	Real Player incl.
Video: editing	Windows Movie	iMovieHD incl.	Not incl.	Not incl.

	Microsoft Windows Desktop	Apple Mac Desktop (OS X Tiger)	Linux Desktop (Ubuntu 7.04)	Google On-Demand Desktop
	Maker incl.			
Browsing the web	Internet Explorer incl.	Safari incl.	Mozilla Firefox incl.	Mozilla Firefox with Google Toolbar incl.
Email	Outlook Express incl.; Outlook avail.	Mail.app incl.	Evolution incl.	Gmail incl.
Instant messaging/chat	Windows Messenger incl.	iChat incl.	Gaim incl.	Google Talk incl.
Voice over Internet Protocol (VoIP)	Incl. with Windows Messenger	Incl. with iChat AV	Not incl.	Google Talk incl.
Home or small office networking for file/print sharing	Windows Network incl.	Incl.	Incl.	Not incl.
Word processing	MS Works or Word not incl.	iWork incl.	OpenOffice incl.	Google Docs
Spreadsheet	MS Works or Excel not incl.	iWork incl.	OpenOffice incl.	Google Spreadsheets
Presentation	MS PowerPoint not incl.	iWork incl.	OpenOffice incl.	Google Presentation
Access controls for user-created documents and files	Incl.	Incl.	Incl.	Incl.
Save-as PDF capability	Not incl.	Incl.	Incl.	Incl.
Calendaring	Outlook Express incl.	iCal incl.	Evolution incl.	Google Calendar incl.
Personal Database	Not incl.	Not incl.	Base incl.	GoogleBase incl.
Webpage creation and management	Avail via FrontPage or Windows Live	.mac and iWeb incl.	Mozilla incl.	Page Creator Incl.
Collaboration in office suite, calendaring, webpage creation	Windows Live	.mac	Not incl.	Page Creator
Photo: viewing and organizing	Incl.	iPhoto incl.	Incl.	Picasa
Photo: touch-up and editing	Not incl.	iPhoto incl.	Gimp incl.	Picasa
Security: Internet firewall	Incl.	Incl.	Incl.	n/a
Security: virus protection	Not incl.	Not incl.	Not incl.	Not incl.
Security: spyware protection	Windows Defender incl.	Not incl.	Not incl.	Ad-aware incl.
Security: Pop-up blocker in browser	Internet Explorer incl.	Incl.	Incl.	Google Toolbar incl.
Security: encryption and/or protection of disk-based data	BitLocker included in some Vista editions	Incl.	Incl.	Incl. for server storage; not incl. for local files
Desktop search	Desktop Search included in Vista	Spotlight incl.	Deskbar incl.	Incl.

The above table includes multi-media, communications, security, and productivity features that most users would consider essential equipment for today's computer desktops. Yet, many of these features were available only as separate, add-on products when they were first introduced. Competition among desktop providers drives them to innovate and integrate features so users will spend less time looking elsewhere to find the features they need.

The table shows that video editing software was once a specialized product offering for serious video professionals with high-end, powerful computers. The rapid consumer adoption of digital cameras and cell phones that include video capture, and the proliferation of portable media players such as the iPod that have playback capability, increase the need for video editing software. Desktop vendors have reacted by adding at least a basic video editing feature. Microsoft packages Windows Movie Maker and Apple includes iMovie with its desktop. Indeed, as previously mentioned, Apple's latest TV commercial boasts the capability to edit movies "right out of the box."

Security features are also prominent in the table. In particular, firewall protection against malicious intrusions has become a basic necessity as users spend more time connected to the Internet. Operating systems now routinely include firewall security software as standard equipment. Indeed, desktop providers compete on the basis of their built-in security features, as seen in a series of popular television commercials from Apple and AOL.

However, it's also apparent from the above table that not enough security features are built-in or packaged with desktops today. Consumers report that Internet security is among their top concerns—and they should be concerned, as McAfee now tracks over 200,000 known security threats.²⁶ Security is an aspect where market demand signals are not driving feature integration as much as would be expected. One explanation could be that desktop providers are reluctant to compete with security software firms, perhaps fearing regulatory repercussions.

Conclusion

Successful software design is all about reading and responding to consumer demand. Consumers express their preferences for software integration in indirect and direct ways. Downloads and store purchases of add-on software indicate preferences for new features. Sales of add-on hardware will lead to demand for new features that help consumers to connect and enjoy their new digital devices. Consumer research and product reviews by industry analysts provide timely feedback on desired features before and after product releases.

Software companies can use similar approaches to *understand* consumer preferences. However, major desktop vendors *respond* in diverse ways to satisfy common demand, based on technology architecture and business models. These varying approaches toward packaging product features indicate that there is no single way to satisfy consumer demand.

With the ubiquity of broadband internet connectivity, a thin-client, on-demand model will challenge traditional thick-client desktops from Microsoft, Apple, and Linux. The rise of the on-demand desktop changes all the rules for desktop competition, because a centralized service like Google can instantly deploy new features, easily integrate these features on the server side, and enable collaboration among connected users.

Hosted, on-demand services have expanded the definition of the desktop marketplace, so Microsoft, Apple, and Linux must improve their feature integration efforts just to defend their hard-earned market positions. Similarly, the rise of the on-demand desktop will change the rules for small, independent software developers, who must adopt new programming interfaces and negotiate for placement within the online services.

Despite their different approaches, all desktop competitors vie for consumer attention by adding and integrating new software features. Consumers will continue to benefit from the evolution in software and from competitive battles to serve them better.

About ACT

The Association for Competitive Technology (ACT) is an international advocacy and education organization representing more than 3000 small and mid-size information technology firms from around the world. ACT advocates for an environment that inspires and rewards innovation, and provide resources like the Innovators Network to help members leverage their intellectual assets to raise capital, create jobs, and continue innovating. See www.ACTonline.org

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Endnotes

¹ The estimated number of cell phone subscribers in the U.S. has jumped by nearly 50 million between 2003 and 2005, see www.ctia.org/research_statistics/index.cfm/AID/10030 The number of worldwide cell phone subscribers has risen by almost 600 million since 2003, from 1.4 billion to 2 billion, see http://www.itu.int/ITU-D/ict/statistics/at_glance/cellular03.pdf

² Wikipedia, Nintendo 64, available at http://en.wikipedia.org/wiki/Nintendo_64

³ See www.palm.com/us/products/palmpilot

⁴ See James Surowiecki, "Blackberry Picking", *The New Yorker*, Dec. 19, 2005, available at www.newyorker.com/talk/content/articles/051226ta_talk_surowiecki. According to a Gartner report, Blackberry became the market leader in 2005. See tom Krazit, Legal Tangles Don't Sour Blackberry Customers, CNET News.com, Feb 14, 2006, available at http://news.com.com/Legal%20tangles%20dont%20sour%20BlackBerrycustomers/2100-1047_3-6039547.html

⁵ See http://www.download.com/3101-20_4-0-1.html For instance, 4 of the top 10 downloads are anti-spyware programs.

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- ⁶ See spyware listings at http://www.download.com/3150-8022_4-0.html?tag=all and antivirus listings at http://www.download.com/3150-2239_4-0.html?tag=cat , pages visited on May 10, 2007.
- ⁷ See the Apple Tiger webpage available at www.apple.com/macosx/tiger/
- ⁸ The advertisements are available online at the YouTube website. See http://youtube.com/watch?v=Z7ReS_ur4Kc
- ⁹ As stated by Canonical CEO Mark Shuttleworth, the CEO of Canonical Ltd.—the company funding the Ubuntu distribution—in an interview with Falguni Bhuta in Red Herring, December 29, 2006, available at <http://redherring.com/article.aspx?a=20497>
- ¹⁰ According to Ubuntu, see <http://www.ubuntu.com/ubuntu/components> , visited on April 20, 2007.
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- ¹⁶ Chris Howard, “Leopard Preview Gives Clue to Top Secret New Feature, Apple Matters”, Aug 9, 2006, available at <http://www.applematters.com/index.php/section/comments/leopard-preview-gives-clue-to-top-secret-new-feature/>
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- ¹⁸ See Jem Matzan, Ubuntu Linux 6.06 Review, The Jem Report, available at <http://www.thejemreport.com/mambo/content/view/269/81/>
- ¹⁹ Ibid.
- ²⁰ TIA’s 2004 Telecommunications Market Review and Forecast projected that U.S. spending on enterprise voice and data communications equipment would continue expanding at a 6.7 compound annual growth rate (2004-2007) to \$122 billion in 2007. See <http://pulse.tiaonline.org/article.cfm?id=1979>
- ²¹ “Google to focus on software: CEO”, Reuters, May 10, 2007.
- ²² See the Joint Letter to the Open Source Community from Novell and Microsoft, available at <http://www.novell.com/linux/microsoft/openletter.html>
- ²³ See <http://thinktank.olliancegroup.com/ostt2007report.pdf>
- ²⁴ Id. at note 10.
- ²⁵ See the Google Products page at <http://www.google.com/intl/en/options/> and Google Apps at <http://www.google.com/a/>
- ²⁶ McAfee(R) Avert(R) Labs released protection for the 200,000th threat in its database on July 6, 2006. See <http://phx.corporate-ir.net/phoenix.zhtml?c=104920&p=irol-newsArticle&ID=879176&highlight=>