



# Notebook Report

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## INTRODUCTION

The modern notebook computer has reached a level of pervasiveness that is rivaled only by desktop PCs. That's not too surprising, since the two major PC form factors share a parallel history and both got their start at about the same time. The notebook computer was first conceived in the mid-1970s, even before IBM released its original PC. Palo Alto Research Center researcher Alan Kay postulated that a notebook computer (which he called the Dynabook) could duplicate many of the functions of a fixed computer and allow users to carry important information while on the go. In 1979, Grid Systems' William Moggridge designed the first laptop. It was followed by the first commercially-viable model in 1983, sold by Gavilan Computer. This MS-DOS-based laptop came with 64KB of memory, an 8088 processor, and weighed 9 pounds.

Truly mobile computing lagged far behind desktop computers throughout the 1980s, though, with few real success stories. Technical and engineering limitations kept notebook computing from breaking through into the mainstream until October 1989 when Compaq introduced the first notebook form factor notebook PC called the Compaq Lite (286 processor, 4MB of memory, 40MB hard disk, 8.5" B&W display). They led the market until 1993 when IBM introduced their ThinkPad line of portables that took the notebook standard to a new level by including a large 10.4" color display in the notebook for the first time (they had sole access to these displays for almost a year). Over the past 5-6 years, the notebook market has gone from a niche player to mainstream where it's the preferred personal computer for many individuals.

It used to be that notebooks were only justified for a special sub-set of the most mobile individuals in an organization. But, due to advances in technology, decreases in prices of components and due to the changing culture that accepts mobile technologies, notebook PCs are used by a wide range of people—from sales and marketing professionals, management, professional staff, college students and even in the home.

Today, mainstream notebook computers typically weigh under 6 pounds and deliver three orders of magnitude more processing power than a few short years ago. At the same time, notebook computing has segmented into a variety of niches that appeal to different kinds of users and business needs, from larger desktop replacements to ultralight 2-pound systems that eschew the usual trappings of desktop computing.

Information Technology (IT) who are responsible for managing the computer resources in the organization have adopted notebook PCs as the standard issue in many cases from a select number of approved vendors. They require a "stable image" in which they can rely on their configuration of Windows, applications, device drivers and middleware to be constant for at least 12 months and, now more recently, 18-24 months. This enables them to configure a notebook PC in a standard way and then use mobile resource management software to maintain the image on

all of the client systems.

This report analyzes the current state of notebook computing, with emphasis on what IT needs to know to purchase and manage these portable systems.

## **BASIC BUILDING BLOCKS**

There are some basic building blocks on which all notebook PCs are built. These form the underlying technology from which a notebook PC is built. Advances have been made in each of these areas over the past years as engineers have figured out ways to improve on the past capabilities.

### Processor

Like their desktop counterparts, notebook CPUs come in a broad range of speeds, from sub-gigahertz through full-speed processors that rival and even equal desktop processors. Notebooks are available with Intel and AMD-based CPUs. While both vendors sell CPUs optimized specifically for mobile applications, many notebook vendors choose to deploy models with desktop versions of the processors instead. The tradeoff is obvious: notebook processors tend to run cooler and are more energy efficient, though they don't deliver the same horsepower as desktop CPUs.

Desktop chips need more cooling (thus requiring larger, heavier cases) because they run at higher wattage and don't run as long on a battery charge—but come in speeds that range all the way up to 3.06 GHz Pentium 4. There is also the possibility—unproven at this juncture—that desktop processors might lead to less reliable operations over the course of years. Desktop processors run hotter which can contribute to premature system failure or slightly less stable operation. Though sometimes hinted at in the popular press, there is little to no empirical evidence to support such a claim.

In general, mobile CPUs are a smart investment for users who need longer battery life and greater mobility; desktop-based CPUs are a better bet for users who need performance despite the drawbacks. At the same time, as the move by many manufacturers to ship notebooks with desktop-caliber CPUs, both Intel and AMD continue to optimize CPUs for mobile devices, most notably with the recent Intel Pentium M architecture.

The range of power consumption is tremendous with the high-end desktop systems consuming 75 watts, mid-range systems consuming 35 watts and newer, low powered mainstream system consuming 20 watts and the lowest power unit consuming under 10 watts. That range is greater than 7.5x. It's important to note that for most standard office applications such as word processing, spreadsheets, presentations, email and Web browsing, the lower powered units perform very well and give users adequate performance while, at the same time, consume far less power and provide reasonable battery life (typically four hours).

The most common notebook processors today include:

- **Intel Mobile Celeron.** Mainly used in value-priced notebooks, the Celeron chipset is a legacy version of the mobile Pentium architecture and delivers one gigahertz-level performance.
- **Intel Pentium 4.** A true desktop chip that's sometimes used in notebook PCs for additional performance.
- **Intel Pentium 4-M.** A mobile-optimized CPU that changes its clock speed based on whether it is connected to AC or battery power.
- **Intel Pentium M.** The newest Intel mobile chipset that serves as the foundation of the Centrino architecture. Centrino notebooks have better power management, improved cooling, and power-optimized wireless networking. Centrino is a combination of silicon, device drivers, optimized power management, integrated wireless and support services that provide enterprise with a stable image for at least 18 months which ensures them that the configuration they install today on a Centrino-based notebook will work 18 months from now even if there's a change in the performance of the CPU.
- **AMD Mobile Athlon XP.** AMD's low-cost alternative to the Pentium 4-M, this chipset outperforms Intel chips with the same clock speed when running certain benchmark tests.
- **PowerPC G4.** This Pentium 4-class processor is quite powerful, though it is found only in the Apple PowerBook G4 family.

### Spindles

One measure of a notebook's storage capability is encapsulated in a statistic that describes how many spindles a notebook has—in other words, the number of spinning media installed internally in the device. Since all notebooks have a hard disk drive, a one-spindle notebook has just a hard drive, and nothing more. Most ultralight notebooks fall into this class, since it's not possible to fit optical storage in a two-pound, small form factor mobile device.

A two-spindle device includes a hard disk and an optical drive like a CD-ROM or DVD-ROM drive, and a three-spindle system usually has floppy, hard disk, and optical—like a traditional desktop PC. Four spindle systems, while rare, may be found in the larger and heavier desktop replacement niche. Such notebooks sometimes include a pair of optical drives, such as a CD-RW and a DVD-ROM drive in a second bay. While it seemed like such notebooks might become popular a few years ago, these days the need for such bulk has been offset by the rise of combo CD-RW/DVD-ROM drives that pack the dual-capability in a single media bay. Thus, the floppy drive is now being abandoned in all notebook PC offerings except for some special high-end systems. Instead, the little DiskOnKey that contains up to 512MB of storage is used to transfer information from one system to another via the USB port.

## Screen

For the most part, notebook LCD screens simply vary in size and native resolution. Gone are the days when there was any true distinction in display technology; today, all notebooks rely on Thin Film Transistor (TFT) technology. TFT displays use a trio of three transistors to control the color of each pixel on the screen. It's a mature technology that results in a sharp, colorful, high-quality display with fleetingly few dead spots on the screen. (Several years ago, immature manufacturing processes resulted in several "dead pixels" on almost every screen sold—but that's a thing of the past these days.)

Smaller notebooks rely on 12.1-inch displays. Apple currently boasts the largest display on the market in the 17-inch PowerBook G4, while a number of Windows-based notebooks offer a variety of slightly smaller screens, the largest of which is 16.1 inches. Screens also vary in native resolution. Unlike analog CRT displays, LCD displays are designed to work with a specific resolution, such as 1024x768 pixels. To accomplish this, the resolution of the display exactly matches the number of transistor groups. Changing resolution, then, is problematic for notebooks. While it can be done, switching to a lower resolution results in a blurry, pixilated approximation. Higher resolutions than the native resolution are not supported, except in the case of a "virtual" desktop that is larger than the physical display and requires panning to see it all. There are several common resolutions in use today:

- SVGA            800x600 pixels
- XGA             1024x768 pixels
- SXGA            1280x1024 pixels
- SXGA+          1400x1050 pixels
- UXGA            1600x1200 pixels
- WXGA           1280x800 pixels
- WSXGA+        1680x1050 pixels
- WUXGA          1920x1200 pixels

Because Windows renders an exact number of pixels for a specific font size, a larger display will show given text “larger” than the same document displayed on a smaller display. Generally, users have accepted XGA in 12.1” displays, SXGA in 14.1” displays and SXGA+ in 15” displays. Many decide to gain the benefit of a lighter weight system using a 12.1” display but then connect the notebook to an external display when in the office or at home, thus gaining the benefits of a higher resolution display such as SXGA but getting the fonts to appear larger when displayed on the larger 17-18-19” displays.

Expect to see some dramatic changes in notebook display technology in the next few years as manufacturers perfect OLEDs (Organic light-emitting diodes) and move away from traditional LEDs. OLEDs promise to be brighter and cheaper than existing displays because glow brightly on their own and don't need a backlight. Right now, OLEDs are in prototype and research, not commercial production.

## BASIC BUILDING BLOCKS

Notebook PCs have evolved to fill a broad range of user needs by establishing a handful of key product segments. Each style of laptop has fundamental strengths, weaknesses, and applications.

Those core characteristics are combined into a variety of notebook formats. These notebooks are each designed to excel in specific niches. When evaluating portable PCs, there are five broad categories into which all notebooks fall. As it happens, there is increasingly convergence among notebooks, blurring traditional lines of distinction among these labels. Nonetheless, these are the principal categories for notebooks:

- Desktop replacements
- Thin and light
- Ultraportable
- Ultralight
- Value

### Desktop Replacement

The desktop replacement category encompasses notebooks that have enough power and flexibility to perform full-time desktop duties, effectively replacing a tower-style PC—yet these systems are also true notebooks, able to go mobile when needs dictate. Such notebooks have the following common characteristics:

- Large displays, usually 15-inches or larger
- Three spindles, including floppy, hard disk, and optical (latest models are dropping the floppy disk but adding flash storage slots)
- Often include option for desktop docking system
- Desktop processor limits battery life
- Typically weigh more than 7 pounds

According to a MobileTrax study conducted in 2Q 2002, 44 percent of all notebooks purchased by large businesses fall into the desktop replacement category.

Usage: Desktop replacements are ideal in corporate environments in which users have modest computing needs—so a traditional tower PC with extensive expansion and upgradeability is unnecessary. By adopting a fleet of notebooks instead of desktops, users are intrinsically more mobile and able to carry their entire PC around the corporate campus or away on occasional trips, without needing complex data synchronization or transfer schemes. While ideal for these sorts of mobile professionals, it bears mentioning that desktop replacements are not a smart choice for users who travel frequently, since these systems are too large and heavy to be comfortable or convenient. Desktop replacements work best when they stay on the home desktop 75% of the time. Desktop replacements may

also be compatible with desktop docking stations—making it easy to "plug into" the desktop after a trip (one connection for mouse, keyboard, printer, and other accessories). Many desktop replacements even have ports for connection to analog video systems.

As a point of comparison, here are some key specs for three top desktop replacement notebooks:

	HP Presario	Toshiba Satellite 2455-S305	IBM ThinkPad R40
Processor	2.2-GHz Pentium 4-M	2.4-GHz Desktop Pentium 4	2.2GHz Pentium 4M
RAM	512MB	512MB	256MB
Hard drive	60GB	60GB	60GB
Optical	DVD/CD-RW combo	DVD-R/RW	DVD/CD-RW combo
Screen Size	15.7-inch	15-inch	15-inch
Weight	9.9 pounds	9.1 pounds	7.4 pounds
Price	\$1,995	\$1999	\$2100

Other vendors who sell the majority of desktop replacement units are Acer and Gateway.

### Thin and Light

Thin and light notebooks constitute the median group of notebook design and constitute the mainstream in notebook purchases by companies and individuals. Thin and light systems can sometimes perform adequately as desktop replacements, but more often lack the high performance components that separate them from true desktop replacements. They are typically known for these characteristics:

- Usually 14-inch display
- Two spindles (hard disk and optical drive).
- Mobile-optimized processor that provides full performance for most all applications.
- Weight between 6 and 7 pounds
- Compact case that measures 1.5 inches or less in thickness

Based on the 2Q 2002 MobileTrax study, it appears that another 33 percent of corporate notebook purchases are thin and light models.

Usage: This class of notebook is intended for traditional mobile professionals—"road warriors" who spend a significant amount of time on the road and thus need a lighter, more mobile notebook that retains the traditional notebook form factor. Like desktop replacements, these mainstream systems often have a broad array of ports for expandability and may come with video-out ports for connecting the notebook to a television or other analog video source.

As a point of comparison, here are some key specs for three of the top thin and light notebooks:

	<b>IBM ThinkPad T40</b>	<b>Dell Latitude D600</b>	<b>HP Compaq Evo N610</b>
<b>Processor</b>	1.6-GHz Pentium M	1.6-GHz Pentium M	2-GHz Pentium 4M
<b>RAM</b>	512MB	512MB	256MB
<b>Hard drive</b>	80GB	40GB	40GB
<b>Optical</b>	CD-RW	DVD/CD-RW combo	DVD/CD-RW combo
<b>Screen Size</b>	14.1-inches	14.1-inches	14.1-inches
<b>Weight</b>	6.2 pounds	5.5 pounds	6.6 pounds
<b>Price</b>	\$3200	\$2217	\$1900

HP sells a similarly configured thin and light system under the Presario and Pavilion brands that are sold via retail to individuals and small business users. Most vendors have at least one thin and light offering in their notebook portfolio.

### Ultraportable

Ultraportables are the smallest traditional notebook form factor, but sacrifice most of the features and capabilities found in thin and light systems. Specifically, they'll have these characteristics:

- Almost all Ultraportable have 12.1-inch displays
- Weigh under 5 pounds
- One spindle (hard drive) or two spindles (hard drive and optical drive)
- Ultra-compact case that is less than 1.5-inches thick
- Modest processor speeds, typically around 1-GHz providing adequate performance for the applications most typically required by mobile professionals (word processing, spreadsheets, email, Web browsing and presentations).

Ultraportables constitute the last significant category of notebooks, at 12 percent of corporate purchases. This percentage has been slowly rising in the past couple of years as the performance level for these smaller systems is now almost equivalent to the thin and light systems except for the size of the display. And, with the introduction of the new ultra thin optical drives, we're seeing this category incorporate a second spindle with DVD/CD-RW. Thus, we believe this will become a larger percentage of total systems sold to enterprise over the coming years.

Usage: Since the emphasis is on portability, these notebooks are smaller and lighter weight than the thin and light category. But, with advances in CPU technology like Centrino from Intel, Ultraportable users can now realize performance almost as good as those in the thin and light segment. Ultraportables typically cost more to get their miniaturized electronics and therefore are justified for those who travel the most. It used to be that the thin and light was the

standard issue for mobile workers. Now, it's being replaced by Ultraportables that provide very good performance in a much smaller and lighter weight package. Ultraportables are also easier to use on airplanes since 12.1-inch displays fit on airplane tray tables, while larger 14- and 15-inch screens can't be fully opened on most airline coach tray tables, especially the person in front has their seat pushed back.

As a point of comparison, here are some key specs for three Ultraportable notebooks:

	IBM ThinkPad X31	HP Compaq Evo N410	Fujitsu LifeBook S
Processor	1.4-GHz Pentium M	1.2-GHz Pentium M	1.4-GHz Pentium M
RAM	256MB	256MB	512MB
Hard drive	40GB	30GB	40GB
Screen Size	12.1-inches	12.1-inches	13.3-inches
Weight	3.6 pounds	3.5 pounds	4.5 pounds
Price	\$2100	\$1100	\$1700

Some vendors have been able to incorporate a DVD/CD-RW drive in this form factor using the latest thin optical drives. The weight does increase slightly, but the users gets a complete system with an embedded optical drive. Such systems come from Fujitsu and Sony.

### Ultralite

Ultralite notebooks are the smallest portable PCs available, but they achieve their diminutive form factor by making serious concessions on performance and convenience fronts. Compared to other styles of notebooks, ultralights are relatively unpopular, though they have found a niche among users who want to be able to work on the road with notebooks so small and discreet that they can fit into a large handbag or small attaché case. Ultralight systems have these specifications in common:

- Generally under 3 pounds
- One spindle—hard disk only
- 10.4-inch (or smaller) display
- Fairly short battery life due to tiny form factor
- Significantly lower performance due to a CPU running at lower power

Usage: Ultralight notebooks are not suitable desktop replacements, even for users who might be able to make do with a thin and light or ultraportable system for most applications. This kind of notebook—with a small hard disk drive, virtually no expansion capabilities, and rarely offering a desktop docking solution—is the ultimate expression of portability for users who want to (or need to) travel light. It's a companion to a desktop PC, and one that is rarely used except during off-campus business travel. Lacking an internal optical drive, these systems don't allow users to easily copy data to CD or DVD and don't permit dual use business/entertainment functions. Their limited battery life is also a liability for certain kinds of travel. Bottom line: this is a solution in situations where

traveling light is the top priority to the exclusion of most other concerns.

As a point of comparison, here are some key specs for three top notebooks in this category:

	<b>Fujitsu LifeBook P5000</b>	<b>Panasonic ToughBook T1</b>	<b>Sharp Actius UM</b>
Processor	900-MHz Pentium M	866-MHz Pentium III M	1-GHz Pentium III
RAM	512MB	256MB RAM	256MB
Hard drive	60GB	40GB	40GB
Screen Size	10.6-inches	12.1-inches	12.1-inches
Weight	3.9 pounds	2.4 pounds	3 pounds
Price	\$1900	\$1900	\$1800

### Value

Value notebooks get their name from the fact that they cost under \$1,000. Price is the determinant in this category, not features, though obviously they are interrelated:

- Priced under \$1000
- Value processor—typically Celeron class
- Conservative components, like 20GB hard disks and screens smaller than 15 inches

Usage: Value notebooks span the gamut of form factors, from desktop replacement to ultralight systems. Since price is the discriminator, value notebooks find a role in all areas of mobile computing, but users select them in situations where cost savings is more important than features, capabilities, or performance. Value systems often have little to no bundled software, no carrying case, a sluggish CPU (compared to contemporary processors), a slow and small hard disk, and limited ports. Surprisingly, that's adequate for a large number of users who, in fact, never utilize the majority of the features in premium notebooks.

As a point of comparison, here are some key specs for three top notebooks in this category:

	<b>HP Compaq Evo N1015v</b>	<b>Averatech 3120X</b>	<b>Dell Inspiron 1100</b>
Processor	1.2-GHz Mobile Athlon 4 1400+	1.2-GHz Mobile Celeron	2-GHz Mobile Celeron
RAM	128MB	256MB	128MB
Hard drive	20GB	20GB	20GB
Optical	CD-ROM	DVD-CD-RW combo	
Screen Size	13.3-inches	12.1-inches	14-inches
Weight	8 pounds	5 pounds	7.8 pounds
Price	\$850	\$950	\$900

## **BASIC BUILDING BLOCKS**

There are several dozen vendors sharing the large and dynamic notebook space, though the most significant players number about a dozen. Based on the 2Q 2002 MobileTrax notebook study, corporate buyers have the most confidence in a handful of companies, including IBM, Dell, HP/Compaq, Toshiba, Sony, Gateway, Fujitsu, and Apple.

### **Acer**

[www.acer.com/us](http://www.acer.com/us)

Acer has a line of notebook PCs under the TravelMate brand (adopted when they purchased the notebook business from Texas Instruments a number of years ago). Acer's notebook have been noted for their long battery life due to advanced power management that they have incorporated into their notebook line. They have a product line that includes desktop replacement, thin and light and Ultraportable. Acer has traditionally focused on education, government, health care and a number of other specific markets. The company is based in San Jose, California.

### **Apple**

[www.apple.com](http://www.apple.com)

Apple's PowerBook G4 is a lone notebook in the industry: it runs Mac OS X instead of Windows XP, and that makes it a niche product for vertical markets that care more for specific applications (like multimedia production) than overall compatibility with peer computers and application file formats. Nonetheless, Apple is known as an innovator in the industry, leading the way for technologies like USB 1.1, FireWire, and wireless networking to reach mainstream acceptance in the tech community. Apple's family of PowerBooks range from ultraportable to desktop replacement. The company is based in Cupertino, California.

### **Averatec**

[www.averatec.com](http://www.averatec.com)

Averatec is the renamed Sotec that's one of the largest manufacturers of portable computers in the world under private label making products for other companies. They have recently entered the US market and have already developed excellent distribution with places like Walmart and Best Buy. Their flagship product is an integrated small, light weight notebook that incorporates a 12.1" display, DVD/CD-RW and wireless LAN. Averatec provides one of the best values in their notebook line for small and medium business user. The company is located in Foothill Ranch, California (Orange County area).

### **Dell**

[www.dell.com](http://www.dell.com)

Dell is a company in transition, attempting to redefine itself as a technology company that doesn't strictly sell computers—indeed, the company has recently made a move to take the word "computer" out of its corporate name. Nonetheless, Dell offers a family of well-respected notebooks that cater to a range of mobile applications. The company sells three families of notebooks—Inspiron, Latitude, and Precision—across the whole range of notebook performance classes. The company is located in Round Rock, Texas.

### **Fujitsu America**

[www.fujitsupc.com](http://www.fujitsupc.com)

Fujitsu has gained significant market share in the US in the past couple of years by providing a full product line at great prices. The company has recently introduced a notebook with the brightest display on the market using their MVA technology. The company is located in Santa Clara, CA.

### **Gateway**

[www.gateway.com](http://www.gateway.com)

Gateway is a vendor in the direct channel that has also had some success with its own branded retail locations in major cities across the US. Currently, the company has three families of notebooks—the 400 and 450 Series (thin and light) and the 600 Series (desktop replacement). The company is located in North Sioux City, South Dakota and the San Diego area.

### **HP/Compaq**

[www.hp.com](http://www.hp.com)

After a recent merger, Hewlett-Packard and Compaq have joined forces to become one of the largest technology companies in the industry. Currently, the two companies' product lines are still largely separate, with distinctly branded Compaq and HP notebooks. Eventually, the company promises to iron out the branding issues (much as it has already done with PDAs by eliminating the weaker HP Jornada in favor of the much more robust and popular Compaq iPAQ). At the moment, though, the company offers a pot pourri of Compaq Evo notebooks and the HP Compaq Business Notebook. The company is located in Palo Alto, California.

### **IBM**

[www.ibm.com](http://www.ibm.com)

The company that launched the PC revolution over 20 years ago has a long legacy of mobile and desktop products; its ThinkPad line of notebooks is a testament to that experience. Big Blue offers notebooks that range from desktop replacement to sub-\$1000 value systems, with models in between to cover every option. IBM is headquartered in Armonk, New York.

### NEC

[www.necsolutions-am.com](http://www.necsolutions-am.com)

NEC is a worldwide leader in computing. In notebook computing, NEC is focused on a number of specific markets including health care, government, manufacturing retail and financial services, many of whom work in a field environment. Their primary products are the NEC Versa E120 DayLite that provides full color display in an outdoors environment. They are the only vendor who makes a notebook that can be used in bright outdoors light. The company also sells its new Versa LitePad, one of the thinnest tablet PCs produced in a slate format.

### Sony

[www.sony.com](http://www.sony.com)

Though Sony's emphasis has traditionally been on the consumer market, its family of VAIO notebooks has an audience with corporate and small business users anyway—thanks in large part to attractive styling, excellent multimedia components, and savvy marketing. The company offers a range of styles and performance levels, from the desktop replacement GRX (which includes a 16-inch display) to the diminutive 4-pound V505. Sony is headquartered in Japan but has a major operation in the San Diego area.

### Sharp

[www.sharpsec.com](http://www.sharpsec.com)

Sharp has a full line of notebook PCs under the Actius brand. They are noted for providing the thinnest form factors in the market. They are best known for the line of Ultraportable products that are one of the he thinnest and lightest notebooks on the market. Sharp sells their notebooks through a number of channels.

### Toshiba

[www.tsai.com](http://www.tsai.com)

Toshiba has been one of the leaders in notebook computing for many years. They have four distinct brands: Satellite for the consumer market, Satellite Pro for small and medium business, Tecra for large enterprise that includes manageability support and Portege for the Ultraportable market. The Portege 2000 line has received a number of awards for its thin form factor.

## SYSTEM COMPONENTS

All of the major (and minor) system vendors work with just a handful of major component providers, packaging a optimizing parts to suit their own branded portable PCs. Here is an overview of the major players in the notebook component space:

## Central Processor

### Intel

Intel has been the leading force in CPU and motherboard design since the first IBM PC, and it's not surprising to find the company is still the maker player among notebooks. Intel currently offers three active families of mobile chipsets: the Centrino, Pentium 4M, and Pentium III M. Centrino features the new Pentium M processor, integrated wireless, device drivers, guaranteed image stability for enterprise deployments and advanced power- and temperature-management features. The Pentium 4 class CPU will be continued to support the desktop replacement category that operate with up to 75 watts of power. Centrino is the future for mobile processors for Intel, however, and Intel has created a total solution to support mobility. Intel will slowly migrate the Centrino offering over time, integrating higher performance at low power, wireless communications, device drivers all designed to provide image stability that enterprise IT requires. Intel chose the 802.11b Wi-Fi offering in their first Centrino offering since that represents 95% of today's enterprise Wi-Fi networks and virtually 100% of all public networks. Combination wireless offerings including both "a" and "g" will be added in the future when the market needs such offerings. Intel will likely integrate wide area wireless networking (wWAN) in the future along with roaming software so that users will be able to go from a wireless LAN to a wireless WAN and back again seamlessly without having to change any device drivers or settings.

### AMD

AMD is the lone surviving competitor to Intel. Once little more than a company that mimicked Intel designs to create lower-cost alternatives, AMD is now a major architecture innovator in its own right. On the mobile front, AMD offers vendors three key chipsets: the AMD Athlon XP-M, Mobile AMD Athlon 4, and the Mobile AMD Duron. The XP-M processor is AMD's flagship chip, boasting capabilities like QuantiSpeed Architecture that can outpace Intel chips of similar speed. AMD also incorporates 3D Now! in the XP-M, which assists the GPU with graphical operations. The Duron family of value-priced processors is similar to the Intel Celeron family—reduced performance for inexpensive deployments.

## Operating System

### Microsoft

Even more so than Intel for the CPU, Microsoft commands a virtual monopoly for operating system sales to notebook (and desktop) PC vendors. Windows XP

Home Edition and Windows XP Professional Edition constitute the overwhelming majority of OS's shipped on notebook system today. Windows XP has been shipping on notebooks for about a year, and the next expected revision will probably be in 2005 when Microsoft unveils the next version of Windows, currently codenamed Longhorn. Longhorn should feature a redesigned 3D user interface, a new filing system that's optimized for increasingly large hard disk drives, integrated wireless services (like Voice Over IP), and improved security features.

### Apple

Traditionally maintaining about 10 percent of the overall computer market, Apple's OS has always been tightly integrated with its own hardware, meaning that only Apple itself sells systems bearing its OS. The current crop of Apple notebooks run OS X, a radically re-designed version of the Apple OS that's based in part on Unix. OS X offers some clever capabilities not found elsewhere in the notebook sector, such as native Bluetooth support. While an attractive OS in specific vertical markets like multimedia, most users can't experience OS X because of its lack of compatibility with Microsoft operating systems.

## System Software

### Phoenix Technologies

When IBM created the original PC, they allowed the system to be open except for one very proprietary element—the system software that booted up the system, did system checking, loads and then provides device drivers during operation (often called the BIOS). Phoenix was able to do a clean room design the BIOS and the PC clone market was built. Today, IBM and Phoenix have collaborated on the future of the BIOS so that all PCs will have true compatibility. Phoenix has also developed an entire line of software for portable PCs including power management, suspend/resume and hibernate.

## Video and Graphics

### nVIDIA

In an increasingly close race with ATI, nVIDIA has recently branched out from desktop graphics products to also support high-end video performance on notebooks. nVIDIA now sells a family of graphics processing units (GPUs) for different classes of notebooks. Distinguished by the "Go" moniker, all of nVIDIA's mobile CPUs include power management software, fast 2D and 3D performance, and multi-monitor support (for duplicating or extending the display to external monitors). GPUs in the nVIDIA line range from the value-priced GeForce 2 Go to the GeForce FX Go, which is designed for desktop replacement systems with robust multimedia requirements.

### ATI

ATI is one of the oldest GPU providers in the industry, but the company let its product line languish for several years while newer, more aggressive companies like nVIDIA claimed market share. In the last year, ATI has returned with a family of extremely high-performance products that have challenged nVIDIA's dominance and currently has the market share lead in notebook graphics. ATI has a wide range of mobile graphics processors that OEMs can use to build across the full range of notebooks. At the top of the line, the ATI Mobility RADEON 9600 is engineered with games and full motion video in mind; vendors can also choose from among other premium chipsets like the Mobility RADEON 9000 and 9200, or value-priced chips like the Mobility M4.

### Disk Drives

#### Hitachi

Hitachi Global Storage is a leader in the 2.5-inch hard disk drive market, which fuels the storage of all notebooks manufactured today. Hitachi is notable for its invention of the magnetoresistive (MR) and giant magnetoresistive (GMR) hard drives that have greatly contributed to the higher capacities in use today. Currently, the company's most popular drives belong to the Travelstar family, which is available in capacities that range from 40GB to 80GB.

#### Toshiba

Toshiba is the other major provider of 2.5-inch hard disk drives to the notebook community. Currently, Toshiba 2.5-inch drives range from 20GB to 60GB and come in formats optimized for average and low-power applications.

### LCD Displays

A large number of companies manufacture LCD displays for notebooks and other portable devices. The biggest manufacturers include Samsung, Hitachi, NEC, Sharp, and LG. Philips. Each of these companies produces traditional TFT-style LCD displays, and several—most notably Samsung and LG. Philips—are investing in very large displays that range from 15.4- to 17-inches.

## **NOTEBOOK TECHNOLOGY INNOVATIONS**

In many ways, both desktop and notebook computing have matured, especially compared to the revolutionary changes PCs experienced in the mid-1990s. Nonetheless, notebooks today continue to be in the throes of significant changes that affect the features and capabilities they offer; emerging features also affect a notebook's versatility, compatibility, and potential lifespan. These are some of the key trends we see in notebook design:

### USB 2.0

USB 2.0 is a high-bandwidth successor to USB 1.1, which has been appearing on desktop and notebook PCs since the mid-1990s. USB 1.1 was intended to be a simple, plug-and-play, hot-swappable alternative to the serial port, which had long been seen as slow, clumsy, and difficult to configure. USB 1.1 transferred data at a modest 12Mbps and thus imposed severe limits on what kinds of devices could be connected to a notebook as well as how many could be chained together. External hard disks, for instance, were almost unusably slow when connected via USB 1.1.

In contrast, USB 2.0 has a data rate of 480Mbps. The connector is the same, and USB 2.0 is backwards compatible with older USB 1.1 devices. The significantly higher bandwidth allows USB 2.0 ports to support external hard disks and other high speed devices. This new port is not yet universally available on all notebooks; value notebooks in particular still frequently ship with USB 1.1 connections. The value of USB 2.0 cannot be overstated, so it's important to seek out USB 2.0-enabled notebooks for compatibility with high-speed external devices.

### FireWire

A technology that originated with Apple, FireWire is known by a few other names as well: IEEE 1394 and i.Link. It is a serial data connection similar to USB. FireWire has a transfer speed of 400Mbps and is most commonly used in digital imaging applications—all digital camcorders and some very high resolution digital cameras include FireWire ports. A FireWire connection allows notebooks to serve as full-performance digital imaging workstations, transferring lossless digital video from cameras and camcorders, editing the data, and outputting the finished product to DVD or some other output media. FireWire also has a role connecting notebooks to external hard disk drives and specialized peripherals like high resolution flatbed and film scanners.

Not all notebooks come with FireWire ports. Indeed, the presence of FireWire is a useful discriminator when selecting notebooks for multimedia and desktop applications. FireWire is most frequently found in desktop replacement and thin and light systems; also, the FireWire ports found in these systems are typically mini FireWire ports, which require a special cable or a dongle-style adapter to connect to the standard desktop-sized FireWire cables.

Another development on the horizon: FireWire 800 is an emerging standard that should double FireWire's bandwidth from the current 400Mbps (which is slightly slower than USB 2.0) to 800Mbps.

### Retreat of Legacy Ports

Just as USB 2.0 and FireWire connections are becoming common in many notebooks, vendors are retreating from including legacy ports in all but the largest

desktop replacement and thin and light models. For most users and applications, this is not a serious problem. Only 37 percent of notebook buyers predict an ongoing need for legacy connections, and 12 percent are ready to abandon such ports right now.

Bottom line: expect ports like parallel, serial, PS/2, and even PC Card slots to become increasingly difficult to find in notebooks as time goes on.

### Demise of the Floppy Drive

We have seen a significant downturn of interest in the floppy disk drive in the last several years. This is a predictable trend, since file sizes have grown precipitously, and there are few practical applications left for the venerable 1.44MB floppy disk drive.

So, just as notebooks have tended toward smaller form factors, a natural way to streamline the size and weight of newer models is to omit the floppy drive entirely (in one- or two-spindle units) or to offer a floppy as an external option. Increasingly, floppy drives aren't included in the base price of the notebook, but are instead offered as an option.

While that's the reality of notebook purchases today, a mere 22 percent of users (according to the 2Q 2002 MobileTrax study) can get by without any floppy drive at all. Half of the respondents require some form of floppy—either as a swappable drive in a multi-function media bay or as an external drive connected via USB or serial cable. DO you need a floppy drive in your notebook? Here are some issues to consider:

- There are few day-to-day uses for a floppy drive, since such drives are slow and can hold very little real-world data. Even Microsoft Word and Excel files can routinely consume several hundred kilobytes, leaving little space on a floppy.
- A better alternative in many cases is a removable media card, such as SD/MMC, Compact Flash, or Memory Stick. Some laptops already come with integrated memory card readers, and others include "key fob" style USB memory plugs that are read through the USB port. Even a small memory card or USB memory plug can hold several megabytes of data, and they range in size up to a gigabyte or more. These gadgets make transferring data painless. Notebooks that lack memory card readers can still take advantage of USB-based removable memory devices like DiskOnKey, which allow users to swap even very large files through key fob-shaped gadgets that plug into the USB port.
- On the other hand, floppy drives can still be essential, even if just for emergency recovery. Many system recovery applications still require access to a floppy disk drive, and a notebook without access to one can be difficult to restore after a critical failure. Our advice is to make sure that you have

one external floppy drive on hand for such situations, especially if your notebook fleet is floppyless. And, to future the demise of the floppy, M-Systems had developed a bootable DiskOnKey so that if the system won't boot, the DiskOnKey can help load the recovery CD.

### Larger Screens

For several years, the largest commercially-available notebook displays—found in desktop replacement systems—measured 15.1 inches. In the last year, though, there's been a move toward even larger displays. The king of screens is currently the Apple PowerBook G4, which delivers a huge 17-inch display, roughly equivalent in viewable area to a 19-inch CRT display on a desktop PC. It offers a native resolution of 1440x900 pixels.

No 17-inch displays exist for Windows-based notebooks, but several vendors come close. Notebooks are available with 15.4-, 15.7- and 16-inch screens, offering more displayable area than 17-inch desktop CRT monitors.

The move to larger screens is understandable, since more "screen estate" yields more working space and the opportunity to multi-task, operate multiple windows on-screen, and better simulate the experience of working with a desktop PC. On the other hand, the trend toward large displays has a number of disadvantages in the mobile environment, so the decision to deploy these models should be weighed carefully. Larger displays:

- consume more battery power, resulting in less unwired operational time
- result in bigger and heavier notebooks, so they are almost always left on the desktop most of the time
- are more fragile, a serious limitation in the mobile environment
- are somewhat cumbersome to use in many situations. Even 14-inch screens are too large to comfortably use on cramped airplane tray tables, rendering 15.4-inch and larger displays essentially unusable in such situations.

Several vendors have embraced the trend toward 17-inch displays:

Model	Screen Size (inches)	Resolution (pixels)
Apple PowerBook G4	17	1440x900
Compaq Presario 3005US	16	1280x1024
Dell Inspiron 8500	15.4	1920x1200
Gateway 600X	15.7	1280x1024
Toshiba Satellite 1955-S803	16	1280x1024

One innovation in notebook display technology bears mention. Estari ([www.estari.com](http://www.estari.com)) is developing a dual-screen notebook for vertical industry applications called the 2VU. The notebook opens with a traditional clamshell design, but features dual 15-inch displays for side-by-side document display and other screen-intensive purposes.

### Hard Drive Inflation

A significant trend in notebook evolution is the growth of hard disk sizes found in contemporary models. Currently, hard disk drive sizes range from 20GB at the low end (most typically found in value and ultralight models) to 30GB, 40GB, and even 60GB hard drives. Larger hard drives are slower to reach the notebook market than the desktop arena, though we expect to see notebooks begin to offer drives as large as 100GB by the end of 2004.

Larger hard drives have few negatives with the exception of price. Statistics do not currently show higher failure rates for larger drives as compared to smaller drives, and the power consumption delta is negligible. The major difference: right now, a 60GB hard disk carries approximately a \$200 price premium compared to the same notebook with a 30GB hard disk. But, this price difference has come down just recently as the newer 80GB drives were just announced mid-2003.

### Rise of Wireless

In the last two years, mobile networking has transformed from expecting to find an analog 56kbps modem and 10/100BaseT Ethernet integrated into a notebook into finding wireless technologies like Wi-Fi and Bluetooth under the hood of modern notebooks. Indeed, over the next few years, the value of wireless networking will continue to grow until it's inconceivable that notebooks won't come with these new technologies. Already, many mainstream systems come so equipped and almost all notebooks offer this capability as an option.

### Wi-Fi

Wi-Fi is the common marketing name for 802.11b, a wireless Ethernet solution that has become the defacto standard for wirelessly accessing local and wide area networks in business and personal computing. Wi-Fi is actually just one of many standards (collectively referred to as 802.xx), which include:

- 802.11a. This version of the 802.xx spec co-exists with Wi-Fi and supports speeds up to 54 Mbps, which is five times faster than 802.11b. It also uses a higher frequency—802.11a works in the 5 GHz range as opposed to 802.11b's 2.4 GHz range. Consequently, it suffers far less from interference from other devices such as cordless phones. A disadvantage of 802.11a, however, is that, because the frequency of the radio waves is higher, the total range from any given access point is significantly shorter. Specifically, 802.11a has roughly half the range of 802.11b—only 150 feet. As a result, 802.11a requires a denser concentration of access points to provide the same coverage as 802.11b.

- 802.11g. This newer standard is still emerging; it has not yet reached commercial status, but should by late in 2003 or early in 2004. It works in the same 2.4 GHz band as 802.11b and should be backwards compatible with 802.11b hardware. While it will be somewhat more susceptible to interference than 802.11a, it will provide speeds that range up to 54 Mbps—and compatibility with current 802.11b equipment should make it catch on fairly quickly.

In contrast to both 802.11a and 802.11g, 802.11b (also known as Wi-Fi) has a maximum transmission rate of 11Mbps, which is low by other 802.xx standards but perfectly adequate for most kinds of Internet and network traffic. The simplicity of 802.11b and its emerging ubiquity means that it's fast becoming a standard way to easily access the Internet from a notebook computer. As a result, a growing number of notebooks are coming with 802.11b as standard equipment. Intel's Centrino chipset delivers integrated Wi-Fi networking to all notebook vendors. Consequently, we have seen Wi-Fi become a standard on-board component, much like infrared, USB, and integrated stereo speakers.

Wi-Fi is reaching critical mass thanks to investments by a number of wireless service providers. Indeed, the presence of Wi-Fi "hotspots" is making it possible to access the Internet from portable devices like notebook PCs from a wealth of locations in major cities across the US. Some of the recent hotspot initiatives include:

- Starbucks Coffee shops have deployed T-Mobile Hotspots at approximately 1,500 locations nationwide.
- Borders is deploying T-Mobile Wi-Fi hotspots at approximately 400 locations nationwide.
- Kinko's business service centers are offering Wi-Fi access via T-Mobile, with plans to launch 1,000 locations by the end of the year.
- Approximately one dozen McDonald's fast food restaurants in Manhattan have "unwired," offering Wi-Fi service via pay-as-you-go service as well as offering access minutes in conjunction with the purchase of certain food items. McDonald's plans to roll out service in about 300 locations later this year.
- Verizon has launched approximately 150 Wi-Fi hotspots Manhattan, with plans to expand that to 1,000 in total by the end of the year. The hotspots are co-located with public payphones. The highest concentration of hotspots is in popular, upscale parts of the city like Battery Park, Columbia University, and Greenwich Village.

A new company—Cometa Networks—has recently been formed that's backed by IBM, AT&T and Intel to design, develop and deploy over 20,000 hotspot wireless LANs over the next 3-4 years. Cometa will not offer services directly to end users since they don't have the brand marketing or billing infrastructure. Rather, they will

design, deploy and operate the networks on behalf of their clients, typically wireless ISPs and traditional wireless carriers.

### Wireless Limitations

Despite the quick ascendance of Wi-Fi in the last few years, 802.11b has some key limitations you need to consider when deploying wireless networks for notebook PCs:

- **Limited Security.** Wireless notebooks are very vulnerable to security problems. By default, Wi-Fi networks come with encryption and security disabled, which allows any Wi-Fi-enabled device to access the entire network without challenge. A low security barrier can be enabled by turning on WEP (Wired Equivalent Privacy) security, which is a private key encryption scheme that keeps out unauthorized devices. Even WEP can be defeated with off-the-shelf cracker tools like AirSnort, though, which means serious business users with particularly sensitive data need to look beyond WEP—or at least change the WEP key on the Wi-Fi access points and notebooks frequently. The enterprise needs to incorporate a better security solution in notebooks where wireless LANs are operating. Companies like Granite Systems and Fortress Technologies focus on providing DOD-certified security for notebooks and other firms such as Bluesocket, Vernier Networks, Roving Planet and ReefEdge provide wireless LAN switches that integrate wireless LAN management with security.
- **Reduced Battery Life.** Wi-Fi takes a toll on battery life. Expect to experience a 10 to 25 percent drop in battery life when the Wi-Fi radio is turned on. Most notebooks have a Wi-Fi switch on the case that allows you to enable and disable Wi-Fi as needed. Users need to remember to turn off the wireless LAN communications when operating the notebook on battery but away from a wireless network such as when on the airplane.
- **Limited Bandwidth.** Wi-Fi is limited to a peak bandwidth of 11Mbps, with an average throughput that's significantly lower. That means Wi-Fi is sufficient for Internet access and lightweight LAN network usage, but is insufficient to transfer very large data files quickly.

All of these concerns can be ameliorated by smart access of technology and tools as well as IT instructing users how to properly use their notebook system.

## Bluetooth

Despite its invention in 1994 and its commercial rollout in 2002, few people—even in technology circles—yet know much about Bluetooth.

Bluetooth is a short-range wireless networking technology that is largely intended to be a wire replacement solution. Generally operating up to 30 feet away from one another (though a less-common mode allows Bluetooth to operate at ranges of 100 feet), Bluetooth devices can talk among themselves at speeds up to 1Mbps. Equipped with Bluetooth devices, users no longer need to contend with serial cables, modem cables, printer cables, or headset cables.

For notebook users, Bluetooth has a number of practical applications:

- Wirelessly copy contact information from a PIM application like Outlook to a mobile phone, eliminating the need to enter those phone numbers into the phone manually
- Wirelessly HotSync or ActiveSync a PDA with the notebook, eliminating the need to bring a cradle on the road
- Connect a notebook to a mobile phone wirelessly for Internet access

Bluetooth has these important characteristics:

- Bluetooth has a 30-foot range, effectively creating a "personal area network" around the user.
- Unlike older wireless technologies like IrDA, Bluetooth is omni-directional and penetrates some materials—which means that a mobile user can leave Bluetooth in his or her pocket or briefcase while using it to access the Internet on a notebook.
- Bluetooth is inherently secure, requiring both devices to "pair" using a pass code and acknowledge each other before data can be exchanged.

Right now, Bluetooth is in its commercial infancy and does not yet have broad industry support. Nonetheless, the Bluetooth SIG claims that over 1000 Bluetooth-enabled products are already available. Few notebooks are available with integrated Bluetooth, though Apple has taken the industry lead by offering several PowerBook models with Bluetooth hardware and software right in the box. Using a PowerBook G4 with Bluetooth, for instance, it's possible to HotSync a Palm OS PDA and share contact data between the notebook's Address Book and an Ericsson T68 mobile phone.

Until Bluetooth is available in more notebooks, it's possible to add Bluetooth functionality to notebooks via USB Bluetooth adapters, such as models available from Belkin. Soon, though, we expect to see more manufacturers following Apple's lead by introducing Bluetooth-ready notebooks.

Bluetooth will be most used as a cable replacement. Thus, it will allow a PDA or cell phone to communicate with a notebook PC via short-range wireless in order to

(most typically) sync personal information such as contacts, appointments and misc. data. Within a few years, lower power Wi-Fi may replace Bluetooth in this example as Wi-Fi becomes built in to handheld devices. It would allow for much faster transmission of data between the handheld and the notebook.

## **CORPORATE TRENDS IN MOBILITY**

Despite a decade of entrenchment in corporate offices, notebook computing is still undergoing a series of evolutionary changes. Not only is hardware continuing to evolve, but deployment strategies are changing as well. That's not surprising, considering the pace at which mobile technology is changing. Consider:

- The notebook PC has now gone from being a niche segment to becoming the standard offering for many enterprises as well as individuals such as college students.
- The number of notebook systems sold has increased to 30 million units a year.
- The notebook category has segmented into at least five different sub-segments as described earlier.
- In Fall 2002, Microsoft and a handful of hardware partners introduced Tablet PCs, which run Windows XP and offer many of the same features and capabilities as notebooks (similar screen size, hard disk, and processing power). The slate-style form factor and pen input system implies a somewhat different role in the mobile environment, but the fact remains that many businesses see Tablet PCs as potential replacements for traditional notebooks.

Given that backdrop, —IT is now considering the notebook as the standard issue personal computer in their organization. IT managers also need to acknowledge these factors:

- Notebooks continue to converge with desktop PCs as measured by processing power, storage capabilities, and overall feature sets. Several desktop replacement notebooks are available with the same top processor (3.06-MHz Intel Pentium 4) as is available in desktop PCs. That means the majority of desktop capabilities are now available in a small, portable framework, adding up to dramatically more operational flexibility.
- Many new notebooks come equipped with broad multimedia support, including video input and output ports, further blurring the role notebooks and desktops play in many vertical applications such as PowerPoint delivery and digital imaging production.
- Most notebooks sold going forward will integrate wireless LAN offerings.

Indeed, according to a study on notebook trends conducted by MobileTrax in 2Q 2002, notebook spending is not decreasing—a particularly telling result considering the current economic climate, which is resulting in somewhat reserved technology investments for the past few years. Only about 6 percent of all respondents planned to decrease spending on notebooks in 2002 compared to 2001, with about 50 percent planning to increase the mobile budget by 5 percent or more. Likewise, a full 85 percent of the companies surveyed expected to further increase spending in 2003.

Such results are inevitable; the modern American workforce is a mobile one, and getting increasingly so as time goes on. Of the businesses that took part in the MobileTrax study, a quarter of all employees are characterized as "extremely mobile," meaning that they are physically away from the office or corporate campus at least 50 percent of the time. Another quarter are somewhat mobile: away from the office less than 50 percent of the time. Likewise, a third of the users surveyed require wireless connectivity a third of the time, and that's expected to grow to as much as 40 percent of users within three years. And, since notebooks are being used by even those who do not travel (except to go home at the end of the work day), the definitions of exactly who is a notebook user have become fuzzy. We believe that eventually, most users will adopt a notebook whether they be in a large enterprise or working from home or being a student. Yes, desktop systems will continue to be purchased for designated administration functions in an enterprise and for a home's initial PC, but notebooks will likely surpass desktop sales in the enterprise.

### Notebook User Behavior

A critical question that must be answered is how users in a corporate environment actually use their notebooks—this is key to making the smartest buying decisions and ensuring resources are optimally utilized. We can draw these conclusions about corporate notebook user behavior:

- An overwhelming majority of users—as much as 75 percent—use their notebooks as their primary day-to-day PC. That means it makes sense to invest in desktop replacements or, at the very least, thin and light systems, since those models offer the most performance and desktop-like capabilities.
- Two thirds of all notebook users use some kind of docking solution, whether that's a full-size dock, a mini-dock, or some sort of port replicator. Indeed, when used with a docking solution, a smaller, more portable notebook can be connected to a complete suite of peripherals when in the office (see below).
- Users don't work well when forced to accept compromises inherent in notebook input control. Most notebook users want a full-size keyboard, for instance, even if buying an ultralight notebook. Performance, then, trumps portability and light weight.

The road warrior who relishes light weight at any cost to performance and usability, then, is largely a myth. Notebook users appear to be happiest when their notebooks closely match what they have come to expect on the desktop.

Likewise, we see another potential trend developing: notebooks as desktop computing engines. Users can plug an ultraportable notebook into a desktop docking solution and get the best of both worlds: a powerful processor with near-desktop performance and extreme portability when needed. Such a system would look like this:

- One- or two- spindle ultralight PC with adequate CPU and hard disk specifications
- Desktop 17-inch (or larger) monitor
- Full-size keyboard
- Mouse
- Networking
- Optional optical drive, such as a DVD/CD-RW

The entire package can be tied together via a docking solution that makes it easy to remove the notebook for mobile applications and return it to the desktop peripherals when the trip is complete.

## **NOTEBOOK SECURITY**

While notebooks offer portability in the corporate environment, these devices have some serious limitations that need to be considered when enabling mobile users.

- Data backup. Unlike desktop systems that can rely on local RAID arrays, notebooks have no access to redundant mirrored arrays. Administrators need to take care to employ network backup software in such a way that notebooks are backed up on an as-available basis. Alternately, notebooks can be backed up via external hard disks, though we do not recommend using a USB 1.1 port for this kind of application, since the performance hit is so great that end users are often inclined to disconnect the drive, eliminating the possibility of backup. Instead, USB 2.0 and FireWire external hard drives are the preferred solution. Online, Web-based backup solutions are ideal for users who travel frequently and need to perform backups of critical data while away from the office. On the other hand, online backup services are costly; alternately, consider using the notebook's integrated CD-RW drive to perform backups as needed.
- Data security. Notebooks spend a significant amount of their useful life on the road, where they are easily lost or stolen. IT needs to ensure that the sensitive data stored on these notebooks is secure. A variety of solutions

exist, from simple password access at boot to sophisticated biometrics like fingerprint readers. Once very difficult to find, biometrics are increasingly popular because of their ease of use. Whatever solution is selected, though, it's important to ensure that end users do not bypass these systems by disabling password checks or using simple passwords.

- Physical security. A number of products and services exist to prevent physical theft of the notebook, or to help recover it after it is taken. Companies like Caveo ([www.caveo.com](http://www.caveo.com)) sell peripherals that alarm when the notebook is moved or taken outside the range of a transceiver. Absolute Software ([www.absolute.com](http://www.absolute.com)) has made a business of recovering stolen notebooks by tracing them after they connect to the Internet. Such solutions are expensive but afford the ultimate in physical security for your notebooks.

## MOBILE RESOURCE MANAGEMENT

Management of the configuration, deployment and management of mobile resources is critical to enterprise IT. The major areas of IT Support “pain” related to the management of mobile and wireless devices include:

Inconsistent Network Bandwidth. Mission-critical applications and data will be transmitted over different public and private data networks, some of which may be bandwidth constrained. Therefore, IT Support requires a management solution that is network-agnostic.

Variable Connection States. The mobile workforce may be “disconnected” temporarily or at a length of time due to a lack of network access, wireless data coverage or the nature of their assignment. Therefore, IT Support requires a flexible management solution that can be used based on demand, a pre-determined schedule or when the device is connected to the network.

Ad-Hoc Device Support. The TCO related to the proliferation of mobile and wireless devices increases as mobile workers support their devices on an ad-hoc basis. Therefore, IT Support requires a centralized management solution that enables them to deploy, configure, monitor and troubleshoot the mobile device systems and applications from a central console.

Deploying Point Solutions. Current “point solutions” provide a limited number of features or only support specific systems or devices. Therefore, IT Support requires a management solution that is broad, standards-based and supports various networks, mobile device systems and other mobile resources.

Mobile resource management (MRM) solutions addresses the seamless wireless data communications and mobile computing needs of the next-generation mobile workforce while efficiently managing their mobile resources.

### Mobile Resource Management Market

Mobile resource management refers to the “lifecycle management” of mobile and wireless devices, operational software and systems and mission-critical applications, content and data. MRM solutions minimize the TCO of mobile and wireless devices while supporting the increased productivity of the mobile workforce. Accordingly, they enable IT Support to manage inconsistent network access, adjust to variable connection states, to centralize IT administration and to deploy broad, network-, device- and systems-agnostic solutions.

The growth of the mobile workforce is driving a proportional proliferation of enterprise-class mobile and wireless devices (e.g. smart phones, handheld PCs, notebooks, etc.) to support their mobile computing and wireless communications needs. As shown in Figure 1, there will be over 110 million enterprise-class mobile and wireless devices by 2004 according to IDC.

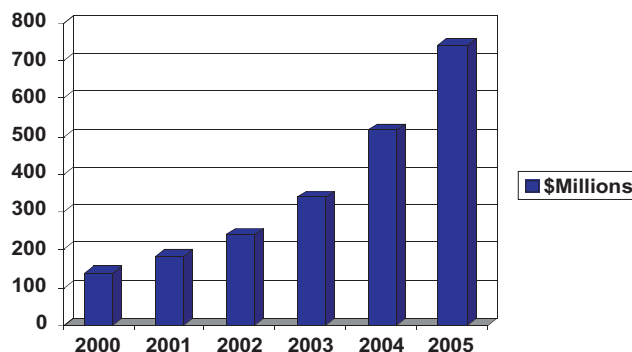
Mobile/Wireless Device	2000 (millions)	2004 (millions)	GAGR
Notebook PCs	26.0	49.0	17.2%
Handheld PCs	1.0	1.8	15.8%
PDA's	9.4	33.7	37.6%
Vertical Application Devices*	2.1	4.9	23.6%
Smart Phones	0.5	23.2	161.0%
<b>Total</b>	<b>39.0</b>	<b>112.6</b>	<b>30.4%</b>

\* Tablet PCs, bar code scanners, portable data collection devices, etc.

Source: IDC

**Figure 1: Enterprise Mobile and Wireless Devices**

Consequently, IT Support’s need to manage the proliferation of the various mobile and wireless devices will drive a commensurate level of growth in the MRM market. For example, Stamford, Conn.-based Gartner forecasts the MRM market to grow at a five-year CAGR of 40% from more than \$135 million in 2000 to almost \$750 million in 2005 (see Figure 2).



Source: Gartner, Inc.

**Figure 2: MRM Market Size**

### Mobile Resource Management Solutions

Mobile resource management solutions enable IT Support to centralize the deployment, monitoring, configuring, upgrading and troubleshooting of mobile device systems, operational software and mission-critical applications, content and data. A broad MRM solution should feature systems management, software management, data management, security management and centralized administration functionality.

Systems Management. Systems management functions allow IT Support to deploy, manage, upgrade and troubleshoot mobile device systems. Key systems management functions include asset management, operating systems migration and license management.

Software Management. Software management functions allow IT Support to deploy, manage, upgrade and troubleshoot operating software and mission-critical applications based on wireless policies as well as device and user groups. Key software management functions include software installations and updates and device configuration and troubleshooting.

Data Management. Data management functions allow IT Support to ensure reliable network connectivity and data transmission across various wired and wireless data networks. Key data management functions include bandwidth management, data compression, data security and database synchronization as well as remote software repositories, checkpoint restart and byte-level differencing.

Security Management. Security management functions allow IT Support to secure the mobile devices and related mission-critical data based on mobile and wireless security policies. Security management functions include data encryption, user authentication, location-aware policy enforcement and power-on passwords as well as popular desktop PC solutions, such as VPNs, personal firewalls and virus protection programs.

Centralized Administration. Centralized administration of mobile and wireless devices enables IT Support to efficiently control the management of mobile devices and related resources. Key centralized administration functions include centralized console management (e.g. Microsoft Management Console, a web-based console or custom Windows-based application console), legacy platform integration and remote control.

There are eight major companies that provide mobile resource management solutions. Each one has a unique set of features that sets it apart from the others. Here is a brief summary of the different features of each system:

Feature	Extended		Mobile		Novadigm	Novell	Rapport	Synchrologic	XcelleNet
	AirPrism	Systems	Automation						
Palm		X	X	X	X	X	X	X	X
PocketPC	X	X	X	X	X	X	X	X	X
Blackberry				X	X	X	X	X	X
Symbian				X			X	X	
Laptops	X		X	X	X	X	X	X	X
BIOS Management							X	X	
Multiple Device Groups	X	X	X	X	X	X	X	X	X
Desktop and mobile support	X			X	X				
Data & device security	X								
Self healing and repair	X					X		X	
Wireless config/support	X								
Active Directory LDAP	X		X	X	X	X	X	X	X
Device Inventory	X	X	X	X	X	X	X	X	X
Back Up	X					X		X	
Centralize mgmt console	X	X	X	X	X	X	X	X	

### MobileTrax Spotlight: Mobile Resource Management Vendors

#### AirPrism

[www.airprism.com](http://www.airprism.com)

AirPrism is a start up in Redwood Shores that has developed what we call a “next generation” MRM solution because of their advanced fault management, wireless and data security features not found in other systems. AirPrism is a relatively new player in the MRM space. AirPrism has the following major features:

- A comprehensive and integrated MRM solution, including mobile resource deployment, security, management and support functionality
- Ability to configure and maintain the application software running on the mobile clients
- Deep support for wireless connectivity, including network configuration, network optimization and the ability to support occasionally connected states (something not supported in traditional systems management resources)
- Fault Management including self-diagnosis and self-healing
- Client-resident, intelligent agents that enforce mobile and wireless security policies and enable mobile workers to manage a disconnected mobile device.
- Device and data security functionality to protect the mobile devices and transmitted mission-critical content and data.
- A management console so IT can see what’s installed on the client devices and generate management reporting
- Software Deployment
- Asset & Configuration Management
- Backup and Restore

### Mobile Automation

[www.mobileautomation.com](http://www.mobileautomation.com)

Mobile Automation has a comprehensive set of MRM resources and facilities. The company is located in Santa Monica. The company's flagship product, the Mobile Lifecycle Management Suite, is built on a Device Management Platform (DMP) that provides a scalable and rapid-deployment solution for corporations who have a mobile workforce. It includes integrated tools for discovering, securing, managing, maintaining, supporting and migrating all desktops, laptops, servers and hand-held devices from any location via a single management console. Indeed, it is designed to play a role in:

- Asset discovery
- Security Management
- Software Deployment
- Operating system migration
- Software license management

### Synchrologic

[www.synchrologic.com](http://www.synchrologic.com)

Synchrologic is best known for the Mobile Suite of integrated mobile systems management resources. Synchrologic Mobile Suite is a modular software infrastructure solution with four major components:

- **Email Accelerator.** Provides mobile workers with a secure, centrally-managed infrastructure to connect mobile devices to an Exchange or Domino server. It features push, alerts, PC synchronization, and WAP access.
- **Data Sync.** Tools to mobilize enterprise applications such as CRM and ERP for handheld use.
- **File Sync.** Automates content distribution to mobile devices and provides offline access to the corporate intranet and Web pages.
- **Systems Management.** Designed to reduce TCO of mobile devices with management tools for backup, configuration management, asset collection, and software distribution.

### Extended Systems

[www.extendedsystems.com](http://www.extendedsystems.com)

Extended Systems has been well-known for their cross platform support and has a number of major accounts. Recently, the company's position has been enhanced by the acquisition of ViaFone, a leading enterprise application provider. The company offers a broad range of products and solutions that include:

- Server-based synchronization and device management solutions
- Mobile enterprise solutions for sales, services, and pharmaceutical professionals
- Mobile application development tools for the integration and deployment of

existing CRM, SFA, ERP and other enterprise applications to mobile devices

- Bluetooth and infrared software development kits
- Client/Server Database Software

### Novadigm

[www.novadigm.com](http://www.novadigm.com)

Novadigm has a product line under the Radia brand name that supports both desktop and mobile device management. Novadigm boasts a broad array of clients from Global 1000 companies, government agencies, and industries like aerospace, automotive, banking, e-commerce, education, electronics, energy, engineering-construction, entertainment, finance, and pharmaceuticals. Novadigm's products utilize the company's e-wrap technology, which is designed to automate the deployment and management of software and content across multiple environments. The goal is to allow the right software components to always be available to the right users at the right time, without requiring administrative or user intervention. Novadigm products include:

- **Radia Application Manager.** A change and configuration management tool for deploying self-managing software over wired and wireless networks without administrator intervention. IT administrators control deployments, updates, repairs and removals through policy-based entitlements.
- **Radia Software Manager.** Enables enterprise IT organizations and service providers to offer self-service software and content management over wired and wireless networks. IT administrators control access to software and content through policy-based entitlements, while users can download, update, and repair software and content through a self-service Web-based catalog.
- **Radia Inventory Manager.** A policy-driven, digital asset discovery and reporting tool that automatically gathers information about software and hardware configurations for mobile devices and consolidates the results into Web-based reports.
- **Radia OS Manager.** A change and configuration management tool that provides policy-based provisioning and ongoing management of operating systems, patches, hot fixes and service packs for Windows, UNIX, and Linux platforms. It enables organizations to provision and manage all the digital asset layers on servers, desktops, laptops and other mobile devices.
- **Radia Patch Manager.** A change and configuration management tool that automatically discovers, analyzes and deploys software patches for Windows Linux and Unix platforms. Administrators control the patch lifecycle, including acquisition, testing, conflict analysis, vulnerability assessments, deployment, and ongoing management, through policy-based entitlements.

## Novell

[www.novell.com](http://www.novell.com)

Novell ZENworks is a complete and integrated resource management tool set that automates IT management processes throughout the lifecycle of desktops, laptops, servers and handhelds. It is unique in its ability to automate application and resource provisioning based on identities and leveraging identity information to determine which applications, resources and information it should deliver to each user.

The Novell ZENworks solution addresses the four major areas of concern regarding mobility: securing corporate IT systems, protecting the corporate data on mobile devices, enhancing productivity, and cost effectively managing the applications and data on mobile devices. Capabilities include:

- Remote self-healing of laptops
- Automatic back-up of laptop data and access to that data anywhere, anytime, on any device
- Remote configuration and inventory of mobile devices
- Centralized and standardized remote configuration of handhelds and laptops
- Enforcement of password policies to protect data on or accessible from a mobile device.
- Automatic software and content distribution to handhelds and laptops
- Detailed inventory of the software on handhelds and laptops
- Automatic retrieval of business process data entered on handhelds to upload critical data into corporate IT systems

## Rapport Technologies

[www.rapporttechnologies.com](http://www.rapporttechnologies.com)

Rapport Technologies is another new entrant to the MRM space. They have already done systems management for over 750,000 Wyse Systems clients and now are expanding to provide those services—including the ability to update the BIOS in the client device. The company's flagship product is Rapport Device Management, designed to give administrators control over all the mobile devices—including embedded devices, fixed-function terminals (such as bar code readers, kiosks, point-of-sale machines, and set top boxes), smart phones and PDAs.

Rapport claims that Rapport Device Management is device agnostic, bandwidth efficient and scalable to over 1 million clients. The product also offers what is no doubt the industry's smallest device management agent—just 80KB. It includes tools for software distribution, asset management, diagnostics, data protection, and automatic distribution of device and application settings.

## XcelleNet

[www.xcellenet.com](http://www.xcellenet.com)

XcelleNet has been the market leader in the MRM space with their Afaria brand that has been very popular with enterprise IT. It is designed to provide optimal

device and application availability, performance and reliability for the full range of mobile devices such as notebooks, PDAs, BlackBerrys, smart phones, and point-of-sale systems. Afaria, includes tools to:

- Distribute content, files and relational data across the enterprise
- Automate key technology tasks to support field activities
- Back up data without employee intervention
- Deploy, monitor and maintain applications
- Track and provision hardware and software assets
- Optimize communications across any network accessed
- Support users when they have problems
- Provide security for devices and users

## **WHAT IT NEEDS TO KNOW**

Notebook computing is still evolving, maturing, converging, and innovating. That's good news, because corporate users are finding themselves ever more mobile—whether it's on the road, in the air, across campus, or just interacting at other cubicles and in the corridor. This drive towards increased mobility means that notebooks and wireless are more important than ever before.

That said, in order to procure, deploy, control, and administer notebooks effectively, IT needs to know and consider the following:

Replace Desktops. Many users do not take advantage of the unique attributes of desktop computing and don't need to have a tower case under the desk. Since notebooks have reached price parity with desktop systems, now is the time to begin replacing desktop systems with notebooks. By purchasing notebooks, IT affords users more work flexibility, including the ability to take their full-time computer home at the end of the day for after-hours work. It also makes part-time telecommuting and other flexible work policies attainable without investing in more than one PC per user.

Lightweight Computing Engines. Rather than investing in large, heavy desktop replacement notebook, consider purchasing ultralight or ultraportable systems that can be "plugged in" to desktop peripherals when in the office. A small, lightweight notebook is easier to transport and use on the go, but it can be plugged into a full-size monitor, keyboard, and mouse at the office, at home, and at branch locations.

Incorporate Wireless. Wireless LANs should become a part of the landscape and architecture for all but the most rigidly non-mobile of operations. Notebooks should be procured with Wi-Fi hardware and notebooks should be optimized for wireless operation (such as via Centrino architectures). IT should develop a strategy to unwire campuses so notebooks and PDAs can access e-mail, Web, and other network services anywhere, anytime. Wi-Fi will not be the reigning standard

forever; already, 802.11a and 802.11g is gaining some momentum. We recommend deploying now, though, and adopting cross-compatible access points when the time comes.

Embrace USB. Thanks to Windows NT's incompatibilities with USB, that connection solution was not an important factor in the enterprise for a number of several years. Windows XP Professional, on the other hand, includes rich USB and Plug and Play support. In other words, the battle appears to be over and USB has won. Organizations should begin to move away from legacy peripherals that use parallel and serial ports as quickly as is prudent, since USB now appears in all modern notebooks and legacy ports will be increasingly difficult to find in any but the largest desktop replacement systems.

Use CD-RW. Despite the aggressive penetration of DVD drives in the PC marketplace, there's still virtually no DVD software available. That's not important, though: the fact remains that DVD recorders can write 4.7GB to a disc, while CD recorders are limited to 650MB. As a result, we recommend that when selecting optical drives for your notebook purchases, choose a DVD-R or similar recordable DVD variant. Having a DVD recorder in each notebook means that users can create quick and dirty data backups wherever, whenever it's necessary. The larger disc capacity also makes it easier to copy large data files for clients and co-workers. Since the price difference is small, DVD recording is the smart choice.

Establish Policies. Notebooks are, by their very nature, more personal and less easily administered. It's important to establish policies and, when possible, enforce them through software. These policies should include:

- Requirements for regular data backups to DVD-R, an external USB 2.0/FireWire hard disk, or the network.
- Regular password changes, with the ability to prevent users from returning to a recently-used password
- A position on software downloads. Create a realistic, fair policy that allows users to download some non-work content, but be pragmatic about large media like MP3s and video files. Especially if users are connecting through wireless access points, bandwidth can become a serious limiting factor if left unchecked. There are also legal and liability issues to consider—copyright watchdogs, for instance, may hold your organization liable if copyrighted files like music are downloaded through one of your own IP addresses.
- A position on what can be installed on the notebook. Companies that issue notebooks to employees may be liable if they are used to download pirated music or used in other illegal activities. Mobile resource management software often allows IT to detect what other software the user has loaded on their system.

Enforce Standardization. Purchase from vendors that allow you to enforce common software images and sell common, standardized peripherals that can be used across multiple models from the same vendor, both now and in the future. Especially useful: USB-style docking solutions that do not rely on proprietary ports and pin-outs which are likely to change in future model years.

“Tracking the Future of Mobile and Wireless”

[www.mobiletrax.com](http://www.mobiletrax.com)

