Cellular phones are no longer just for making calls. Today, they also function as PDAs, digital cameras, Internet consoles, and e-mail and instant-messaging clients.

Because of this, the operating systems used in phones have had to improve. According to David Wood, OS-vendor Symbian Ltd.’s executive vice president for technical consulting, “The relentless increase in user requirements for mobile phones means that proprietary operating systems adopted by phone manufacturers years ago are now at their limits.”

This demand for better mobile OSs has changed the nature of the marketplace. And that marketplace is healthy, despite the global economic problems, largely because smart-phone sales are increasing.

According to Ross Sealfon, research analyst for the Smart Handheld Devices Program at IDC, a market research firm, worldwide shipments of smart phones in 2003’s first quarter grew by more than 400 percent over the same period last year, to 1.71 million units. About 3 million smart phones are in use now.

Carl Zetie, analyst with Forrester Research, a market research firm, said the recent rise of middleware for mobile devices made it much easier and less expensive to integrate mobile applications into the enterprise infrastructure and thereby increased corporate demand for smart phones.

Perhaps the most important driver of the smart-phone-OS market, though, is the increasing corporate demand for mobile applications as powerful as those used on laptops, along with the consumer demand for rich multimedia and games on handheld devices.

Meanwhile, faster processors and more memory on handheld devices, as well as wireless networks with greater bandwidth, have enabled the development of powerful mobile applications and smart-phone OSs.

**Today’s Smart-Phone OSs**

The most important smart-phone operating systems today are Microsoft’s Smartphone 2002, Palm OS 5.x, and Symbian OS 7. Each has taken a different path to deliver services to host devices. The Smartphone OS is a subset of the Windows CE 3.0 OS for handheld devices. Palm OS is a PDA operating system retrofitted for phones. Mobile phone vendors built Symbian OS specifically for use in telephones.

Despite the differences, each faces common problems. For example, each OS must work with small, mobile devices that have small screens, relatively few processing resources, and limited input options. To accomplish this, vendors optimize their OSs and eliminate redundancy and other types of unnecessary code, including some APIs and device drivers.

To handle smart phones’ increased functionality, the operating systems, although small by desktop standards, require at least 16 Mbytes of host-device RAM to operate effectively, considerably more than past OSs. As Figure 1 shows, vendors have taken different approaches to maximizing the limited memory resources.

The OSs also must support different telephony communications standards, such as the Third Generation Partnership Project video format, and other networking services, such as infrared data communication, Bluetooth, and TCP/IP over cellular networks and wireless LANs. At the same time, the OSs must minimize power consumption to reduce the strain on devices’ batteries.

Vendors have designed their OSs and optimized their code to take advantage of mobile devices’ increasing processor performance and memory capacity, and wireless networks’ growing bandwidth. They have also added APIs so that the phones will work with cameras and other devices.

**Microsoft’s Smartphone 2002**

Microsoft’s Smartphone 2002 OS adds some PDA functionality to telephones. The Smartphone OS offers less overall functionality, has a smaller footprint, provides a simpler user interface, and consumes less power than Microsoft’s Pocket PC Phone Edition.

The latter, which is used with PDAs that have some telephony features, provides more functionality, including enhanced security, multimedia capa-
bilities, touch-screen functionality, handwriting recognition, and multitasking capabilities.

Smartphone offers no touch-screen capabilities, unlike the Palm OS and Symbian OS. Users thus must use a device’s small keypad to enter commands. Microsoft says it didn’t include touch-screen capabilities because it wants users to be able to operate Smartphone devices with one hand.

Isaac Ro, a senior analyst with the Aberdeen Group, a market research firm, said Smartphone’s initial version has some technical and implementation problems. “Historically,” he said, “Microsoft’s first products are very rough, but their next version is much better [and their] developer tools are unparalleled.”

Meanwhile, Forrester’s Zetie said, Microsoft is bypassing brand-name handset makers that are already using other OSs by working directly with service providers—such as AT&T Wireless, Telefonica Céular, and Verizon Wireless—that could provide their own handsets using the Smartphone OS.

Palm OS
The Palm OS started in 1998 as an operating system for the first highly successful PDA, the Palm Pilot. Palm has recently added APIs to let the OS also work with telephones.

The 16-bit early versions of the Palm OS supported the Motorola 68000 chip series known as DragonBall. To handle today’s more demanding smartphone tasks, the recently released 32-bit Palm OS 5 was rewritten to support the more powerful and functional ARM-based processors from companies such as Intel, Motorola, and Texas Instruments.

Thus, said Albert Chu, vice president of business development for PalmSource, which develops the Palm OS, “it has the horsepower to do sophisticated multimedia and security applications.” For example, the new Palm OS supports 128-bit secure sockets layer encryption technology. In addition, it provides such capabilities as audio playback, e-mail, and instant messaging.

The Palm OS also offers better screen resolution and includes a Web browser, virtual private networking software, and a network API that supports IEEE 802.11b wireless LANs.

According to Chu, Palm OS 6, slated for release late this year, will provide additional telephony and wireless functionality, as well as multitasking, with applications running in the foreground and background without time-sharing.

Symbian OS
The Symbian OS was developed in 1998. Symbian Ltd. is owned by some of the world’s biggest handset makers: Ericsson, Motorola, Nokia, Panasonic, Psion, Samsung Electronics, Siemens, and Sony Ericsson. This gives it an edge in vendor adoption. Major programming tool vendors such as Metrowerks also support the Symbian OS.

Because the Symbian OS, unlike the Palm OS or Windows CE, was originally built for phones, said Aberdeen’s Ro, it is technically the most suitable for smart phones.

Moreover, Symbian supports video, as well as audio, e-mail, instant messaging, and multithreading. The OS also provides each program process with its own protected address space, reducing application memory conflicts and crashes.

In addition, Symbian doesn’t put its name on its OS interface, which handset vendors like because that means their names are the only ones that appear on the products.
Meanwhile, Symbian works with open standards—such as Bluetooth, Java, and SyncML—more than other smart-phone OSs.

**Linux**

Linux can be used for smart phones, but users have not adopted it significantly. One reason is that Linux technology for telephony is immature and requires double the RAM and flash memory of other OSs for full smart-phone functionality, said Rick Lehrbaum, founder and editor in chief of LinuxDevices.com, a Web site that focuses on embedded Linux.

Nonetheless, a few small Korean companies such as PalmPalm and Mizi have developed Linux-powered phones. However, Lehrbaum noted, none of the Linux vendors has the resources to attack the market on its own. They need major smart-phone handset and chip vendors to invest some money and support Linux, which hasn’t happened yet, he said.

For the first quarter of this year, according to IDC, Nokia (whose smart phones use the Symbian OS) shipped 57.3 percent of smart phones worldwide, Sony Ericsson (Symbian) shipped 11.1 percent, Motorola (Symbian) shipped 7.4 percent, Samsung (Palm OS and Symbian) shipped 5.1 percent, Handspring (Palm OS) shipped 4.1 percent, and various small companies shipped the remaining 15 percent.

IDC predicts that by 2006, Symbian OS—because of its broad industry support and use of open standards—will remain the leader with 53 percent of the market, while Microsoft—with its marketing muscle—will have 27 percent and Palm will lag behind with 10 percent.

Aberdeen’s Ro predicted that the number of phone vendors will decline sharply because the market will mature and only the solid companies will survive. In the process, he said, smart phones will continue to have more new features, such as videoconferencing.

These factors will force phone vendors to build more cost-effective and complex phones, which will demand even more of their OSs.

Because of this, smart phones and their operating systems will continue to become increasingly important.

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