Introduction

Mobile computers have become ubiquitous in the enterprise, from the warehouse floor to the boardroom. Thanks to advancements in processor speeds, reductions in cost, and the development of robust and reliable wireless local and wide-area networks, an increasing number of businesses have deployed mobile devices across a wide array of applications — warehouse management, sales force automation, field service, point of sale, and others.

Because mobile computers must, in many cases, communicate in real time with back-end business systems, the mobile operating systems (OS) on these devices play a key role in the successful integration of mobile applications with the wider corporate IT infrastructure. In the case of rugged or semi-rugged mobile devices targeted at vertical applications, the OS of choice has been Microsoft Windows CE.

However, over the past several years, new OS platform options have emerged from both Microsoft and other providers that have made the mobile operating system landscape more complicated. Since a mobile computing deployment can have significant security, productivity, and IT ramifications on the business, a careful approach to OS selection will help ensure a successful implementation and reduce the total cost of ownership (TCO) of these devices.

Microsoft Dominates the Mobile OS Landscape

To fully take advantage of the benefits of mobile computing, end users must be certain that the devices they deploy can be fully integrated with their enterprise systems, provide adequate security to protect corporate data, and do not pose a significant support challenge for the information technology department.

Because of the ubiquity of the Windows platform and the ease of integration, the bulk of purpose-built, rugged mobile devices in use today are based on Microsoft's mobile operating systems — Windows CE and Windows Mobile.

By 2012, VDC Research predicts that Windows CE will hold 58% of the market for rugged, small, form factor devices, while Windows Mobile will represent 35% of the market. Linux and Palm will account for barely 5% of the market combined.

Other options do exist. There have been rugged mobile devices based on the Palm, Symbian, and Linux operating systems, and new platforms like Google's Android could be similarly utilized. In some applications like delivery, field service, and field sales a number of companies have deployed consumer-grade smart phones running a number of different operating systems.

These less-common platforms can create support, maintenance, security, and development challenges when it comes to mobile enterprise applications. Those support issues can increase cost of ownership and erode the return on investment of these systems.

The choice of mobile OS can directly impact the TCO and performance of a mobile solution in a number of ways:

Cost — A stable, standardized OS is easier and less costly to support because IT staff are familiar with the platform, and developers can more easily create custom applications for the devices.

The more widely used operating systems benefit from a larger universe of third-party developers generating applications for those platforms. Mobile device management solutions — which allow IT staff to provision, update, and even lock-down mobile computers remotely — also do not support some of these less common operating systems. If the mobile devices cannot integrate with these existing IT asset management tools, the cost to support the solution within the enterprise increases exponentially.

Security — Mobile devices present a number of security risks, particularly when they are deployed in field service, route accounting, delivery, or sales applications. Devices that utilize wireless networks (either WAN or LAN) require additional protection to ensure that data is not compromised during wireless transmission. For applications where mobile computers are used to process credit card payments, compliance with Payment Card Industry (PCI) data security standards is critical, but may not be supported by operating systems designed for smart phones or other consumer devices. Because these devices may be lost, stolen, or damaged in the field, it is also important that they can be sufficiently locked-down so that unauthorized users are unable to access sensitive data (such as customer credit card numbers) or to remotely breach the corporate firewall.

Productivity — Because employees using mobile devices often work remotely, device downtime is a significant drag on productivity. Replacing or repairing a device deployed hundreds or even thousands of miles away from headquarters is no easy feat. A stable, reliable OS with a familiar and easy-to-use interface is key to keeping these devices running reliably and efficiently in the field.

Legacy Applications

Companies with existing mobile applications that are several years old may be running systems that are based on legacy mainframe platforms. When an organization wants to upgrade to newer mobile computers, these "green screen" apps can be a challenge, in that they are not supported by newer operating systems like Windows CE or Windows Mobile.

But because these mobile applications are often tightly integrated with a company's back-end systems, it may be too

costly to purchase or develop entirely new mobile applications to replace the existing systems.

In these cases, terminal emulation can provide a "bridge" between old and new environments. For end users with

existing mainframe-based mobile applications, they are either unwilling or unable to upgrade or modify, Windows based devices are available with terminal emulation capabilities so that these more advanced devices can still run the "dumb terminal" application. In the case of Datalogic Mobile, software developer Wavelink provides terminal emulation software via its Telnet solution, which is pre-loaded and licensed on select mobile devices.

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Rather than ripping and replacing software and business processes, companies can phase in these changes by "future proofing" their hardware. Then, when they are ready to migrate their applications to a newer platform, mobile devices are already in place that can run the new solutions.

Operating System Options

Windows CE and Windows Mobile

Microsoft's mobile operating systems (Windows CE and Windows Mobile) provide a de facto standard in rugged, enterprise mobile computing, with market penetration expected to reach 95% over the next several years. Because of this wide acceptance, these platforms provide the greatest variety of software applications and development tools. They are also less costly to support than proprietary or less-common OS platforms. Both Windows CE and Windows Mobile share a number of features — Windows Mobile is, in fact, built upon the Windows CE kernel. Where they differ is in how Microsoft and device manufacturers control the elements of the OS.

Windows CE — Windows CE was originally introduced in the mid-1990s, and currently runs on the majority of rugged mobile devices in the market today. The tailored, real-time OS is optimized for devices that have minimal available storage, and manufacturers are able to customize the presentation of the OS for their specific devices. In fact, one of the reasons the OS is so popular with vertical devices is because of the relatively small number of restrictions on the platform, as well as its low overhead.

Windows CE also offers a wide variety of configuration and application options, is supported by a large number of device manufacturers, and provides end users with a wider choice of service and solution support.

Advantages of using Windows CE include:
- Larger effective memory by combining RAM Object Store with Flash
- Built-in tools including WordPad, Excel Viewer, and Mobile Internet Explorer
- Ability to customize devices for unique user requirements
- Tailored OS minimizes space and enables greater data capacity and faster boot times

Windows Mobile — Windows Mobile includes a targeted set of APIs and user interfaces built upon Windows CE. Unlike CE, however, the elements of the Windows Mobile OS are more strictly controlled by Microsoft.

Windows Mobile provides fast access to e-mail, messaging, full phone capabilities, and other services, and includes a customizable start page. It also features the improved Mobile Internet Explorer and built-in support for services likeWindows Marketplace for Mobile (to purchase applications), Windows Live, and Microsoft My Phone for back up and syncing data via the Web. The current version of Windows Mobile 6.5 features the latest enhancements to Internet Explorer, touchscreen, and accelerometer support.

Advantages of using Windows Mobile include:
- Standard operating system components ensure ease of application portability
- Includes mobile versions of Outlook, Word, Excel, PowerPoint, and IE

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- Enhanced security through provisioning and trust levels
- Common user interface and desktop reduce training requirements

The earlier versions of Windows Mobile required device manufacturers to follow a strict set of rules for the OS presentation and the desktop. The platform was designed to present a consistent interface to end users across devices. Because of these strict rules, however, Windows Mobile was seen as less suitable for the type of vertical, rugged devices required in warehouse management and other industrial applications.

Windows 6.5, however, provides greater flexibility in configuring and restricting the devices than was possible in the past. Datalogic Mobile was the first vendor in the vertical/rugged space to release a device based on WM 6.5, the Datalogic Elf, a rugged PDA targeted at field service, sales, delivery, retail, and logistics applications that functions as a rugged bar code scanner, mobile computer, and mobile phone.

Recently, Microsoft announced Windows Phone 7, targeting consumer devices and smart phones. All software and support for hand-held terminals and rugged devices on the Windows Mobile 6.x platform was recently transferred to the Windows Embedded organization, which also manages Windows CE.

Microsoft has pledged to continue to enhance and support both Windows CE and Windows Mobile 6.x for the enterprise space as part of its long-standing commitment to the vertical device manufacturers that have traditionally made up a significant portion of its mobile OS business.

Other Platforms

In addition to Microsoft's mobile operating systems, there are several other platforms used in enterprise applications, although not always on rugged mobile devices.

Palm — The Palm OS originated on the popular PalmPilot personal digital assistant (PDA). There were rugged mobile devices released utilizing the Palm OS, but the platform's market share has steadily eroded over the past decade as Microsoft gained dominance in the hand-held space.
Now that Hewlett-Packard has acquired Palm, it is unclear whether the platform has any future in the rugged enterprise market at all. HP will likely introduce both smart phones and tablet/slate devices using the platform (Google's Linux-based Android is also under consideration for an HP tablet product).

Linux — Mobile Linux, which VDC expects to hold 4% of the mobile OS market by 2012, has gained the most traction in the rugged space thanks to its open source origins, and the fact that many enterprises have successfully transitioned their back-end business systems to Linux platforms. Mobile Linux would conceivably provide high portability of applications and increased speed to market, according to VDC. However, because multiple versions of the OS exist, the cost to integrate applications could conceivably be high. For the same reason, it might be difficult to find reliable support for applications built on any of the myriad flavors of Linux.

Android — Android is Google's open-source, Linux-based entry in the mobile OS space, and so far is primarily found on a number of high-end smart phones. At least one rugged device from a small Korean manufacturer, however, has been released using Android 1.5. Like Palm, Symbian and other platforms, Android suffers from having a relatively small base of developers and a lack of common line-of-business applications designed for the OS. This could change over the course of several years, however; while most Android devices and applications are firmly in the consumer space right now, Google announced in the first quarter of 2010 that the application market for Android was up 70% quarter over quarter.

There are other platforms as well, such as Symbian, BlackBerry, J2ME, and Apple's iPhone, but by and large these operating systems are not utilized in rugged devices.

The disadvantage to utilizing platforms like Palm or Android in vertical market applications is that there is a much smaller developer community generating new applications. The majority of mobile enterprise solutions are written for Windows. Further, mobile devices based on Linux and other platforms may not have the necessary drivers to support mobile printers, bar code scanners, RFID readers, and other devices that are common in these solutions.

Deploying a less-common mobile OS also poses a challenge for the IT department in terms of support — many IT departments are already struggling with these issues as more employees access company data on their personal smart phones. For mission-critical applications, integration and support should be as trouble-free as possible.

New platforms like Android are also relatively unstable, with new versions appearing far more frequently than is the case with mature operating systems like Windows CE. Upgrading system software multiple times per year is simply impractical in most rugged mobile applications.

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Mobile Operating Systems Comparison

Operating System	Market Share*	Pros	Cons
Windows CE	57%	Large OEM and developer community; highly customizable; memory efficient	Doesn't support common desktop applications
Windows Mobile	36%	Large developer community; common user interface; enhanced security; e-mail, SMS connectivity	More restrictions on OS; consumer-oriented functionality may be unnecessary in industrial applications
Palm	1%	Familiar user interface; established developer community	Few rugged devices available; declining market presence; targeted at consumer space
Linux	4%	Open source; growing developer community	Multiple versions of OS; presents support challenges, few vertical applications
Android	—	Open source; growing developer community	Few vertical applications; few rugged devices available; presents support challenges

*2012 market share data on rugged hand-held/PDA form factor shipments provided by VDC

CE vs. Mobile – How Do You Choose?

Although they are similar in many ways, Windows CE and Windows Mobile each have strengths that may make one platform more suitable than the other, depending on the use case. For users trying to determine which OS to choose it is important to evaluate the specific requirements of the application.

For many traditional line-of-business applications, like warehouse management, inventory management, and delivery, Windows CE provides several advantages. End users in these markets typically only need access to certain functions or specific applications, and CE allows device manufacturers to tailor mobile computers to these vertical solutions, without all of the additional bells and whistles (e-mail and Internet access, for example) available in Windows Mobile. Windows CE devices are also a better, and typically less expensive, option for environments where terminal emulation may be utilized.

For end users that may split their time between a desktop system and a mobile device (i.e., store managers or district supervisors), Windows Mobile can provide access to traditional desktop tools like Word, Excel, and PowerPoint, while providing a more consistent user interface. Windows Mobile is also optimized for devices that have both voice and data capabilities. In a retail application, for example, store managers may need to use devices that provide the look and feel of their desktop system, while store associates may use purpose-built computers for checking inventory or scanning goods during re-stocking. In field service and delivery applications, Windows CE devices would be used in situations where employees only need to access specific business applications — such as scanning items on a truck during delivery, for instance. Mobile employees that also have sales responsibilities, as in route accounting or even cable television service, may

need access to desktop applications like Outlook or Excel, or even GPS, which would make Windows Mobile the better choice. But the most compelling reason for selecting Windows Mobile for workers outside the four walls of the enter prise is the platform's support for voice services and wide-area network connectivity. Unlike CE, Windows Mobile provides

a standard phone interface, which is why the majority of field service and sales applications are developed with that operating system in mind. Because both types of users may exist within an enterprise, or even within the same application, some organizations may require devices based on both platforms. That's why Datalogic Mobile has released mobile computers based on both Windows CE and Windows Mobile. For retail and warehouse applications, the Datalogic Memor, Falcon, Skorpio, Pegaso, and Kyman are available with both operating systems. For field force applications, the Datalogic Memor, Pegaso, and Elf lines include the Windows Mobile operating system. The Datalogic Elf, a rugged, professional PDA, couples smart phone features with advanced data capture technology including 2D imaging, 1D laser scanning, RFID reading, and Green Spot visual scan confirmation capabilities. It is the only Datalogic Mobile computer offered exclusively with the Windows Mobile operating system.

Summary

Mobile computers play an increasingly important role within the enterprise, automating operations in field service, sales, warehouse management, point of sale, and other applications. While there are a variety of mobile operating systems available for these devices, for most enterprise applications that require a rugged or semi-rugged device, Microsoft's Windows CE and Windows Mobile have been the platforms of choice. Because of their stability, widely supported development tools, the large number of applications that support the Microsoft operating environment, enhanced security, and familiar user interfaces, Microsoft's mobile platforms remain the best bet for mission-critical mobile solutions.

About Datalogic Mobile

Datalogic Mobile is a global manufacturer of mobility solutions for retail applications, assisted shopping, warehouse solutions, and field-force automation. Our diverse product range of rugged mobile computers includes pocket-sized computers, pistol grip mobile computers, and industrial PDAs designed to keep workers connected to their enterprise inside or outside the four walls. Our mobile computers use Cisco® Certified CCX radios for maximum levels of: RF security, data throughput, and efficiency. Datalogic Mobile computers use the latest technologies for voice and data communications giving mobile workers on-the-go connectivity.

Datalogic Mobile is the worldwide leader in Assisted Shopping. Over 350 retail stores have implemented Datalogic Shopevolution™ software and the Datalogic Joya™ handheld pod as their assisted shopping solution. Datalogic assisted shopping gives retailers a competitive advantage while reducing their operational costs. Joya makes shopping a multimedia experience that increases consumer loyalty. Datalogic Mobile has worldwide presence in over 30 countries and over 800 business partners worldwide. A leader in technology, Datalogic has a growing portfolio of over 850 patents, eight research and development centers, and 300 engineers.

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