
The Return on Your Mobility Investment:

*Enterprise opportunities for Windows
Powered Pocket PCs and Smartphones*

April 2004

Abstract

Wireless, mobile devices are seen as tools to improve mobile workforce productivity, reduce operational costs, and increase customer satisfaction. Turning these potential benefits into a business case that justifies the expense has been a challenge for many organizations. This paper is intended to assist you in identifying and quantifying the value of these mobile devices in your organization.

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1. Introduction

There are millions of people who work outside a typical office setting. In many cases they use inefficient or costly tools and time consuming processes to collect data and complete their tasks. Mobile technology advances are converging to improve this situation. The integration of wireless connectivity, found in cell phones and pagers, with computer applications is providing a selection of new, small mobile devices that have shown promise to enhance the effectiveness of a mobile workforce.

Since 1996 when they first became available, the majority of Windows® Powered mobile devices have been used in business environments. Since the introduction of these mobile devices every dimension of mobile computing has significantly changed to enable cost-effective solutions for mobile workers. Hundreds of case studies have been published which describe mobile enterprise deployments including the associated benefits. Details of these benefits are summarized in [Appendix A](#). Organizations that deployed Pocket PCs have seen both “soft” or qualitative as well as measurable quantitative business benefits.

While Personal Digital Assistants (PDAs), such as the Pocket PC, were initially used for managing one’s calendar and contacts, users are now finding them useful for a broader range of functions such as accessing data from mission critical business systems or for voice, text, and instant messenger communications. When an enterprise identifies a potential opportunity to utilize mobile devices such as Pocket PCs or Smartphones, the formal process for gaining executive endorsement typically requires a business justification for the expenditure. While many mobile device users have found that an electronic device can be an improvement over a paper-based organizer or useful for reviewing one’s e-mail when a PC is not easily accessible, it is not easy to cost justify the expense based on this functionality alone. However, it is possible to cost justify a mobile deployment when existing enterprise systems are extended to small, wireless mobile devices or manual business processes are automated. Once a business-specific application is identified, the personal information and messaging capabilities often complement the business applications to support a more complete set of one’s daily tasks.

This paper identifies technology changes that have made mobile computing solutions more cost effective and fiscally feasible in section 2, outlines in section 3 the basic types of mobile solutions that have generated a significant return on investment (ROI), in section 4 provides examples of the quantitative and qualitative benefits organizations have already experienced from deploying mobile devices in an enterprise, section 4 also offers a financial framework to assist in analyzing the potential impact and value of specific mobile solution approaches, and identifies the steps involved in starting your own mobility project in section 5. Appendix A summarizes the quantifiable business benefits that have been documented in published case studies covering a wide range of industries and business applications. Specific examples of potential qualitative benefits are organized by industry and application type in Appendix B.*

2. Key enablers of mobile enterprise solutions

Before looking at the quantitative and qualitative benefits of mobile solutions in an enterprise it is important to highlight recent changes that help make these devices ready for enterprise work loads and merit the investment. Four industry trends are enabling mobile devices to become a mainstream tool for enterprise solutions:

- 1) **Extending enterprise systems.** Enterprises have been making their operational data available to more users. This started with mainframe-based data being accessible via a desktop PC. The

* The companies and products featured in this white paper are for information purposes only and form a guide to a subset of the products available today. Microsoft does not recommend or endorse any product or company mentioned in this paper above another.

PC also enabled broader access to new data sources including the Internet. This data can now be accessed and updated on smaller, more mobile, devices thus extending the existing infrastructure. The resulting information flows and business process streamlining is being referred to as the “Real-Time Enterprise” by consulting organizations such as [Gartner](#) and [Meta Group](#). The broadly accepted approach for PC applications in the enterprise is the client/server architecture. Many of these existing business systems are being extended through Web-based applications. Many see the next step in extending the reach of these systems is to support mobile devices. This entails adapting to smaller screen sizes and different wireless connectivity options. Pocket PCs support a large number of industry standard protocols and interfaces (e.g., 802.11b, Bluetooth, GSM/GPRS, CDMA/1xRTT, SD/MMC, CompactFlash, PCMCIA, HTML, XML, SOAP, and WAP) so they have the flexibility required to integrate with the wide range of existing enterprise systems in place today. While the architecture of the applications is changing, Windows developers are able to use a consistent set of tools and technologies. Leveraging this familiarity when developing wireless mobile enterprise solutions helps to reduce the training costs while speeding up the development time. Being the first to market with a new service can bring significant revenue opportunities.

- 2) **Wireless computing convergence.** Mobility usage started with single function devices such as cellular phone handsets, text pagers, bar code readers, walkie talkies, and Personal Digital Assistant organizers. These functions, along with business applications are becoming available in converged PDA and cell phone devices (either PDAs with an integrated phone or a cell phone with PDA software functions integrated). The Pocket PC Phone Edition provides support for a calendar, contacts, e-mail, multimedia, and business data along with a built-in phone in this PDA-sized device. Rugged Pocket PCs, ones that can withstand being dropped or exposed to water, dust, and extreme temperature ranges, are available for harsh work environments from [Intermec](#) and [Symbol Technologies](#). The Windows Powered Smartphone supports a combination of voice and data functions but in a smaller cell phone-sized device. Specific enterprise examples below provide details on how these integrated devices help to reduce the costs and decrease the complexity associated with outfitting a mobile workforce.



Figure 1. Over 30 hardware manufacturers produce Pocket PCs and Smartphones

- 3) **Higher capacity data storage media.** Devices used in business may need to store a large amount of data. Due to the advances driven by digital camera adoption, smaller cards with increasing storage volume are available for Pocket PCs and Smartphones. For example, postage stamp sized Secure Digital (SD) and Multimedia Cards (MMC) are available with up to [512 Megabytes](#) of storage. Over the next six months SD card manufacturers believe they can double that amount. Large storage capacity is key to reducing the need for costly and bulky printed material. In the mid 1990’s external Flash storage cards cost [over ten dollars per Megabyte](#) (e.g. 4MB CompactFlash card sold for about \$160 in 1996). In 2003, these same storage cards can be purchased [for less than one dollar per Megabyte](#) (e.g. The SimpleTech 512MB SD card sells for about \$350 in 2003). Ready access to up-to-the-minute data can save costs (e.g. avoid an additional customer visit), speed up business processes, and build customer trust.

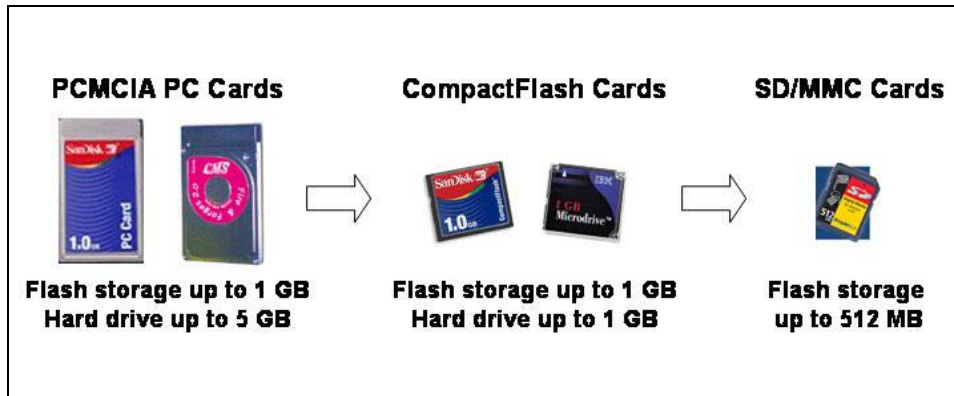


Figure 2. Storage card advances

- 4) **High speed wireless networks are available.** Wireless bandwidth is increasing for local and wide area connectivity which supports the higher data transfer demands of business applications such as e-mail with attachments, multimedia content, and Web services. Wireless operators are expanding the coverage, reliability, and data capacity in their GSM/GPRS and CDMA/1xRTT phone networks as well as adding specific data services such as wireless e-mail. Pocket PCs support these cell phone networks as well as 802.11b wireless local area network and Bluetooth personal area wireless connectivity. Some devices, such as the rugged [Intermec Pocket PC](#), incorporate Bluetooth, Local Area Network (LAN), and Wide Area Network (WAN) wireless connectivity all into one device. Wireless connectivity helps to flow information and business transactions to remote locations where it was not available before. This expands the reach of business services opening up more revenue generating opportunities.

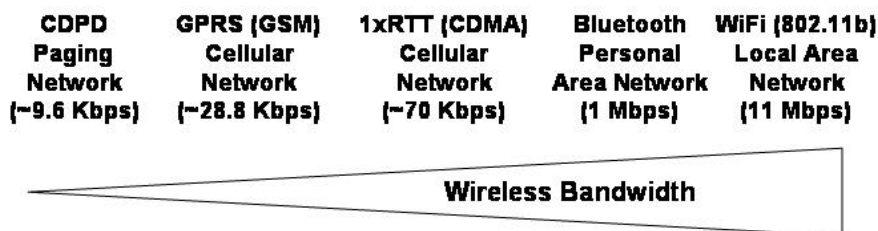


Figure 3. Increasing wireless connectivity bandwidth and options

These trends closely mirror the key enablers for high performance, networked personal computers that resulted in broad scale adoption in the office and at home. A number of workers are using wireless networks in the home to connect to systems and services at work. The PC has been credited with improving work productivity. Now this flow of information is able to affordably extend outside the office and home. As the adoption of these technologies increases, it is likely that the overall costs of each component will decrease. This, along with competition reducing costs for mobile services, provides the opportunity for a positive return on investment to occur in a shorter period of time.

3. Types of mobility solutions offering significant benefits

When evaluating where is the best place to deploy a mobile device-based solution it is important to focus on those types of mobility projects that have a high probability of making a quick and substantial return on investment for an organization. Pocket PCs are intended to complement, not replace, laptop PCs. Projects that have attempted to replace laptops with Pocket PCs have typically run into difficulty simply because only a subset of PC tasks can be accomplished on a Pocket PC. However,

there are new solutions that are enabled by Pocket PCs which increase the range of options for the mobile workforce. In fact Pocket PCs are being used by a number of mobile professionals that work outside a typical office setting and have not had a PC before. This section identifies a number of approaches that have generated significant business value as a result of a mobile enterprise solution.

Converting paper-based processes to forms-based applications

The fastest way to identify a business solution that has a high potential for a significant and quick return on investment is any process that utilizes paper for data capture. Paper is an inherently slow and inaccurate tool for collecting data. These paper processes are often coupled with key data transmitted through verbal conversations which is also error-prone and harder to track. Many enterprises that have converted a paper-based process to an electronic form-based application on a mobile device have seen data collection times reduced in the field, more accurate data flowing to central enterprise servers, and faster business reporting (see Figure 4). The very small size of the Pocket PC along with internal battery power that can support mobile workers for an entire day shift while wirelessly connected makes it capable of handling tasks that are not possible with laptop computers. Automating data capture in this way helps to reduce the overall time it takes to provide customer services. This enables more business transactions at the same staffing levels while improving overall customer satisfaction. Because errors can be so costly, in some cases error avoidance can be the vehicle for achieving a rapid return on one's mobile solution investment.

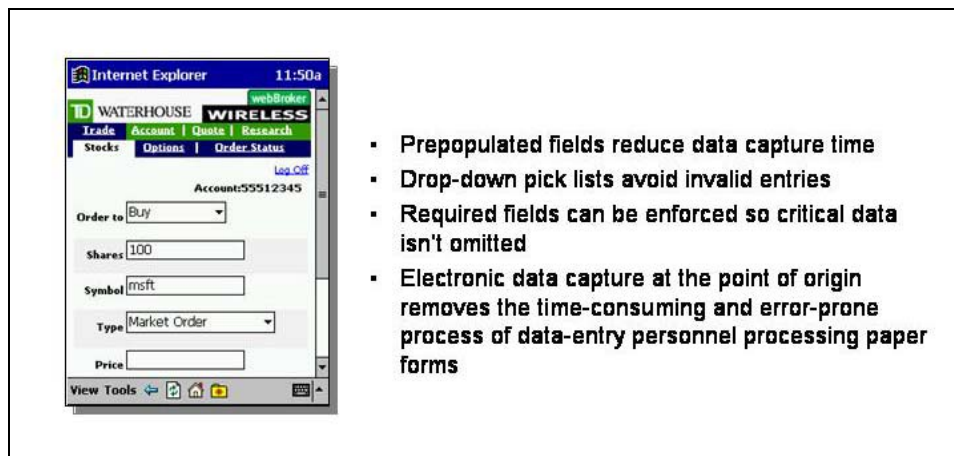


Figure 4. How electronic forms are an improvement over paper-based processes

To provide a sense of the possible benefits possible from this type of approach, these are some sample mobile solutions where enterprises replaced paper with electronic forms on Windows Powered mobile devices in support of their process reengineering efforts:

- **Reducing operational (including malpractice insurance) costs.** [Temple University Health System](#), in Philadelphia, implemented electronic applications for writing medical prescriptions, the ability to fill a patient's first prescription for commonly prescribed medications at the point of care, and an electronic medical reference guide solution in less than three months which increased the use of generic medications from 39% to 50%, reducing overall drug costs. This Pocket PC-based approach has also helped reduce malpractice insurance costs by 10% resulting in savings of approximately \$130,000 per year.
- **Increasing research grant funding while reducing transcription costs.** [Holston Medical Group](#), in Kingsport, TN, has made electronic medical records (EMR) available on Pocket PCs which has resulted in over \$2.4 million in research funding for the next three years and is expected to produce savings of \$24,000 per year/per physician by eliminating transcription costs utilizing the Allscripts TouchWorks Note software module. Small Pocket PCs fit the needs of a mobile health care provider by offering quick access to a broad range of current patient, medical, and insurance data and transactions all day long.
- **Shortening the cycle time for business transactions.** [GMAC Commercial Mortgage](#) is reducing the time it took to process commercial loans from 90 – 120 days down to 10 days or less

with a project that was completed in three months by three people. This productivity gain is being realized by process reengineering that converted a serial paper-based process to parallel tasks supported by electronic forms on a Pocket PC.

- **Reducing data collection time.** Microsoft's internal project to collect the amount of software product inventory on retail store shelves saw a 50% reduction in the time required to collect the data. This was achieved by moving from a paper-based process to an electronic form-based application with pre-populated data fields. The internal end-of-month reporting time was reduced from days to hours.
- **Improving customer response times.** Field sales people at [Egmont Entertainment](#) were able to use Pocket PCs to receive information and enter orders while at retailer outlets enabling them to visit 20% more customers per day. Automating about 50% of all orders enabled Egmont to redeploy most of their call centre staff to provide improved customer service. Egmont found the user training costs to be minimal and the mobile solution maintenance costs to be low.

Value of converting paper-based processes to electronic forms

There is a great opportunity to collect high quality and more complete data with electronic forms which also generates cost savings and new revenue possibilities. In one example, The [California Department of General Services](#) converted a paper process for managing monthly vehicle auctions to an electronic form-based process which doubled the number of vehicles sold during an auction – from about 100 on a good day in the past to 200 or more now, thereby reducing inventory and increasing revenues. These are specific areas to consider in your ROI model for cost savings when automating manual business processes.

- **Value of faster data capture.** Capturing data faster improves the productivity of a mobile workforce. Measure data capture times using mobile devices and compare this to the previous approach. It is not unusual to see a 50 percent reduction in time required to capture data associated with business transactions such as a customer purchase or an inspection. Apply this time savings to the number of times this task is done during a typical day and then calculate this for the number of people in this job role on a daily basis. In one example, The Psychosomatics department at [Uniklinik Regensburg](#), a German university hospital, has delivered a mobile solution which automates the process of delivering a psychological test improving their costly and time-consuming medical documentation process. The test reporting process that previously took around 15 to 20 minutes now is immediately available to the doctor as soon as the patient has completed the test. Costs associated with refining the clinical process through database updates have also been reduced.
- **Value of higher accuracy.** Businesses with processes that are frequently repeated may be able to associate costs or revenue opportunities with reducing bad manufacturing runs or bad business decisions. Mobile devices can prevent common breakdowns in business decisions including faulty calculations and estimates, product remanufacturing due to not catching faulty parts, delivery personnel who waste travel time going to the wrong location, and more. Mobile devices can produce higher quality data and faster reporting, which greatly reduces these common issues. Jack Gold, a Meta Group analyst, estimates that double key error rates, mistakes made when data entry personnel process paper forms, can be as high as 15 to 20%. [U.S. Customs Officers](#) use Pocket PCs when inspecting inbound aircraft and sea vessels at more than 300 international air and sea ports of entry, fighting to halt the smuggling of narcotics into the United States. Customs officials at Miami International Airport needed to make the time officers spend in the field conducting inspections more efficient while increasing the accuracy of data collected. The results including saving almost one work week per month and reducing errors by 80% through automation and digitization.
- **Value of completeness of data.** It is difficult to force required data to be collected on a paper form. But if required fields on an electronic form are not filled in, the software can prohibit the user from finishing their transaction. Incomplete forms can result in significant amounts of someone's time doing follow-up work. Examples where this can waste valuable time include pharmacies calling to clarify the details of a drug prescription, service personnel that need to return to the shop to get repair parts they didn't know would be needed, or delivery personnel that

find a key portion of the address missing while out on the road. Freeing up unproductive time can result in measurable cost savings or revenue generating work.

- **Value of removing data entry cost.** Moving away from paper as a collection mechanism for data removes the need for the data entry step. If these jobs are eliminated there is a significant cost savings. Even if this personnel is moved to other tasks this removes the need for additional employees. Either way there is a significant opportunity to reduce large costs in a business process or apply people resources to tasks that can increase revenue or customer satisfaction. The [Kudos Restaurant & Wine Bar](#) in Australia uses the FABS OrderPad application to collect orders in the dining room, with data transmitted across an internal wireless network to terminals and printers in the kitchen, cold larder and bar. The improvements in staff mobility, elimination of manual transcription, and the grouping and sorting of individual meal items for the kitchen staff has led to a reduction in staff of around 10 percent.
- **Value of increased customer satisfaction.** The Real-Time Enterprise concept is intended to provide a better customer experience. If customers are retained for longer periods of time or if new customers can be obtained more quickly or at a lower acquisition cost, each of these can be factored into an ROI equation. In the [Kudos Restaurant & Wine Bar](#) example mentioned above, the ability to advise customers of current menu and wine label availability, combined with the improved accuracy of orders, has substantially enhanced the customer experience and encouraged repeat business.
- **Value related to personnel.** Removing odious aspects of a job is a great way to improve morale. Automating time consuming, tedious tasks like filling in paper forms can result in lower employee attrition rates, lower costs to have new employees become effective, and lower costs to attract new talent. It goes without saying that providing an advanced wireless computing device sends a clear message to employees they are valued.

Upgrading custom devices

Support and maintenance costs for currently deployed MS-DOS based mobile devices are growing. These devices are used, for example, by people providing field-based services, delivering packages, and keeping track of stock on store shelves or in warehouses. Replacing these older devices with more powerful Pocket PCs may significantly reduce the overall cost of ownership and provide a more flexible platform for mobile business solutions. The cost savings associated with modernizing legacy devices and infrastructure has the potential, in some organizations, to pay for the entire project. And new Windows Powered mobile devices use rewritable memory so that system software updates can continue to extend the hardware investment. These are some of the potential areas for cost savings:

- **Lower hardware cost.** The direct replacement cost for one of these older devices and spare parts can be substantially higher than for a Windows Powered mobile device, even a ruggedized Pocket PC from companies like [Intermec](#) and [Symbol Technologies](#). Integrated wireless Pocket PCs could potentially replace a number of single purpose devices such as a cell phone, personal organizer, pager, calculator, cassette recorder, bar code reader, magnetic stripe reader, or walkie talkie. An example savings associated with upgrading mobile hardware can be seen in [Cyberonics'](#) ability to save more than \$1 million in hardware costs by using Pocket PCs in place of more expensive administrative equipment associated with their NeuroCybernetic Prosthesis (NCP) System for regulating epilepsy.

Additionally, Pocket PCs with a magstripe reader attachment and optional mobile printer attached to one's belt can be used as mobile point of sale terminals. For example, these mobile devices can assist in line busting, enabling customers to pay faster during crowded periods, and then be used for inventory management and store-to-store communications the rest of the time. This configuration is also appropriate for field service personnel to print an invoice, to collect payment, to manage inventory on the vehicle, to get driving directions, and to provide video instruction for infrequently serviced equipment. This flexibility is not typically possible with older hardware.

- **Lower software development costs.** The ongoing cost of supporting the older devices with software upgrades has the potential to be reduced by using new development tools familiar to the large PC development community. Tools and technologies for mobile solution development such as Visual Studio .NET, ASP.NET mobile controls, and the .NET Compact Framework may make

the development process more efficient due to automated code generation, visually building XML Web services, and IntelliSense® technology.

- **Lower wireless service charges.** Using newer wireless devices may also reduce wireless service charges since the new data services with higher bandwidth connections can transmit data faster and may have lower monthly fees.

An organization with older devices, which have already provided a reasonable return on their investment and are considered to be near the end of their operating life, has a great range of new Windows Powered mobile devices and wireless connectivity options from which to choose.

In some cases older devices provided a single business function by design. For organizations concerned about moving from a single function to a multi function device, it is possible to configure Pocket PCs so that nonessential applications can be locked down so employees have access only to work-related functionality. These policy management tools are available from companies such as [Symbol Technologies](#), [Odyssey Software](#), and [Trust Digital](#).

Real-time Web-based applications

Some organizations are interested in developing broad reach applications – providing information and services that are accessible on phones and PDAs which are in broad use today. Since these services may be intended for public use there is no opportunity to limit the types of mobile devices which need to be supported. The services need to be easily accessible across many different types of devices created by numerous manufacturers and built using different software platforms.

XML-based Web applications or services can be developed today that are accessible by most mobile devices. In the past, Web-based solutions required time consuming and costly manual labor to adapt the core design so that it worked on many different types of mobile devices. This was necessary because of the differing screen sizes, screen orientation, and Web technology supported by each wireless device.

To facilitate development of these types of applications, [ASP.NET mobile controls](#) (formerly known as the Microsoft® Mobile Internet Toolkit) provide an approach where a master Web page is created and maintained on a Web server as a form that automatically adjusts to match the screen size and technology of [a large number of mobile devices](#).

These server-side controls that intelligently render content for different devices enables Web-based mobile applications to be deployed faster and support a broad range of devices with no incremental development required for each specific device.

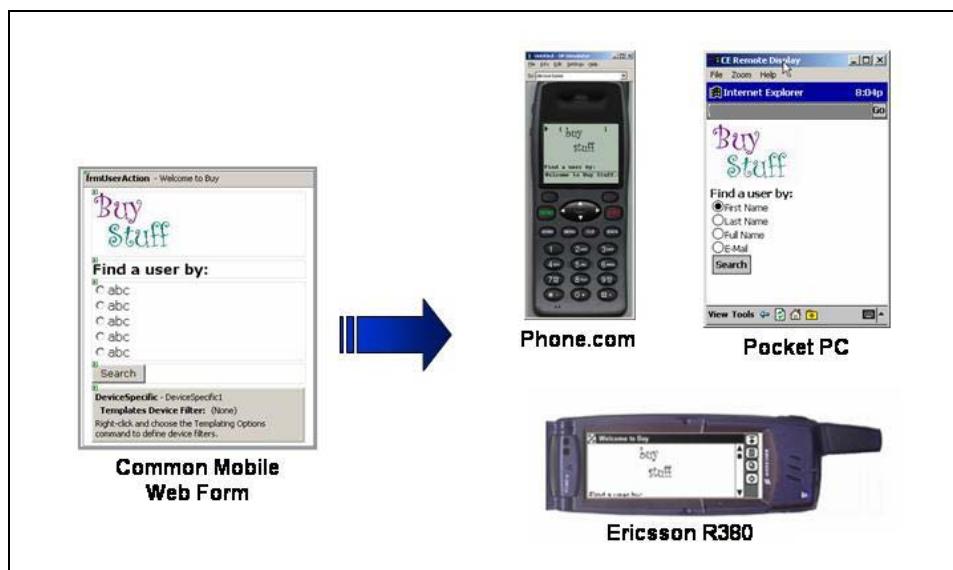


Figure 5. Sample views of a Web form created using ASP.NET mobile controls

These customers illustrate the benefits:

- **Cost effective way to open up new lines of business.** [Dollar Rent A Car](#) created a reusable XML Web services-based interface into its existing reservation system to make it available to new partners. The development costs were less than 10 percent of any proposed third-party solution, and the project was completed two to three times as fast as any external proposal. Microsoft [BizTalk](#) Server translation of reservations sent in a flat file format from tour operators into the internal business system format reduced the time required to integrate each new business partner by 75 percent – from two months down to two weeks – and did not require any modifications to the mainframe applications for each new partner. By providing partners with direct, secure access into its reservation system, Dollar was able to cost-effectively open up another sales channel that has provided millions of additional rate requests and thousands of new reservations per year, equating to millions of dollars in additional revenue.
- **Low development and maintenance costs.** [Scandinavian Airlines System](#) has delivered its first XML Web service that provides flight status information to SAS customers worldwide. The new Web site mobile device architecture enables support for a broad range of phones and PDAs from a single mobile Web Forms page. Ongoing maintenance costs are lower due to easy support for new mobile devices as they are introduced in the market since the mobile/wireless interface is completely independent from the application logic.

Intermittently connected applications

Not all mobile users have access to consistent wireless connectivity throughout their entire work day. This may be a result of physical limitations (e.g., well shielded buildings or geographic features such as mountains blocking the signal) or legal limitations (e.g. cellular phones are not allowed to be used on airplanes in flight and cellular and wireless LAN connectivity is prohibited in parts of hospitals due to concern about conflicts with patient monitoring equipment).

As a result, some mobile business solutions need to be completely self-contained on a mobile device with the capability to swap e-mail, data and business transactions when intermittently connected.

Microsoft has developed the [.NET Compact Framework](#) (CF) technology, leveraging the .NET Framework for PCs, to enable developers to quickly build applications that utilize Web services and run in a standalone mode on Windows Powered mobile devices. Database and transaction queuing technology is available, such as [SQL Server CE](#), to reliably store and forward business data and transactions each time a user is able to connect their device to an organization's network. These network connections can be done directly or can pass through a PC.

- **Shorter development time and higher performance.** [Abaco Mobile](#) is an example of a software company with extensive mobile enterprise solutions experience that is using the .NET Compact Framework to quickly extend Enterprise Resource Planning systems based on SAP's server technology. They have found this provides shorter development times and better end user performance than parallel projects done using Java technology.
- **Improved sales force productivity and enhanced customer service.** [SAP AG](#) has deployed an intermittently connected mobile sales solution. This complete mobile enterprise application provides SAP's mobile workforce with access to mySAP.com and non-SAP applications, services, and information as well as maintain personal information such as calendars and e-mail. This flexible, efficient business tool has helped SAP's field organization improve productivity and provide enhanced customer service.
- **Reduced Field Service errors.** [Xerox Global Services](#) extended their current Microsoft .NET-based asset management solution, developed to track network printers and copiers on behalf of their customers, so they would run on Windows Powered mobile devices. Much of the Asset Management workflow involves dispatching Xerox technicians to fix a problem, perform scheduled maintenance, perform supplies replenishment, or move an asset. This Pocket PC-based solution helped eliminate error-prone pencil-and-paper recording for field technicians. As a result of using this .NET CF technology, the project was completed in 2 months by 3 developers in support of a mobile user population of 5000. The project eliminated human error from duplicate data entry and reduced time to input data into system, which helped improve synchronization of data to the central database. One of the key benefits of using technology that is available on PCs as well as Pocket PCs is the developers were able to port existing code between the desktop, server and mobile device saving development time and reusing tested code. This approach

provides developers with a single environment for desktop, server, and device development reducing training time required when working with a completely new technology and tools. For this Xerox project, the .NET Compact Framework supported a single compiled program across all .NET Compact Framework devices, which eliminated the need to compile separately for each target device. SQL Server CE was used to securely store the data on the Pocket PC.

Estimates related to wireless e-mail using mobile devices

A number of ROI models have been developed to justify wireless e-mail deployments. They typically estimate the average time per day spent accessing messages on a mobile device at 10-15 minutes. It is best that each organization identify a cross section of representative work roles and experience levels to gain accurate measurements of usage time. The philosophy behind this mobile messaging scenario is that “turning downtime to uptime” by reading e-mail away from an office setting generates additional revenue for an organization. Additionally, the models perform better if the person accessing the e-mail remotely has a large salary. At least one wireless e-mail model uses not only one’s salary to calculate a financial return to the business but also places a uniform financial value on each e-mail message processed remotely to calculate a return on the mobile device investment. These models usually do not stand up to rigorous financial scrutiny since salaries are fixed costs and it may be very difficult to quantify additional revenue generated by handling e-mail during otherwise unproductive time. The challenge is identifying how the freed up time directly generates revenue to make a valid financial case.

However, many organizations that deploy wireless e-mail solutions have not done so based on rigorous financial justification. They justify the deployment expense similar to the process for providing desk phones in offices. Since e-mail has become the predominant messaging medium it is considered a core business function which is made readily available wherever one’s employees need to work. [Tim Bajarin](#), President of Creative Strategies and an analyst that has tracked mobile enterprise solutions since the early 1990’s, estimates that the ratio of e-mail to phone calls is now around 10 to 1 making e-mail the mainstream communication medium.

If you still wish to cost justify a wireless e-mail solution the general ROI model would include:

- **Infrastructure costs.** Costs associated with the hardware, wireless service, and e-mail messaging infrastructure service costs discussed above.
- **Revenue generation due to freed time.** The average time per day spent accessing wireless e-mail multiplied by the “savings” associated with a mobile employee’s salary is one approach. It may be more effective to identify the ability to complete more projects or tasks (e.g., another sales call made, document written, or product delivered) that are more directly tied to new revenue streams.
- **Time to break even.** This is the total time it takes for the new revenue stream or cost savings to cover the deployment and ongoing service costs of a mobile enterprise solution.

Notification-based solutions

Some businesses have key milestones and metrics that are monitored daily that provide employees with a view into how well the business is operating. Someone needs to be notified when these data points fall outside the acceptable operating range for the business or when a change happens to the organization. The longer the delay in responding to these issues the higher the potential cost to the business.

An automated notification-based approach can help to simplify one’s administrative tasks. In one customer example, managers used to be provided with thick paper-based reports. Out of all the raw data provided there were only a few key numbers that were actually reviewed and infrequently action was required. Reviewing the reports in this manner was time consuming. Now those key data points are being tracked in an enterprise system and alerts are sent to a manager’s Pocket PC phone only when action needs to be taken.

Windows Powered mobile devices that incorporate a phone also include the capability to send and receive Short Message Service (SMS) text messages. SMS messages can be received even if the device is powered off [Note: Powering off the device screen does not turn off the cell phone radio. The cell phone radio can be independently turned off for situations such as an airplane flight. The cell phone radio needs to be turned on for SMS messages to be received]. This provides the means for sending an alert to a person as long as they are within reach of a cell phone network. Based on the text in the message, a user may need to make a phone call, use an application located on the device, or access a Web site. This process is one example of an organization operating like a Real-Time Enterprise.

Microsoft's SQL Server database provides [Notification Services](#) that send out SMS text messages when internal database triggers have been activated. This infrastructure technology enables a new class of scalable Web applications that deliver personalized, timely information updates to a variety of mobile devices.

Some notification-based scenarios are appropriate for jobs across many industries such as new customer calls for field service or when internal assistance is required of roaming helpdesk personnel. However, the following table provides some examples of mission critical events in different specific industries which may require immediate attention:

Vertical Market	Examples of important notifications for a mobile workforce
Engineering	An elevator, farm machinery, large household appliance, or other pieces of equipment need to be serviced or approach warranty deadlines
Financial investments	Changes in the market have reached a level for purchasing or selling certain securities or financial instruments. Notification when a customer executes a trade or opens a new account. The Financial advisor could then contact customers and be proactive in understanding their needs.
Government	The Homeland security alert status level has changed, the Amber Alert system has been activated, new warrants for someone's arrest have been issued, or a crime has been reported. System that sends alerts of bridges that need inspecting due to flood and other weather conditions or due to accident damage. Parking violation devices sending alerts to police personnel can aid in consistent enforcement of parking laws as well as enable recovery of other unpaid tickets or stolen vehicles.
Healthcare	In a hospital environment this could be a patient emergency, a lab test result becomes available (especially if it is out of the normal bounds for the test), the Center for Disease Control has issued a new alert for an outbreak in some part of the world, or a prescription has expired which requires a refill
Hospitality	A manager of multiple hotel properties needs to know occupancy rates to determine advertising levels and promotions on a continual basis
Insurance	Policies that are coming up for renewal or claims that need to be investigated
Manufacturing	The raw materials on hand are not enough to satisfy the current order rate, a piece of equipment or cell controller in the manufacturing process has stopped functioning, or a supplier is unable to deliver their product on time. Alerts can also be sent when machinery or vehicles need regular scheduled maintenance, reach a warranty replacement date, or are scheduled for obsolescence.
Pharmaceutical	A participant in a drug trial needs to be notified it is time to take their medication and fill out a form

Real estate	New properties have come on the market, typically through a multiple listing service, that match a client's specifications
Retail	Inventory is low and needs to be restocked at a retail outlet or a vending machine
Sports	Immediate results transmitted from a sporting event
Transportation	An aircraft has landed that needs to be serviced, a package is available that needs to be picked up, or a ship has arrived that needs to be unloaded
Utility	A rupture has occurred in a pipeline, a generator is running low on fuel, a transformer is malfunctioning

These are two examples of mobile solutions that have been deployed which use automated notifications.

- **Real-time information for real-time decisions and more time for customers.** [Carlson Hotels Worldwide](#) has deployed a wireless system called MACH-1, which provides mobile access to critical user-selected data. Carlson has found wireless alerts to Pocket PCs provided significant improvements in real-time communication. Hotel managers now have fast access to vital information such as room availability and sales trends, enabling them to make real-time decisions that positively affect the property's financial performance. Wireless capabilities enable managers to "get out from behind the desk" to personally interact with hotel guests while retaining timely access to back-end systems.
- **Sport scores transmitted in real time.** Intermecc Pocket PCs were used to record golf scores at the 102nd [U.S. Open golf championship](#) and sent updates to the central scoring system over a wireless LAN. Within seconds of each shot, the results were posted on the leader board and available to the gallery, Web surfers, officials, TV networks and other media. This kind of solution can also accommodate notification services to subscribers.

Estimates related to timely wireless notifications or alerts

The key costs or savings associated with wireless notifications depends on the real-time nature of the communication. For people in job roles where every second counts, this approach can result in saving lives, faster decisions with a large financial impact, or improved customer service. One advantage of wireless alerts is the reduction of data one needs to review to make a key decision. If the system is looking for special business triggers, time is freed up to focus on other aspects of the business. Here are some examples where these alerts can result in quantifiable benefits:

- **Financial services.** Some investment management roles require staying abreast of changes to the market, specific securities, and specific portfolios. When certain financial thresholds are triggered a quick notification can result in a timely financial transaction.
- **Healthcare.** Hospitals or medical practices may be able to get reductions in malpractice insurance due to automated systems.

Doctors may be able to respond to prescription requests faster using lower cost generic drugs due to automated checking of a patient's insurance coverage requirements. This also reduces the costs associated with an office staff having to respond to pharmacy questions due to unclear paperwork or drugs not covered by insurance.

Emergency personnel in public safety organizations may be able to quickly get more details about a situation that improves the potential outcome. Better record keeping and advanced notification systems may enable organizations to demonstrate they are providing state of the art care reducing the opportunity for frivolous lawsuits. Avoiding one lawsuit could cover the costs of an entire mobile solution deployment.

- **Hotels.** Knowing occupancy rates in real time and getting alerts when special processes need to be activated can result in timely, accurate decisions that generate additional bookings.

- **Manufacturing.** Alerts related to inventory levels may improve the accuracy of just-in-time manufacturing processes. Cost savings would be achieved through lower storage costs, reduced rush charges for raw materials, and lower cost shipping options.

4. The business value of mobile solutions

There are many benefits enterprises have observed after deploying Pocket PCs within their organizations. Some of the benefits are quantitative and some are “soft” in that they are not easily measured. However, users clearly recognize the positive impact a mobile solution has made in their daily tasks. The net result is a strong desire never to go back to the old way of doing things. [Appendix A](#) provides numerous examples of mobile enterprise solutions and the associated business benefits for each solution.

The next two sections identify areas where an organization can measure the financial impact of mobile devices in an enterprise. These can be a combination of cost savings as well as new extensions to the business that result in additional revenue. The combination of quantitative and qualitative benefits can be compelling to key business decision makers. At a time when economic conditions are severe, identifying ways to increase productivity, decrease operational costs, improve revenue generating processes, and increase customer satisfaction provide a strong justification for technology investments.

Quantitative business value

Achieving a positive financial return on investment can be achieved a number of ways when deploying mobile business solutions. These are some of the approaches that companies have used to quantify the benefit:

Return on Investment (ROI) = Total Cost of Ownership (TCO) minus cost savings. This standard approach looks for removing costs through business process reengineering. Using different approaches to mobile solutions discussed above, costly and time consuming processes are removed or made more efficient with mobile computing technology. Below we will look at the details for calculating TCO and the areas where savings can be realized.

Lower maintenance costs. Replacing older equipment can sometimes result in lower operational or maintenance costs that can cover the cost of a project. The cost associated with older wireless services to enterprises can be significantly reduced for accessing mainframes. The costs of maintaining connectivity to legacy systems can be substantial and essentially pay for a new mobile solution in less than a year.

Reducing costly errors. Many organizations track the costs of errors and know the value of reducing a percentage of these errors. In manufacturing and supply chain management processes errors can be costly and result in poor customer satisfaction. Improving data capture, process management, and timely communications can provide a measurable decrease in errors that can be an approach for cost justifying a mobile solution deployment.

Qualitative business benefits

Enterprise mobile device deployments using the first Windows Powered mobile devices generated cost savings and improved productivity. In one example, [Hoechst Marion Roussel](#) (now part of the pharmaceutical company Aventis) deployed 1600 devices to a mobile sales force and recorded \$5 million in infrastructure cost savings over the first year as well as an automated sales process with digital signatures that enabled their sales representatives to visit an average of one more customer per day.

New capabilities, a broader choice of devices, and significant development environment improvements have accompanied each successive generation of mobile device. These enhancements have made mobile solutions more accessible to more enterprises. While some solutions have not taken the time up front to obtain base line measurements with which to compare

process improvements and cost savings, perceived benefits have been mentioned numerous times in public statements documented in mobility case studies.

This section provides a cross section of “soft” benefits, which are not easily measured, that many enterprises have identified and are experiencing through the deployment of Windows Powered mobile devices:

- **Improve efficiency and effectiveness of field sales and service personnel.** Reducing administrative overhead provides more time to focus on the core job role. Shortened business cycle times enable the existing workforce to get more work done (e.g. faster loan processing, shorter waits in store cashier lines, more customer visits per day, etc.).
- **Improve data accuracy.** Capturing data at the source can help increase the accuracy of the data used to run an organization. This can be product orders, inventory levels, pharmaceutical drug trial field data, distribution tracking lists, or real time patient data. Accurate data leads to more accurate billing to customers. Maps, charts, 3D infrastructure drawings, and aerial photos can all be more easily annotated and updated in the field for Engineering, Telecommunications, Transportation, and Utility solutions. Bar code scanners and other data capture devices help to improve data accuracy as well.
- **Deliver the right data at the right time.** Location based services can provide information or directions to key points of interest that are in close proximity to a mobile worker's location. Notification services can be triggered by changes within the business or in the broader marketplace. Faster access to more accurate operational data enables more timely and informed business decisions.
- **Turn downtime into uptime.** Providing mobile access to e-mail and other messages enables employees to utilize time that would otherwise have been wasted. While users may feel more productive, it may be hard to quantify the financial value of processing e-mail while on the go. The result can be more time for work on core business functions when back at the office or more time at home. There have been some ROI studies and white papers that try and assign a financial value to mobile e-mail. That is as hard a case to make for wireless e-mail as it is for a wired or wireless phone. The general assumption in these studies is that a company somehow achieves a cost savings, calculated as a percentage of one's salary, when downtime is utilized to process e-mail. Some of these studies have also assigned a monetary value to each and every e-mail. Applying a financial value to a message, or the same financial value to all messages, is hard to justify to an organization's top management. This is one assessment of this approach:

Message value is extremely variable and very often the value of a completed business transaction must be spread over a number of participating users and their different message types and voice calls, so that it defies such a simplistic form of analysis.

["2002: The Year of Handheld Multi-modal UC \[Unified Communication\]?", CommWeb.com, January 2, 2002](#)

- **Improve customer satisfaction.** Through faster service and timely, accurate information. Better integrated, automated services can strengthen relationships and provide financial incentives by avoiding switching costs.
- **Attract and retain top talent.** By providing access to more efficient mobile business solutions. Mobile solutions show organizational investment in the employee. These solutions make the work more desirable by reducing time spent on menial or repetitive tasks. In one example, an insurance company relied upon an extensive network of independent agents. By providing a Sales Force Automation solution on Pocket PCs, the insurance company found it easier to attract and retain these sales agents.
- **Reduce carry around bulk and weight.** Pocket PCs and Smartphones come in small packages yet can hold large amounts of data. For someone already carrying product samples and literature to leave with a customer, a small wireless device can provide a lot of benefit without a lot of bulk or weight. With integrated wireless and data functionality Pocket PCs and Smartphones may be able to replace multiple task specific devices such as a cell phone, personal organizer, pager, calculator, cassette recorder, or walkie talkie. Other examples of opportunities to eliminate document bulk and weight would include using electronic versions of PDRs for healthcare personnel, MLS books for real estate agents, and airline or train schedules for travelers.

- **Provide educational materials in more settings.** With audio, video, Flash web technology, ebooks, and text available, different forms of training and reference content can travel along with an employee. Instruction manuals for performing repairs in the field, medical information can be used for training healthcare personnel or for informing one's patient, and monthly organizational updates are all examples of educational materials that can be made available through a mobile device. The content can be carried on high capacity storage cards. In an example of communicating organization updates, Microsoft now provides monthly product and sales training materials to employees as Windows Media Player audio files that can be downloaded to a Pocket PC or Smartphone. This enables the training materials to reach more people than the old process of just using CDs.
- **Less training required.** Familiar user interface makes it easier for new mobile device users to get up and running quickly if they have prior experience with a PC. There are examples in [Appendix A](#) of companies, such as Egmont Entertainment, that found the familiarity with Windows helped to facilitate mobile device deployments in their organizations.
- **Faster development time.** Developers can leverage their existing expertise with PC development tools when building mobile solutions for Windows Powered mobile devices. For example, [Tesco](#) was able to extend their grocery store automation system to their delivery vans using rugged Pocket PCs and due to high developer productivity was able to have the mobile solution built by one developer in 8 weeks. [GMAC Commercial Mortgage](#) was able to essentially build a new business model by creating a Web-based mobile solution including Pocket PCs using 3 developers in 3 months. They expect to process \$8 billion worth of commercial mortgages through this new system.

[Appendix B](#) provides additional examples of qualitative benefits that customers have experienced in different vertical industries.

Total cost of ownership

To calculate a return on investment it is necessary to start with the overall cost. Based on the measured business results the financial benefits to the business can be compared against the total cost of ownership to determine if there was a positive ROI and when the break even point occurred.

These are the items to include when attempting to get a complete picture of the total cost of ownership associated with a mobile device-based solution:

- **Mobile device hardware.** This is the cost that is never overlooked. However, volume discounts may enable an organization to reduce this cost when a corporate standard is put in place. All Pocket PCs are required to use re-writeable "Flash Read Only Memory" so that the core operating system and device applications may be upgraded without having to replace the hardware. This can significantly reduce the costs associated with a mobile device upgrade.

There is an approach that some organizations are using that actually removes this cost from the equation. Some enterprises are using a solution model where the employee is provided with a list of "supported devices" and then the employee uses their own money to purchase their favorite mobile device. The company then deploys and maintains company specific applications on the device (with a process for deactivation should the employee leave or be terminated), provides systems management support, offers training for the business applications, and has trained helpdesk personnel to answer any questions that may arise. This approach enables the end user to not only choose the device that best meets their needs but also the flexibility to upgrade as frequently or infrequently as their personal preference desires. Should that employee leave the company, there is no question about their ability to take their personal mobile device with them. This approach is particularly attractive for organizations that cannot cost justify a mass deployment of mobile devices but wishes to gain mobility experience. This may be the case if the devices are primarily used for one's calendar, contacts, and staying on top of e-mail.

Another aspect of mobile device hardware costs are the costs associated with older custom or single-purpose mobile devices. The new Windows Powered mobile device may contain a set of functionality that replaces the need for older MS-DOS-based mobile equipment as well as single

function devices such as walkie talkies or RF Radios, pagers, cell phones, personal organizers, cassette recorders, bar code scanners, magstripe readers, Dictaphones, Point-Of-Sale terminals, calculators, and in some cases cameras. Eliminating older, single-purpose devices may also eliminate the ongoing costs those devices incur.

Jack Gold provides some independent estimates and guidelines of Total Cost of Ownership for mobile solutions in a [September 2002 report](#).

- **Peripherals.** Depending on the specific tasks of a mobile employee, there may be additional pieces of hardware that are required to complete the functionality needed for the mobile device to integrate seamlessly into the existing enterprises' infrastructure. These may include a storage card to hold reference information or a database for business applications, a wireless connectivity card (modem, Bluetooth, 802.11b wireless LAN, etc.), VGA display card for presentations, a Global Positioning System (GPS) for driving directions, a camera, a TV, or a bar code scanner. A [list of add-on hardware](#) can be found on the Microsoft Mobile Devices web site.
- **Wireless service.** When an enterprise device requires wide area network connectivity (cellular, paging, or satellite), the service charges associated with this connectivity need to be included in the overall cost equation. Some wireless operators provide a single service plan that includes both voice and data while others charge separately for voice and data services. Some wireless operators, such as Sprint and Verizon in the U.S., provide fixed prices with no limit to the amount of data that flows to and from the device. Some charge for a fixed amount of data (e.g. 5 or 10 megabytes) but add on additional costs should the user go over their limit. This specific type of wireless data plan is hard to account for in a total cost of ownership calculation given the potential variability of monthly bills.

One additional cost to consider is for Short Message Service text messaging. In different countries around the world there are service plans where additional costs are associated with each SMS message handled by a phone handset. Business models that rely on this SMS technology for sending business alerts need to factor in this cost.

- **Wireless infrastructure.** When a mobile enterprise solution is going to be deployed in environments such as warehouses, corporate campuses, hotels, or manufacturing facilities, shorter range and higher bandwidth wireless connectivity is usually required than is available in today's wide area cellular phone networks.

Wireless local area networks, often referred to as WiFi (wireless fidelity) or by its industry standard numeric designation 802.11b, and Bluetooth personal area networks primarily have fixed costs. For a wireless LAN, the first cost would be associated with the wireless access points that are distributed around a facility. Wireless LAN connectivity is integrated into some Pocket PCs such as the Toshiba e740, HP 5400 series iPAQ, and the Intermec 700. Otherwise mobile devices have expansion slots that accommodate different size wireless LAN cards. A wireless LAN can provide connectivity to a corporate network in two ways. It can either be directly connected to the Ethernet network or it can be connected to the Internet. One reason for connecting to the Internet instead of directly to the Ethernet LAN is when an additional level of security is desired using Virtual Private Network (VPN) authentication and encryption. When connected to the Internet, there are two costs to consider – the monthly service charge associated with the Internet connection and any additional costs associated with VPN connectivity such as third party software licenses. There are different protocols including PPTP and IPSec used for VPN connections. Pocket PCs all have the PPTP protocol built in. Some Pocket PC manufacturers have also added the IPSec protocol to their devices. If an organization uses VPN gateways based on the IPSec protocol and it isn't provided with the mobile device, this will incur a third party software cost.

Bluetooth connectivity is also built into some Pocket PCs such as the HP 5400 iPAQ and Intermec 700. Small Bluetooth expansion cards are available but due to technical implementation details associated with the expansion cards, they may not work with all devices. It is best to pilot test each specific hardware and wireless configuration to ensure it matches the needs of the mobile solution. Since Bluetooth is primarily intended to replace short distance wired connections, examples of costs associated with this wireless technology would be Bluetooth printer adapters, phone headsets, or access points bridging to an Ethernet LAN.

- **Business infrastructure.** All new costs associated with connecting mobile devices to an enterprises' existing infrastructure needs to be included. These would include development and software costs. The software could be resident on a mobile device or maintained on a business server and accessed through a thin client on the device (e.g., Terminal Services client or a Web browser). In addition to software supporting a mobile user's task, costs associated with synchronization, security, systems management, and data conversion software need to be included. Sometimes enterprise data is stored in specialized formats that need to be converted to a more universal format, such as XML, so that it can be easily viewed and updated on a mobile device. [BizTalk Server](#) is an example of this type of conversion software. When mobile devices connect to back end servers some client access licenses may need to be purchased.

When new mobile systems are put in place, this may be a catalyst for updating parts of existing systems that have matured. These upgrade costs may be factored in when appropriate.

- **External assistance.** Enterprises can either develop the software for mobile solutions with internal talent or outsource some or all of the solution to Systems Integrators, Industry Consultants, Solution Providers, or Independent Software Vendors. Mobile Workplace solution partners, such as [Accenture](#), [Cap Gemini Ernst & Young](#), and [HP](#), offer services for delivering mobile solutions associated with wireless e-mail, field service, and sales force automation. Costs associated with external assistance including ongoing maintenance and support functions need to be considered.
- **Training.** While training time is typically minimal when using Windows Powered mobile devices due to their similarity to the familiar Personal Computer, costs should be considered associated with developing training materials, training personnel, and any downtime while employees are receiving training.
- **Support services.** Costs associated with the ongoing support of employees also need to be included. These costs would include Help Desk personnel, internal employees or services provided by companies such as Mobile Workplace systems integrators, as well as representative equipment and training required to support end users. Over-the-air provisioning services are available for Windows Powered mobile phones from companies such as [Embrace Networks](#), [Logica](#), [SingleTap](#), and [Wireless Data Services](#). These service costs need to be considered as well.

Where to look for savings and new revenue opportunities

Once all associated costs are identified with a mobile solution, it is important to identify all areas where cost savings or new revenue opportunities may be achieved to provide a significant business justification for a mobile solution.

Many enterprises created standards for PCs in the late 1980's to improve the efficiencies related to purchase costs, hardware inventory, and internal helpdesk support. In the same way organizations can reduce costs and operate more efficiently by adopting mobility standards. Creating a list of preferred mobile device and wireless service vendors can help reduce costs with volume purchase agreements. Organizations can build on existing business partner relationships due to the selection of over 30 manufacturers offering Windows Powered mobile devices including companies such as Dell, Fujitsu, HP, Hitachi, Intermec, NEC, Samsung, Siemens, Symbol Technologies, and Toshiba. Maintaining a core set of mobile device and peripheral inventory can help replace lost, stolen, or damaged devices quickly keeping the mobile workforce in the field. And training technical support personnel on a limited set of standard devices and configurations can mean fast, accurate assistance when questions come up.

These are areas to consider when identifying areas where revenue can be increased or costs can be reduced.

- **Redundant data entry personnel.** In some cases it is possible to reduce the number of people on the payroll when their data entry role is no longer needed. This can be a substantial cost savings. However, companies have found these people can also be moved to more valuable roles such as providing customer support. This also can be cost effective since the cost of hiring, and perhaps even training, new personnel has been removed or lowered significantly.

- **Lower expansion costs.** When the productivity of an existing workforce can be substantially increased through business process reengineering improvements, less new personnel are needed reducing the costs of capturing new business. For example, if pharmaceutical sales reps were able to meet with one more customer per day on average, that could provide a substantial growth in sales revenue without the need to increase the size of the sales force. In another example, an application on a mobile device could track inventory on a truck notifying the employee when there was insufficient parts to support that day's projects thus reducing inventory management time. As a result, if a field service engineer could handle one more customer per day that would not only enable more customers to be served at the same staffing level, but more efficient service may also result in higher customer satisfaction. Integrating cross selling and up selling techniques into an automated field service process is another avenue for additional revenue.
- **Reduced error rates.** Many businesses are able to identify and track the number of business errors and their associated cost. Paper and voice-based communication is inherently slow, cumbersome, and error-prone. Collecting data and distributing it electronically using mobile devices has been seen to increase the accuracy of the data reducing error rates while increasing the responsiveness to that information. Products and services can be delivered faster and trends can be spotted faster resulting in higher quality business decisions. Before starting a pilot project, take the time to quantify the current business process. During the pilot process look for changes in the quality and timeliness of the data. Errors can result in incorrect orders, higher shipping costs, and lost customer business. By tracking errors and correcting them, businesses can realize cost savings and improve their revenue generating opportunities.
- **Lower employee costs.** This topic has two facets – acquiring and retaining top talent. Hiring new employees can be easier if they see that business processes are efficient. Reduced training costs can also be realized. Existing employees who see mobile technology investments being made that improve the quality of their work life will find it harder to leave. For some companies with a business model that relies on independent brokers or where data capture while mobile is a significant portion of the job, this can be a key differentiator for attracting and retaining the best business people possible.
- **Increase customer retention.** When sales people are knowledgeable and responsive, ongoing service or maintenance is efficient, and overall information is consistent from all touch points of a company, then customer satisfaction is high. It is important to track customer satisfaction levels before and after a mobile solution deployment since keeping existing customers is always more cost effective than acquiring new ones. Higher retention rates for existing customers should be a factor in considering the overall return on a mobility solution investment.
- **Modernize legacy infrastructure.** One key advantage of Windows Powered mobile devices is their ability to integrate into existing business systems. Software tools and technology, as evidenced by the customer examples provided in this paper, make it easy to transform data in existing data stores for easy access from a Pocket PC or Smartphone. Automating business processes and providing new mobile interfaces to business services that have traditionally been only available to PC users does provide opportunities to consider infrastructure cost savings too. However, a new mobile extension may also be the right time to consider infrastructure changes that significantly reduce operational costs. Areas to investigate include reducing the number of dedicated mobile devices one person needs to carry, reducing wireless infrastructure service charges, and reducing the costs associated with maintaining older mobile devices. Some mobile workers carry multiple devices with them that typically perform one function. Examples would include Radio Frequency handsets (walkie talkies), cell phones, bar code readers, personal data organizers, voice recorders, pagers, Global Positioning System handset, and dedicated e-mail devices. Replacing these with an integrated wireless Pocket PC or Smartphone can result in reduced equipment costs per employee, complexity, number of electrical charging systems, and overall weight. For air travelers, these factors may also result in faster a check-in process at airport security screening areas. Some mainframes are connected to older wireless communications systems that still incur large monthly service charges. Adopting a new in-building wireless network with a single cost at installation time or a lower monthly cellular voice and data service charge for one's mobile workforce may provide significant cost savings over a legacy wireless service. Mobile devices based on older operating systems such as MS-DOS, because of their highly customized nature and dated development tools, are typically more costly to purchase and

maintain than new Pocket PCs. This is one factor behind the [FedEx](#) project to replace all mobile handsets for their carriers with new Pocket PC-based devices from Motorola and a similar project at [United Parcel Service](#) working with Symbol Technologies.

5. A positive ROI starts with advanced planning

Good business results from deploying new tools are not typically accidental. When adopting any new technology, especially on a large scale, it only makes sense to manage the process closely. These recommendations will assist an organization to achieve great results out of their mobile enterprise solutions:

- **Executive support** – commitment to support a staged deployment with clear milestones (project definition and business objectives, pilot phase, deployment phase, support phase)
- Adopt **mobile device standards** (preferred hardware vendors, connectivity options and preferred wireless vendors, standard purchase process, security standards, centralized systems management policies, etc.)
- Provide **training for helpdesk** personnel before any large scale mobile device solution is rolled out
- Measure as many aspects as possible of the current work process to **create a base line** with which to assess the results of a mobile device deployment – time to collect data, amount of time it takes to complete the core job tasks, customer satisfaction levels, employee turnover rate, all hard costs associated with the entire process (all personnel including data entry personnel), amount of down time or other costs associated with errors (bad data entry, uninformed decisions, etc.)
- Measure the same metrics each quarter for at least the next two quarters to **assess the results** and continue to improve the process
- To speed solution delivery, **leverage off-the-shelf solutions** from independent software vendors that focus on your specific application or industry segment. A list of vendors is maintained on Microsoft's [enterprise solution providers](#) web site.

Many enterprises have measured positive results with their Pocket PC deployments. As the functionality associated with mobile device deployments has improved (including [add-on](#) utilities, peripherals, business applications, development tools and integration services) the opportunity to realize a positive return on one's mobile solutions investment continues to get even better. Set up your own internal mobile solutions team and start a pilot project or contact an experienced [mobility systems integrator](#) to expand the reach of your enterprise in a cost-effective way.

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Appendix A. Mobile solutions within specific vertical markets

These examples in the table below provide details associated with a number of enterprise deployments. Both quantitative and qualitative benefits are summarized from more detailed case studies that are published on the Internet.

Company	Type of Solution	Quantitative & Qualitative Benefits
Boulder County, Colorado Road Maintenance Division of the Transportation Department	Government. Using global positioning technology (GPS) and Pocket PCs to run a new road sign maintenance program	<ul style="list-style-type: none"> • Risk of liability from missing signs, incorrect signs or incorrectly placed signs has been significantly reduced • Road sign placement in the county has become extremely accurate due to this new program • Missing or incorrect signs in the field have become much easier to locate and replace • This program also results in significant labor savings for both Sign Shop and GIS (Geographical Information Systems) personnel
California Department of General Services (DGS)	Government. Process to increase the efficiency of monthly vehicle auctions that traditionally had been conducted with paper-based forms, to clear more cars and trucks out of inventory. The government of the nation's largest state uses tens of thousands of cars, trucks, and other assorted vehicles. At the end of their life cycle, these vehicles are sold off once a month.	<ul style="list-style-type: none"> • Doubled the number of vehicles sold during an auction – from about 100 on a good day in the past to 200 or more now, thereby reducing inventory and increasing revenues
Coca-Cola Bottling Company Consolidated	Manufacturing Field Service. Provide field service technicians with a mobile solution to help them repair and service tens of thousands of vending machines	<ul style="list-style-type: none"> • A flexible, highly rugged, end-to-end solution with the Symbol handheld computers, as well as a quick turnaround with its national service organization • An up-to-the-second directions anywhere on the road via satellite communications to the vehicle cradle system
Coca Cola Corporation	Manufacturing Sales Force Automation. A portable selling tool to support its field sales force – the people who go out and prospect for new locations and customers for vending machines. This solution automated the collection of information about sales calls, customers, and	<ul style="list-style-type: none"> • A \$500 handheld device supported the specific user's tasks that would have been done on a \$4000 PC. This savings was associated with over 80 salespeople. • The ability to point and click through the wizard windows of Visual CE enabled the application almost develop itself. [Visual CE is a database development tool from SYWARE, Inc. used to create this solution.]

Company	Type of Solution	Quantitative & Qualitative Benefits
	prospects.	<ul style="list-style-type: none"> • Radio buttons and drop down menus tend to be quicker to access and manipulate while mobile than working with a keyboard and mouse on a laptop • The new approach is also good for mobile worker morale
Cyberonics, Inc.	Healthcare. Uses Pocket PCs to administer their NeuroCybernetic Prosthesis (NCP) System for regulating epilepsy	<ul style="list-style-type: none"> • Annual savings of more than \$1 million in hardware for Cyberonics by avoiding more costly administrative PCs • Simpler, more portable system for clinicians and nurses that is easier to use in the confines of a doctor's office and requires less administration. • Expandable. Easy-to-expand functionality using the Windows programming environment. • Small. Slip into a coat pocket • Quick. Have instant-on capability • Storage. Holds all the data necessary for making changes in the patient's NCP device • This project needed to be done to FDA standards at the lowest possible cost: <ol style="list-style-type: none"> 1. Leverage Windows expertise. Able to use existing skills in the Win32® programming environment, which enabled this application to be built in about four months within cost guidelines. 2. Portability of code. Able to reuse the ADO components makes the data portable to a desktop version of the NCP System software. This provides the ability to create a desktop or laptop version of this application at only an incremental cost. With Palm, according to Cyberonics, every line of code is useless except for use on a Palm unit.
Delimo	Retail. Retail solution where sales staff need access to a range of business data, stock control information and product details to carry out their work efficiently	<ul style="list-style-type: none"> • The mobile device synchronizes both the data and the application (on average 20-50k) with the server and the transfer taking about 90 seconds. This centralized management approach keeps the cost of ownership below that of a networked PC. • This efficiency and speed of this Pocket PC-based solution means that business production has increased by between 10 and 12% • Previously, Delimo sales staff performed these tasks using basic bar code reading equipment. The old solution consisted of hand scanners which exchanged data between the sales team and our back office only once a day. The bar code scanner on the iPAQ accelerates data

Company	Type of Solution	Quantitative & Qualitative Benefits
		<ul style="list-style-type: none"> • collection and minimizes data input errors • The deployment is faster and cheaper because software engineers have already worked with Windows-based architectures • It was quicker and cost-effective to train the sales team to use the device because the user interface is so recognizable and easy to use
Dollar Rent A Car Systems	<p>Transportation. Created a reusable XML Web services-based interface into its legacy system to extend access to its reservation system to capitalize on new business opportunities</p>	<ul style="list-style-type: none"> • By providing partners with direct, secure access into its reservation system, Dollar was able to cost-effectively open up another sales channel that has provided millions of additional rate requests and thousands of new reservations per year, equating to millions of dollars in additional revenue • The company expects to save a significant amount in annual Global Distribution System fees, the cost associated with each reservation transaction through systems such as Sabre or Apollo • The development costs were less than 10 percent of any proposed third-party solution, and the project was completed two to three times as fast as any external proposal • BizTalk Server translation of reservations sent in a flat file format from tour operators into the internal business system format reduced the time required to integrate each new business partner by 75 percent—from two months down to two weeks—and didn't require any modifications to the mainframe applications for each new partner • Plans to consolidate two web sites, dollar.com and mobile.dollar.com, without having to add any new hardware will reduce the administrative overhead associated with maintaining two separate Web sites • Cost, reusability, and time to market benefits are identified in the published case study comparing an XML Web Service (using ASP.NET mobile controls) approach to other technical approaches (CORBA and the Internet Interoperability ORB Protocol, Java Remote Method Invocation, Distributed COM, and socket programming) [The company name in the left column is linked to the published case study or see the link in Appendix C.] • One developer created the initial working prototype in just two weeks and then was able to build a complete solution in just 30 days that supported all common mobile devices • The reservation interface XML Web Service has already been re-used four more times,

Company	Type of Solution	Quantitative & Qualitative Benefits
		each time extending Dollar's market reach with very little additional effort
Eagle Rock Distributing Company	Manufacturing – Direct Store Delivery – Sales Force Automation. A direct store delivery solution for a beer distributor that equipped its account managers with Pocket PCs so they can have exact customer account and inventory information when they visit a store, tavern, restaurant, or other outlet for their products	<ul style="list-style-type: none"> • Eagle Rock replaced its pen-based tablet devices with Pocket PCs that cost about 80 percent less • The SQL Server CE remote data access synchronization approach enables users to connect via modem, network, or cell phones to transfer data back and forth across the Internet to wherever they are in the field • Real time data provides Eagle Rock account managers with the ability to more precisely meet customer needs • The .NET Compact Framework was used to apply the knowledge internal developers had gained from developing for desktop PCs when doing new Pocket PC solutions.
Egmont Entertainment	Retail and Distribution. Field sales people at Scandinavia's leading distributor of films for cinema, TV and video as well as electronic games receive information and enter orders whilst at retailer outlets	<ul style="list-style-type: none"> • 20% more customers/day. Faster, more efficient ordering processes means the sales force can now take this improved service to 20% more retail outlets per day • 50% of orders will now be automated, therefore lowering operating costs. By cutting down on data entry through the call centre by 50%, we can redeploy most of our call centre staff to improve our customer service • Higher quality sales visits • Maintenance is low and training costs are minimal
Eisenmann	Manufacturing. Replaced paper and pager. Needed maintenance staff to repair and install machinery and equipment more efficiently on the factory floor. Previously the company used pager technology to alert engineers about faults and paper-based processes to administer fault finding and business reporting. The system was slow and not cost effective. Incorporating new technologies such as 'push' data and infrared location finding, the system locates the nearest engineer to the job, and sends an alert to summon the engineer.	<ul style="list-style-type: none"> • Cuts downtime in the car painting line by up to 50 percent • Boosts maintenance staff productivity by 100 per cent: Until now, we always used two employees for this kind of maintenance work, one at the switch cabinet and one carrying out the control directly at the machine. Now we only need one • Push technology and infrared location identification keeps employees connected to critical information. • Faster maintenance and fault repair system improves overall productivity • Reduces costs in testing installations and maintenance work
Emery Forwarding (business unit of Menlo	Distribution/Transportation. A package pickup and delivery system. When Emery drivers pick up or drop	<ul style="list-style-type: none"> • The BizTalk Server solution was projected to provide a 102 percent return on investment • The Pocket PC was projected to provide

Company	Type of Solution	Quantitative & Qualitative Benefits
Menlo Worldwide Technologies)	<p>Emery drivers pick up or drop off a shipment at a customer site, they either enter the shipment information or get a customer signature. The Pocket PC wirelessly transmits a message to the mainframe system, which then feeds the message into the event notification system driven by BizTalk Server. Upon receipt of that message, the event notification system generates an e-mail message or page to notify the customer in real time.</p>	<p>almost 151 percent return on investment.</p> <ul style="list-style-type: none"> • The estimated payback for the implementation was 4.2 months • Familiar Windows development environment led to fast time to market: From concept to a fully functional prototype in just three weeks
Enning GmbH	<p>Utilities/Engineering. Engineers collecting electronic pipe infrastructure information while in the field</p>	<ul style="list-style-type: none"> • The mobile pipe design application works similar to its PC counterpart making it easy to use and is compatible with almost any 3D design package reducing process time to 1 hour. Before this mobile solution was in place, using paper based data collection took too long, creating accurate pen and paper sketches was difficult especially when working in a remote location, and the process of manually inputting all the collected data slowed the job down considerably meaning that a simple repair job could take up to 8 hours. • The paper-based system was prone to human errors. Unlike manual drawings the electronic procedure regulates style and content of drawings to company standards, improving quality and consistency. • A low cost, scaleable tool compatible with the rest of the infrastructure
GMAC Commercial Mortgage	<p>Financial Services. Complete Web-based workspace for commercial loan origination called MortgageRamp</p>	<ul style="list-style-type: none"> • Reduced sales cycle time. With a traditional commercial loan, all the information-gathering done in the field—by inspectors, appraisers, engineers—took a lot of time. MortgageRamp has revolutionized the commercial mortgage lending cycle, accelerating the turn-around time of commercial loan processing from an average of 90 to 120 days, to 10 days or less. • Three people were able to build this new business channel in three months.
Holston Medical Group	<p>Healthcare Provider. Electronic medical record (EMR) solution based on Allscripts' technology</p>	<ul style="list-style-type: none"> • Expected savings of \$24,000 per year/per physician by eliminating transcription costs utilizing the TouchWorks Note module • More than \$2.4 million over next three years in additional research funding • Decreased variance in care

Company	Type of Solution	Quantitative & Qualitative Benefits
		<ul style="list-style-type: none"> • Improved chart organization • Enhanced patient inquiry and outcome analysis • Ability to control redundant procedures, something that cannot be monitored in a manual paper-based process • Ability to search on clinical data has far-reaching implications for clinical research, speeding new forms of treatment to the market
Kudos Restaurant & Wine Bar in Hawthorn, Victoria, Australia	Hospitality. Restaurant staff use the FABS OrderPad application to collect orders in the dining room, with data transmitted across an internal wireless network to terminals and printers in the kitchen, cold larder and bar	<ul style="list-style-type: none"> • Improvements in staff mobility, the elimination of manual transcription, and the grouping and sorting of individual meal items for the kitchen staff has led to a reduction in staff of around 10 percent. • The ability to advise customers of current menu and wine label availability, combined with the improved accuracy of orders, has substantially enhanced the customer experience and encouraged repeat business. • Data interpretation and transcription accuracy has improved by 20 percent, further eliminating the cost of these errors on turnover • OrderPad improved order accuracy enough that the typical two percent loss of a restaurant's weekly turnover through mistakes was virtually eliminated • Orders are not waiter-dependant any more, as each Pocket PC has access to ordering history of all tables: any available waiter can service a table as the need arises • When people want to pay their bill, the calculation is already done avoiding the time consuming process of combining the food docket with the bar tab
Montgomery County, Maryland Department of Police (MCPD)	Government Public Safety. As part of a consent decree with the U.S. Department of Justice, traffic stop data is collected by officers on Pocket PCs and downloaded to a central data base to track information related to racial profiling concerns	<ul style="list-style-type: none"> • 1,130 personnel were trained in the operation of the Pocket PC and Traffic Stop application within a 45-day period • Systems tests have downloaded over 450 records from locations throughout the county within a 4-minute period, significantly faster than entering the equivalent data from paper forms (In the first 45 days of operation over 11,000 traffic stops were successfully recorded in the main database) • MCPD chose the Pocket PC after an evaluation due to it being the most cost-effective, efficient and accurate method to collect the data • The Pocket PC provided greater flexibility and more memory than alternative approaches in developing sophisticated applications that can

Company	Type of Solution	Quantitative & Qualitative Benefits
		interface with existing desktop applications
National Express	Transportation. UK rail network train ticketing system with software modules for ticketing, fare enquiries, timetable enquiries, accountancy and ticket formatting to be used by on-train staff	<ul style="list-style-type: none"> • More than 100 million ticket types and combinations can be stored on the device • Ticketing and timetable data is up to date • Simple user interface for non-technical users with a touch sensitive display to support a wide range of options • Small, light and extremely portable solution • Ticket issuing is fast and efficient and the new solution makes it easier for staff to serve customers • Reduces fraud through use of stolen or otherwise unacceptable credit • Greatly reduces sale of the wrong ticket or mispricing tickets
Ray & Berndtson	Human Resources. Executive search professionals where much of their work involves checking e-mail and using a custom contact management system that tracks more than 300,000 candidates–tasks	<ul style="list-style-type: none"> • It was estimated that about \$800,000 would need to be spent to replace high-end laptops. Compaq iPAQs with Compact Flash modems and network-ready PCs were purchased instead and provided to representatives to install in their homes or offices. This approach resulted in a decrease of about 50 percent from the capital acquisition budget. • Laptop conversion. Size/weight, boot-up times, and cost issues were addressed by Pocket PCs • A high level of integration and synchronization with the enterprise, easy-to-learn development tools, and economical wireless capabilities
San Jose Medical Group	Healthcare Provider. Deployed the Allscripts TouchWorks Prescription module to help manage prescription complexity for patients who have insurance coverage from many different providers, each one of which has its own practice guidelines and prescription drug formulary	<ul style="list-style-type: none"> • TouchWorks on the Pocket PC has enabled SJMG to realize a 2 to 3 percent cost savings on first-fill prescriptions • Was able to save more than \$60,000 in the first full year of operation. Those savings arose from increased compliance with provider formularies, decreased phone calls about noncompliant prescriptions, and increased use of suggested generic medications • TouchWorks does away with all the waiting, all the callbacks, all the tracking down, and all the uncertainty • Not only can a physician determine which medications are approved for use under that patient's plan, but he or she also will be notified if a particular medication has a contraindication. The physician can see if the drug is inappropriate for a patient based on prior adverse reactions, medical condition, or potential interactions with a medication prescribed by another physician in the practice

Company	Type of Solution	Quantitative & Qualitative Benefits
		<ul style="list-style-type: none"> • Our patients recognize that this technology helps eliminate the chance of an error occurring. This makes patients feel safer and helps our physicians ensure that we are delivering the highest level of care.
Singapore's National University Hospital's (NUH) Accident & Emergency Ward (A&E) Emergency Medicine Department (EMD)	<p>Healthcare Provider. Information retrieval and test-ordering system extending the use of their wireless LAN. This system enables the health care personnel to search and retrieve patient records, order tests, and allocate costs for each test to the appropriate department</p>	<ul style="list-style-type: none"> • Not having to wait for a patient's record to be retrieved manually can add up to each doctor saving around 20 minutes per shift • Pocket PC mobile solution also reduces error by eliminating the need for handwritten instructions (mistakes are always a possibility when one person has to decipher another person's handwriting) • By putting the medical charges where they belong, we can reflect the true financial picture of the Department • View publicly available products such as PEPID (a downloadable clinical database) where ever they are saving time normally spent poring over medical references in their office
Swire Beverages (holding company of Swire Coca-Cola HK Limited)	<p>Manufacturing Direct Store Delivery. A mobile computing solution to empower its sales representatives, who travel frequently visiting customers, to perform critical ordering tasks and access the corporate network while on the road. An application extension has integrated Microsoft BizTalk Server, Microsoft SQL Server and SMS gateway via web services so that sales representatives can receive important alerts and synchronize their sales and operational information and reports.</p>	<ul style="list-style-type: none"> • Their EOS (Electronic Order System) completely opens up access to the corporate data for all its sales representatives, without compromising security • Instead of being mobile but out of touch, or deskbound, our sales representatives can concentrate on generating more sales wherever they need to be, and still have access to all the information they require • The new system has also opened up many possibilities for extending functionality further down the road • With access of customer database at any time, the sales representatives are able to update their customer information effectively and provide better services to the customers, while eliminating multiple data input in the back office • Extending and mobilizing EOS on the Pocket PC has been straightforward, owing to the ease of developing custom applications using Visual Studio
Temple University Health System	<p>Healthcare Provider. Electronic medication prescribing application, electronic medical reference guide, and Allscripts FirstFill solution with this implementation completed in less than three months</p>	<ul style="list-style-type: none"> • Increased use of generic medications from 39% to 50% reducing overall drug costs • Reduced malpractice insurance costs by 10% resulting in savings of approximately \$130,000 per year • Improved quality of care provided • Improves the quality of information the health care professionals receive by having an

Company	Type of Solution	Quantitative & Qualitative Benefits
		information device available to them all the time
U.S. Customs	Government. Officers inspect inbound aircraft and sea vessels at more than 300 international air and sea ports of entry, fighting to halt the smuggling of narcotics into the United States. Customs officials at Miami International Airport needed to make the time officers spend in the field conducting inspections more efficient while increasing the accuracy of data collected.	<ul style="list-style-type: none"> • Saves up to 9 hours in a 24 hour period resulting from streamlined data capture and reporting • Saves almost one work week per month by automating most of the report process • Reduces errors by 80% through automation and digitization • Better-informed, more timely decisions and quicker action resulting from access to critical information • Increased efficiency and productivity • All-in-one device helps improve coordination and communication • Lower development costs and increased developer productivity
Uniklinik Regensburg	Healthcare Provider. The Psychosomatics department at this German university hospital has delivered a mobile solution which automates the process of delivering a psychological test improving their costly and time-consuming medical documentation process	<ul style="list-style-type: none"> • The test reporting process that previously took around 15 to 20 minutes now is immediately available to the doctor as soon as the patient has completed the test • Reduces costs: Costs associated with refining the clinical process through database updates has been reduced • Optimizes workflow: At any time, the hospital staff knows which patients are waiting to be treated and what their location is saving time trying to track down patients; Less time is spent on paperwork; And the quality of the documentation has improved • Enhances patient privacy: Pocket PCs directly saving sensitive patient information to a database offers a more private test atmosphere in the patient's room, which paper forms are unable to provide
WHSmith	Retail. Point of sale solution using Pocket PC with integrated barcode scanner and a belt mounted printer to drastically reduce in-store queuing times and to discourage people from leaving the stores in frustration	<ul style="list-style-type: none"> • On average the solution has cut transaction time at the checkouts by 50 per cent • Between 6 and 12 percent more customers came through the queue busting process than on traditional tills, with an overall customer conversion rate increase of 1 per cent • The Pocket PC also provides up-sell opportunities. For example, whenever greetings cards are sold, staff are prompted to remind customers to purchase a stamp. In this instance stamp sales were up by 10 per cent • Flexibility of solution reduces queue times, increases customer satisfaction

Company	Type of Solution	Quantitative & Qualitative Benefits
		<ul style="list-style-type: none"> • More information available at point of purchase • Secure transactions across wireless LAN, scalable to future IT infrastructures • As a result of the Pocket PC using the Windows platform, it integrated well with the existing EPoS point-of-sale system while offering the scalability need for future developments. • Off the shelf application enabled faster implementation • Intuitive, easy to use interface reduces staff training times to under two hours - which is ideal for part-time employees

Appendix B. Qualitative benefits for specific industries or job roles

These are qualitative, or soft, benefits that customers have identified which apply to specific vertical industries or job roles:

Customer service and sales

- Increases staff efficiency and customer service by providing access to the latest organizational information including reporting structures, product information, and inventory levels
- Provides ability to obtain a customer signature closing a deal or signaling the end of a project which immediately generates a well documented invoice
- Stylish device telegraphs corporate image
- In some countries, complete project documentation including the customer's signature on the final invoice are required before a client has to pay for the project. In some cases the paperwork is not complete and clients are not obliged to pay. Automating the process of documenting a project and capturing an electronic signature at completion can result in more complete and faster billing processes.

Education

- Enables new types of educational applications and learning tools such as student collaboration in the classroom
- Large data storage of electronic textbooks, student records, and reference materials eliminating carry around bulk and weight

Financial

- Real time processing of financial applications, Shorter loan processing times
- Enable financial services professionals to stay current while on the road by receiving notifications of specific market conditions and advisories that are posted on the news wires
- Greater convenience for banking customers

Healthcare

- Enables statistical analysis for planning improvements in business processes (health care procedures, sales initiatives, pharmaceutical detailing approaches, etc.)
- Improved health care procedures and better availability of information where needed (e.g., more convenient way to have quick access to the PDR and other medical reference documents)
- Electronic devices more appealing than paper based diaries for pharmaceutical trial participants
- Remotely access corporate server-based applications using Terminal Services to maintain data security for sensitive patient information

Hospitality

- Wireless transfer of food and drink orders to different locations (i.e., kitchen and bar) reduces travel time for employees thus enabling restaurant staff to handle more customers while achieving high customer satisfaction levels. This immediate data transfer between server and kitchen staff can also result in faster table turns.
- Up-to-minute reporting of rooms that have been cleaned for new guests
- Clients that have arrived and can be checked in at the curb increasing customer satisfaction

Manufacturing

- Accurate, up-to-date centralized data for reliable market analysis

- Data input quality improved with integrated bar code scanning
- More real time data available to improve job scheduling while reducing overruns

News

- The faster a report can be sent into an editor using a Pocket PC phone the faster news can be published providing a competitive edge over traditional communication and connectivity options in the field.
- High quality digital audio can be captured by journalists working in the field using Pocket PCs so that their reports match broadcast quality standards. This helps to replace a specialized single-purpose device.

Real Estate

- More efficient approach to having quick access to the latest inventory in Multiple Listing Services integrated with driving directions and client communication via e-mail or instant messaging

Retail & Distribution

- Real time monitoring of buying trends
- Call handling, job allocation, and stock control all from the same device
- Faster monitoring of the inventory on retailer shelves as well as visual pictures of the shelves and end caps
- Increased efficiency through location based services for drivers (directions, nearest printing/faxing facility, nearby services for food, gas, etc., and relevant traffic conditions)
- Wireless orders immediately transmitted for same day delivery
- Real time view of where fleet vehicles are located
- Data input quality improved with integrated bar code scanning

Solution development

- Easier to leverage existing Windows development expertise
- Remotely access corporate server-based applications using Terminal Services reducing development costs and software distribution overhead while maintaining data security
- Easily integrates with existing business systems using format translation with [BizTalk](#) Server

Utilities

- Meter readings are faster and paper work is eliminated

Appendix C. Web links for more information

Throughout this paper there is underlined text which is linked to Web sites that provide more detailed information for a topic. This is a list of those links in alphabetical order by topic.

- **.NET Compact Framework** for Web Services infrastructure on mobile devices:
<http://msdn.microsoft.com/vstudio/device/compactfx.asp>
- **Abaco Mobile** Enterprise Resource Planning solution provider:
<http://www.abacomobile.com/products/mobile.html>
- **Accenture** systems integrator offering Mobile Workplace solutions:
http://www.accenture.com/xd/xd.asp?it=enweb&xd=industries%5Ccommunications%5Cwireless%5Ccomm_wireless_micro.xml
- **Add-on** utilities, peripherals, business applications, development tools and integration services for Windows Powered mobile devices:
<http://www.microsoft.com/mobile/enterprise/solutionproviders/>
- **ASP.NET mobile controls** development toolkit:
<http://msdn.microsoft.com/vstudio/device/mobilecontrols/default.asp>
- **ASP.NET mobile controls** list of supported devices:
<http://msdn.microsoft.com/vstudio/device/mobilecontrols/devices.asp>
- **Cap Gemini Ernst & Young** systems integrator offering Mobile Workplace solutions:
<http://www.cgey.com/solutions/adi/mcommerce/ms.shtml>
- Case study - **Boulder County, Colorado Road Maintenance Division** of the Transportation Department: <http://www.esri.com/news/arcnews/winter0102articles/boulder-cnty.html>
- Case study - **California Department of General Services (DGS)**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13423>
- Case study - **Carlson Hotels Worldwide**:
<http://www.microsoft.com/resources/casestudies/CaseStudy.asp?CaseStudyID=13374>
- Case study - **Coca Cola Corporation**:
http://www.mobileplanet.com/askexperts/solutions/syware_case10.asp
- Case study - **Coca-Cola Bottling Company Consolidated**:
http://www.symbol.com/news/pressreleases/pr_ret_coke.html
- Case study - **Cyberonics, Inc.**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13313>
- Case study - **Delimo**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13152>
- Case study - **Dollar Rent A Car**:
<http://www.microsoft.com/resources/casestudies/CaseStudy.asp?CaseStudyID=11626>
- Case study - **Eagle Rock Distributing Company**:
<http://www.microsoft.com/resources/casestudies/CaseStudy.asp?CaseStudyID=13403>
- Case study - **Egmont Entertainment**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13322>
- Case study - **Eisenmann**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13299>
- Case study - **Emery Forwarding** (business unit of Menlo Worldwide Technologies):
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13455>
- Case study - **Enning GmbH**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13095>
- Case study - **Federal Express**: http://www.businesswire.com/cgi-bin/fdx-cnn-storydisplay.cgi?story=/www/bw/webbox/bw.112602/223302301.htm&textcolor=#000000&bgcolor=#FFFFFF&linkcolor=#004988&vlinkcolor=#003A12&alinkcolor=#FF0000&target=_top&pre=0&strip=1&nohrule=1¬imestamp=1
- Case study - **GMAC Commercial Mortgage**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13371>

- Case study - **Hoechst Marion Roussel**:
http://www.mobileplanet.com/askexperts/solutions/mcs_sales_case4.asp
- Case study - **Holston Medical Group**: http://www.allscripts.com/ahcs/sol_testimonials2.htm#2
- Case study - **Kudos Restaurant & Wine Bar**:
<http://www.microsoft.com/australia/business/casestudy/studies/kudos.asp>
- Case study - **Montgomery County, Maryland Department of Police (MCPD)**:
<http://www.pocketpcmag.com/Mar01/profiling.stm>
- Case study - **National Express**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13428>
- Case study - **Ray & Berndtson**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13303>
- Case study - **San Jose Medical Group**:
https://www.allscripts.com/ahcs/news_2.asp?S=1091&ID=1
- Case study - **SAP AG**: http://www.compaq.com/newsroom/emeawireless/mySAP_story.html
- Case study - **Scandinavian Airlines System**:
<http://www.microsoft.com/resources/casestudies/CaseStudy.asp?CaseStudyID=12020>
- Case study - **Singapore's National University Hospital's (NUH) Accident & Emergency Ward (A&E) Emergency Medicine Department (EMD)**: <http://www.mshk.com/crp/crpdoc/nuh.doc>
- Case study - **Swire Beverages** (holding company of Swire Coca-Cola HK Limited):
<http://www.microsoft.com/hk/SIA/search2.asp?CaseID=148>
- Case study - **Temple University Health System**:
http://www.allscripts.com/ahcs/sol_testimonials2.htm#1
- Case study - **Tesco**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13394>
- Case study - **U.S. Customs**:
<http://www.microsoft.com/resources/casestudies/casestudy.asp?casestudyid=13634>
- Case study - **U.S. Open golf championship**:
<http://home.intermec.com/eprise/main/Intermec/Content/About/getCaseStudy?section=about&ArticleID=272>
<http://home.intermec.com/eprise/main/Intermec/Content/About/getCaseStudy?section=about&ArticleID=272>
- Case study - **Uniklinik Regensburg**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13198>
- Case study - **United Parcel Service**:
<http://www.computerworld.com/mobiletopics/mobile/story/0,10801,70133,00.html>
- Case study - **WHSmith**:
<http://www.microsoft.com/uk/casestudies/caseStudy.asp?CaseStudyID=584>
- Case study - **Xerox Global Services**:
<http://www.microsoft.com/mobile/enterprise/casestudies/CaseStudy.asp?CaseStudyID=13400>
- Cost of **storage example** from the 1990's: <http://news.com.com/2100-1001-244936.html?tag=bplst>
- Cost of **storage example** from today:
http://www.simpletech.com/upgrade_navigator/?ProfileID=330&upnav=part.php&&PartNumber=STI-USBMD/512
- **Embrace Networks** over-the-air provisioning offering: <http://www.embracenetworks.com/>
- **Gartner** industry analyst firm: <http://www4.gartner.com/pages/story.php.id.2632.s.8.jsp>
- **HP Services** systems integrator offering Mobile Workplace solutions:
<http://www.hp.com/hps/sol/provider/mob/ms.htm>
- **Intermec** rugged Pocket PCs:
http://home.intermec.com/eprise/main/Intermec/Content/Products/Products_ShowDetail?section=Products&Product=CMPTR700COLOR&Category=CMPTR&Family=CMPTR2
- **Jack Gold** mobile industry analyst **Total Cost of Ownership report**:
<http://techupdate.zdnet.com/techupdate/stories/main/0,14179,2879286-2,00.html>
- List of **add-on hardware** for Windows Powered mobile devices:
<http://www.microsoft.com/mobile/enterprise/solutionproviders>
- List of **enterprise solution providers** with mobile device expertise:
<http://www.microsoft.com/mobile/enterprise/solutionproviders/>

- **Logica** over-the-air provisioning offering:
http://www.logica.com/company_info/news/press_releases/press_releases.asp?display=detail&id=401&page=9&sec=0&exp=0&loc=0&lan=0
- **Meta Group** industry analyst firm: <http://www.metagroup.com/cgi-bin/inetcgi/jsp/displayArticle.do?oid=33321>
- Microsoft **BizTalk Server** for legacy data translation: <http://www.microsoft.com/biztalk/default.asp>
- Microsoft **SQL Server Notification Services**: <http://www.microsoft.com/sql/ns/default.asp>
- **Mobility systems integrators** participating in the Mobile Workplace program:
<http://www.microsoft.com/mobile/enterprise/MobileWorkplace>
- **Odyssey Software** policy management tool: <http://www.odysseysoftware.com/products.html>
- Paper **analyzing ROI modelling tools** - "2002: The Year of Handheld Multi-modal UC [Unified Communication]?" : <http://www.commweb.com/article/COM20020102S0001>
- **SimpleTech** example of high capacity, small SD storage cards:
<http://www.simpletech.com/products/consumer/minidrive/index.php>
- **SingleTap** over-the-air provisioning offering: <http://www.singletap.com/solutions/mobileCat.html>
- **SQL Server CE** database for mobile devices: <http://www.microsoft.com/sql/CE/default.asp>
- **Symbol Technologies** rugged Pocket PCs:
http://www.symbol.com/products/mobile_computers/mobile_ce_ppt2700.html
- **Tim Bjarin** mobile industry analyst: <http://www.creativestrategies.com/president.htm>
- **Trust Digital** policy management tool: <http://www.trustedigital.com/enterpriseed.htm>
- **Wireless Data Services** over-the-air provisioning offering:
<http://www.wdsglobal.com/mywds/m2m.asp>

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