

The logo graphic consists of several overlapping, light blue curved lines that form a stylized, abstract shape resembling a lowercase 'i' or a similar character. The lines are thin and have a slight gradient, giving it a sense of motion or depth.

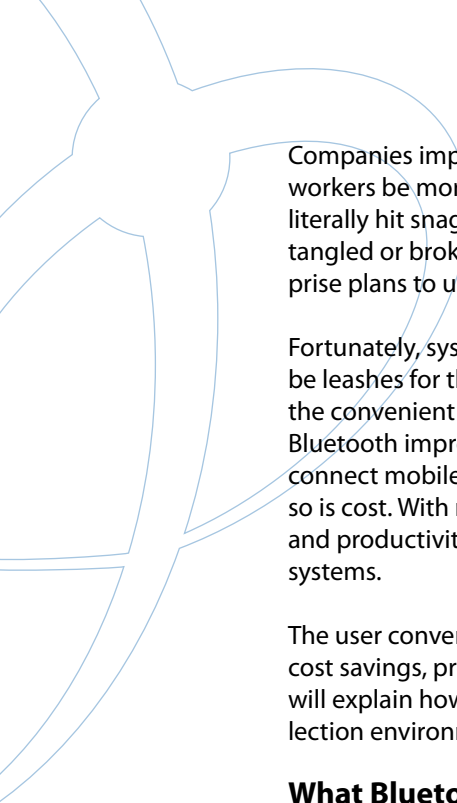
Intermec



White
Paper

**BENEFITING FROM BLUETOOTH
IN ENTERPRISE MOBILE
COMPUTING ENVIRONMENTS**

Intermec



Companies implement mobile computers, scanners, printers and other peripherals to help their workers be more mobile, productive and accurate. Unfortunately, many of these deployments literally hit snags when cables that connect mobile computers to peripherals become caught, tangled or broken. Cables and interface ports can become a constraint for users, and for enterprise plans to upgrade and enhance the application with new peripherals in the future.

Fortunately, systems that help information flow freely throughout the enterprise don't have to be leashes for the workers who use them. Bluetooth® wireless connectivity has proven itself as the convenient complement that provides true mobility in enterprise computing applications. Bluetooth improves safety and convenience in mobile environments by eliminating cables that connect mobile computers, scanners, printers and other peripherals. When cables are removed, so is cost. With no cables or connectors to wear or break, Bluetooth interfaces improve uptime and productivity, and reduce the lifetime total cost of ownership (TCO) for mobile computing systems.

The user convenience, flexibility and improved safety of cable-free operations is obvious. The cost savings, productivity gains and long-term system benefits are surprising. This white paper will explain how to take advantage of Bluetooth in enterprise mobile computing and data collection environments and the benefits to doing so.

What Bluetooth Is – and Is Not

Bluetooth is a low power, short range, wireless radio frequency (RF) communications technology. Range is typically from 30 to 300 feet (10 to 100 meters), depending on whether a Class 2 or Class 1 radio is used. Bluetooth devices exchange data directly with each other through an ad hoc personal area network that does not require transmissions to travel through an access point or server. Bluetooth shares the same frequency band as the popular IEEE 802.11b and 802.11g wireless networking systems, but can be used concurrently because each technology has different protocols for transmission power, signal modulation and interference mitigation. Bluetooth devices can also be used concurrently with wireless wide-area network (WWAN) devices. In fact, many cell phones have a Bluetooth interface, and many mobile computers that operate on wide-area wireless data networks also use Bluetooth for communication with printers or other peripherals.

The technology was developed to create a standard way to link disparate devices, and takes its name from the 10th-century king Harold Bluetooth, who united warring tribes to unify Denmark and Norway. Bluetooth standards are developed and administered by the Bluetooth Special Interest Group (SIG), a trade association comprised of leaders in the telecommunications, computing, automotive, industrial automation and network industries. Intermecc Technologies is an Adopter Member. For more information about Bluetooth technology and the Bluetooth SIG, visit www.bluetooth.com.

To understand the technology's capabilities and limitations, it is also important to understand what Bluetooth is not. For enterprise mobile computing users, Bluetooth should not be considered a networking technology, even though up to seven Bluetooth devices can operate simultaneously in ad hoc networks. The technology lacks the range, quality of service and throughput to meet enterprise wireless LAN needs. Early on, a faction of Bluetooth supporters tried to move the technology beyond its roots in cable replacement and position it as a networking technology. This was an unwise move, because Bluetooth was not designed to compete with 802.11b and related protocols. Bluetooth was miscast for enterprise networking, but has shown tremendous value as a cable replacement technology to provide highly reliable, fast and cost-effective communications for mobile computers and peripherals.

Devices can be Bluetooth-enabled through PC Cards or Compact Flash (CF) cards, by building the radio into the device, or by integrating a radio through a USB or RS-232 port. Using non-integrated radios somewhat limits the flexibility Bluetooth provides, because the user must give up an expansion slot or interface port for the radio. Some manufacturers, including Intermec, integrate Bluetooth radios directly into computers and peripherals so users can keep their options open for adding peripherals or extra memory, which is often desired for enterprise applications.

Bluetooth Security

Enterprise mobile computing users have several advantages that can make their Bluetooth devices highly secure without losing any convenience and performance. The Bluetooth protocol offers several optional layers of security to limit communications among devices, and additional levels of security access once communication is established. Transmissions may also be encrypted, although they usually are not. There have been very few documented Bluetooth security problems, and most of these have involved consumer devices configured to provide minimal protection.

Bluetooth devices can be configured for open mode, which enables them to communicate with any other Bluetooth device, or they can be set to communicate only with known devices. Because enterprise users typically only need to communicate with a limited number of known peripherals, the less secure open mode can be avoided. For example, Bluetooth mobile computers used by service or delivery workers could be configured to communicate only with the specific printer carried by the worker. Authentication support within the Bluetooth security protocol would require each device to identify itself to the other before any data was transmitted. This level of security is seldom used in consumer Bluetooth devices or even in PDAs and cell phones, whose users want the flexibility to exchange contact information and cannot anticipate all the Bluetooth users and devices with which they will want to communicate.

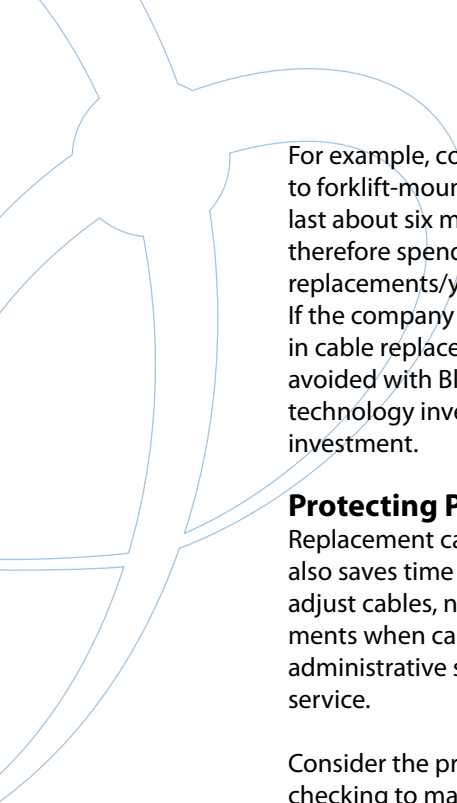
Ensuring Flexibility

Device flexibility is the main advantage Bluetooth delivers for enterprise mobile computing users. Flexibility takes several forms, including user convenience, which leads to improved productivity and safety. Bluetooth also provides the flexibility to use multiple peripheral devices, both in the course of a shift and throughout the lifespan of the computer, without having to repeatedly unplug, swap out and manage interface ports to ensure connectors are always available for the desired device. A Bluetooth connection also ensures the enterprise will be able to connect to and take advantage of new scanners, printers, GPS systems, sensors, scales and other devices as they are needed without worrying about availability of the required connector port.

The flexibility that Bluetooth provides is an important part of its value. Historically, users of rugged mobile computing and data collection equipment have retired their devices with life still left in them because they wanted to upgrade to more functional devices. Research by Venture Development Corp. (VDC) in 2004 suggested many ruggedized mobile computers have a lifespan of approximately seven years, but are replaced after five because of enterprise desires to take advantage of newer technology. Equipment replacements are often triggered by the need for more memory to run more feature-rich applications, and for additional communications capabilities. Bluetooth can mitigate these limitations by allowing users to defer their equipment replacements by one or two years by adding peripheral capabilities without having to replace the entire computer. Extending the life cycle of mobile computers has a dramatic effect on the return on investment they provide.

Cable Cost Control

In addition to extending device life, Bluetooth devices provide total cost of ownership benefits compared to their cabled counterparts on a day-to-day basis. Computers connectors are a \$28 billion industry. Some of that money is spent on the cables and connectors that join mobile computers and peripherals, which on average cost about \$50 to replace. Take a quick look at the number of peripheral devices in use in your business to get an idea of how much capital is tied up in cables and cable replacement.



For example, consider a warehouse with 50 workers using handheld bar code scanners cabled to forklift-mounted mobile computers for picking and put away operations. Cables may only last about six months in this industrial environment and cost \$50 to replace. The company therefore spends \$5,000 per year, or \$100 per user (50 workers x 1 cable/worker @ \$50/cable x 2 replacements/year), on cable replacement, exclusive of repair costs and lost productivity time. If the company plans to keep its system in service for four years, it should plan to incur \$20,000 in cable replacement costs. These costs, along with the associated lost productivity, could be avoided with Bluetooth scanners. If other Bluetooth peripherals were used in the system, the technology investment would be leveraged and would produce an even stronger return on investment.

Protecting Productivity

Replacement cable savings only illustrate part of the value that Bluetooth provides. Bluetooth also saves time – time for mobile workers who don't have to repeatedly plug in, reconnect or adjust cables, non-productive time spent returning their equipment and waiting for replacements when cables fail, time for IT personnel who have to fix cables, and time for clerical and administrative staff who must make repair arrangements and package and ship cables out for service.

Consider the productivity effect if the time each worker spent plugging in cables, periodically checking to make sure connections were tight, and occasionally rescanning items because the cable came out added up to just one minute a day. Returning to our 50-worker warehouse example, the cumulative enterprise effect is nearly an hour of lost productivity related to cable care each day. If each worker works five days a week for 48 weeks per year, 200 hours are spent annually to maintain cable connections. A minute here or there may seem inconsequential to the enterprise, but the impact of 200 additional man-hours would be pretty clear.

Workers also spend time bringing items into position to be scanned or labeled because of the location of a tethered scanner or printer, and sometimes rely on forklifts or other equipment to do so. These operations can substantially increase the time required to complete tasks. Bluetooth gives workers the flexibility to go where the work requires, not where the cable allows, which can be an important time saver. Desire for greater productivity is what leads many companies to implement automated data collection systems in the first place. Small, incremental improvements to systems can have a surprisingly strong effect on ROI by eliminating non-value-added activities and costs from daily operations.

Subtle productivity improvement is just one example of how Bluetooth can complement operations. Bluetooth enhances many of the productivity and convenience benefits that mobile data collection systems provide. Venture Development conducted a major analysis of ruggedized mobile computing users to determine which product features and performance characteristics were valued most. Although users did not expressly rate Bluetooth connectivity as important, the functionality it provides directly supports the four most desired characteristics in ruggedized mobile computers, as illustrated on the next page.

What Enterprise Users Value in Ruggedized Mobile Computers (scale of 1-7)*	How Bluetooth Helps
1. Reliable – minimal downtime 6.4	Eliminates cable failures, repair needs.
2. Ease of use – software 6.3	Integrated Bluetooth keeps expansion slots available for more memory for applications and customer records.
T3. Ease of use – hardware 6.1	Cable-free operations are ergonomic, convenient and reduce risk of tangles, tripping.
T3. Expandability/ease of integration 6.1	The standardized interface lets any Bluetooth device communicate with any other Bluetooth device, giving users plug-and-play convenience to integrate a variety of peripherals into their applications.

*As ranked by Venture Development Corp. Users were asked to rate importance of various specifications on a scale of 1-7. The third position was a tie.

There are also convenience and ergonomic benefits to using Bluetooth. Workers will never become tangled in or trip over a Bluetooth connection, which can happen with cables. Wireless connectivity enables users to move naturally, without having to bend, stretch and reach awkwardly to accommodate cable limitations. These factors improve convenience, reduce fatigue and therefore improve safety. Falls are the second-leading cause of workplace injuries (trailing only overexertion), and cost employers more than \$9.8 billion annually in medical and lost productivity expenses, according to U.S. government figures. No data is available on the number of falls caused by cables, but only a small percentage would represent a very high cost burden that is largely preventable.

The following sections show how to take advantage of Bluetooth connectivity to improve convenience and productivity in typical enterprise mobile computing activities. Remember that these applications can be combined, because a single Bluetooth interface on a mobile computer or PC can be used to communicate with multiple peripheral devices like scanners, printers and GPS devices.

Case in Point

Schwan's Home Service operates the largest privately-owned fleet in the world to deliver its frozen food products right to residential doors. When Schwan's upgraded the mobile computing system used by its delivery drivers, it implemented Bluetooth wireless printing for the first time. Schwan's drivers use Bluetooth-enabled Intermec mobile printers and 700 Series handheld computers to record deliveries, track inventory and issue customer receipts.

Previously, Schwan's drivers used non-Bluetooth printers, which were extremely slow and caused minor delays in completing deliveries. "Our route managers didn't print invoices unless they absolutely had to, because our old printers really slowed them down," said Ron Ruud, vice president of operations for Schwan's Home Service East. The results were incomplete records and an increased workload for support personnel. "When we planned the new system we wanted a very fast, very reliable printer. We felt Bluetooth was the best answer."

Schwan's drivers now issue a receipt with every delivery, which has improved customer service and reduced customer phone calls. Schwan's credits the new system with saving time enough time for drivers to make more stops – and sales – per day.

Bar Code Scanning

The most common input device for a mobile computer is a tethered bar code scanner. Therefore, cordless scanning enabled by Bluetooth holds the most potential to eliminate cable problems and improve user convenience. Cordless scanners provide extra safety when operations require the user to scan around conveyors and other moving parts or machinery by eliminating the possibility of cables being caught and tangled. Consider cordless as a form of insurance to help protect against worker injuries and equipment damage.

Cordless scanning is highly advantageous in confined or cluttered spaces and thus is a good option for inspectors, maintenance technicians, nurses, pharmacists and for many desktop and countertop scanning applications. They are especially helpful for scanning large, bulky items, particularly when bar codes aren't in consistent locations. Bluetooth-enabled scanners are an especially good alternative to wearable scanning systems, which become tiring for workers to use and tend to require more maintenance than separate handheld scanners.

Consider a high-volume picking or cross docking operation, where workers must quickly scan items before placing them in totes or on conveyor belts. The repeated reaching and stretching to gather items and record shelf locations accelerates cable and connector wear. Tethered scanners also limit mobility and flexibility, which decreases productivity when workers have to quickly process items or orient them to find the bar code for scanning. Bluetooth scanners would not produce any resistance or tangles to interfere with the user's work pace. These safety benefits aren't limited to Bluetooth scanners and apply to printers and other cordless peripherals as well.

Bluetooth Printing

The most common use of Bluetooth in mobile enterprise operations is for communication between mobile computers and printers. Direct store delivery (DSD) drivers commonly review orders with customers on a handheld computer, send confirmation to a truck-mounted Bluetooth-enabled printer and have it generate the invoice or delivery confirmation while they are walking back to the truck to begin unloading the order. The solution saves time, because the driver doesn't have to plug his computer into the printer and wait for the output, and enables the printer to be wired into the truck power supply instead of using batteries. At the end of the day, drivers returning to headquarters can generate reports on a page printer without having to swap cords, wait for a dock or otherwise connect their computers.

There are numerous variations of the application. Invoices and receipts can be printed at the customer's door with a belt-worn mobile printer, to eliminate a trip back to the vehicle. Inspectors, maintenance and repair personnel can print inspection labels and documentation, repair receipts, test results and invoices on site. For mobile payment processing, the handheld computer could be used to capture credit card information and on-screen signature capture, and direct the printer to create a signed receipt. A wide-area wireless connection could even be used to authorize the card payment in real time.

There are also multiple opportunities for Bluetooth printing in indoor environments. Warehouse workers with dual-radio mobile computers receive instructions over a wireless LAN, and then use their Bluetooth radio to order picking and put away labels from a mobile printer. Retailers could use a similar arrangement to produce shelf and price labels. In manufacturing, wireless connectivity enables multiple workers in a work cell to share a single printer for producing work-in-process, inspection and other labels. Printers and computers can also receive wireless input from scales, sensors and test and measurement equipment.

Wireless Docking

Wireless docking can eliminate delays and congestion that result when mobile workers all need to download data from their computers at the end of a shift. Frequently, workers have to wait for docking cradles to become available, which is at best an inconvenience, and at worst an unnecessary expense if the workers are paid for their waiting time. Workers may even be tempted to stop working early to avoid the rush at the docking cradles. A Bluetooth base station can accept simultaneous transmissions from multiple computers, which can greatly reduce waiting time and competition for docking devices.

Other Peripherals

In 2003 manufacturers shipped more than 1 million Bluetooth-enabled products every week. The rapidly increasing universe of Bluetooth devices gives users more opportunities to take advantage of the technology, and to leverage investments in Bluetooth-enabled mobile computers, scanners, printers and PCs.

Bluetooth-enabled Global Positioning System (GPS) receivers are available, which means the GPS system does not have to be hard-wired to a computer. Route drivers can take advantage of the wireless communication to use their handheld computers for GPS-assisted navigation applications in the truck, and then take the computer to the customer door for delivery confirmation and other applications. To learn more about the business benefits of GPS systems, see Intermec's white paper, "Supporting Mobile Enterprise Operations with GPS: the Benefits Are Easy to Find."

For mobile computers without imaging capabilities, Bluetooth-enabled digital cameras can be used to take pictures to create a visual record of deliveries, record accident, property or equipment damage, and provide other documentation.

Bluetooth is built into many cell phones to facilitate the exchange of contact data with other phones or PDAs. The wireless connection also enables the phones to be used as modems for wide-area wireless data communications for relaying information from applications in a handheld computer. Having the WWAN connection built into the computer is a more durable and reliable solution, but two-piece, Bluetooth-enabled communication remains an option.

Bluetooth-enabled keyboards, sensors, scales test and measurement equipment are all available to provide input to mobile computers and other peripherals. Computers with Bluetooth connectivity become a powerful platform from which new applications and technologies can easily be launched.

Conclusion

Bluetooth unlocks the full benefits of mobile applications by improving the flexibility, reliability and convenience of mobile devices. These benefits translate into total cost of ownership advantages because computer repair and maintenance costs are reduced, and life cycles may be extended because new peripherals and upgrades can conveniently be added.

Intermec Technologies supports Bluetooth throughout its product line, with a wide offering of Bluetooth-enabled mobile computers, bar code scanners, printers and other devices. Intermec, a UNOVA Inc. (NYSE:UNA) company, is a leader in global supply chain solutions and in the development, manufacture and integration of wired and wireless automated data collection, Intellitag® RFID (radio frequency identification) and mobile computing systems. Intermec's 700 Series was named the 2003 Best Industrial Class PDA by Pen Computing Magazine. Intermec earned recognition as manufacturer of the top PDA, handheld and vehicle-mounted computers used in manufacturing by VDC, which also named the 700 Series the top PDA used in field service. The company's products and services are used by customers in many industries to improve productivity, quality and responsiveness of business operations, from field sales and service to supply chain management and enterprise resource planning.



To learn more about how companies can benefit from Intermec's supply chain technologies, contact Intermec Technologies Corp., 6001 36th Ave. West, Everett, WA 98203 USA; telephone 800-347-2636; or visit Intermec's web site at www.intermec.com. To learn more about UNOVA, visit www.unova.com.

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