

White paper

Top 10 Supply Chain Technology Trends

It's easy to name "mobility" and "wireless" as trends, but it's less clear exactly what direction these developments are taking and how they can be used to improve business. One can hardly pick up a business or IT magazine without seeing multiple articles about the growth of mobile and wireless technologies. And it seems people can't put down their PDAs, smart phones and other mobile computing and communications devices, at least when judging by the adoption rates and future growth projections.

But what's missing in all this attention is context, particularly regarding how adoption of these technologies is creating improvements in enterprise and supply chain operations. For example, identifying mobile computing, printing and GPS as growth technologies doesn't explain how one field service provider combined them to save at least 40 minutes per crew per day, and up to \$2.1 million in overtime. This white paper does. It also provides many more examples of how to use technology for business advantage.

Intermec has been helping companies take advantage of the latest technologies for manufacturing, distribution, field service and other supply chain environments for more than 40 years. We pioneered many of the data capture, mobile computing and wireless communication technologies in use today, and continue to innovate through our close collaboration with leaders in wireless networking and data services, enterprise software and other advanced technology development. Drawing on our experience with thousands of customers worldwide, access to analysts and researchers, close relationships with IT leaders, and extensive network of solution providers, we have identified the top 10 technology trends in mobile, industrial and supply chain operations environments for 2007-2008. This white paper identifies these trends, explains how they apply to supply chain operations, and presents results from users who have adapted the technologies to improve their businesses.

The Top 10 Technologies

Here are the top 10 trends and technologies impacting supply chain operations spanning production, distribution, retail and remote service.

1. Comprehensive connectivity – from 802.11 wireless LAN technologies, cellular networks, Bluetooth
2. Voice and GPS communication integrated into rugged computers
3. Speech recognition
4. Digital imaging
5. Portable printing
6. 2D & other bar coding advances
7. RFID
8. RTLS
9. Remote management
10. Wireless and device security

You're probably familiar with the technologies listed above, but perhaps not with the latest developments and trends. For example, did you know that practically any application can be easily modified to accept speech input because of the recent development of terminal emulation-based speech recognition technology? Did you know that Bluetooth, 802.11b/g, cellular and GPS communication are all available in a single handheld device? Did you know improved optics allow 2D bar codes on paper to be read at greater distances (over 50 feet) than 1D bar codes on

retroreflective labels? Read on to learn more about how these and other developments are helping make production, distribution, service and other supply chain operations more efficient.

Connectivity

The various forms of wireless connectivity – Bluetooth for personal area networking, 802.11 wireless local area networking, and cellular wide area wireless networks for voice and data communication – are all highly visible and provide compelling business cases for many specific operations. Although innovation and adoption is continuing at a strong pace, these trends aren't new. What is new and significant is how these technologies are being combined into single devices that provide multiple forms of wireless functionality, bringing convenience to both users and to IT staff responsible for managing mobile devices.

Smart phones have strong appeal because they provide convenient voice and data access. However they are extremely limited for delivery, field service and other mobile supply chain operations because the computer screens and interfaces aren't optimized for enterprise applications, and the devices themselves aren't rugged enough for everyday use in these environments. For operations with intensive data collection or transaction volume, companies have traditionally used ruggedized handheld computers to gain the reliability and performance they need, but these devices lacked cell phone capability.

Advanced Wireless: Voice & GPS

Now leading cellular carriers have certified rugged handheld computers for voice communication, enabling data collection, data communication and cell phone functionality to be converged into one device. Users don't need to worry about keeping separate cell phones and computers charged and maintained, nor do they need to switch back and forth between devices to complete routine tasks. Converging data and voice onto an integrated piece of equipment can cut the number of devices system administrators need to support in half, which provides sustainable operating cost savings. Bluetooth is also frequently integrated with these devices to interface peripherals and further reduce total cost of ownership by eliminating the costs of repairing and replacing cables.

Connectivity convergence continues with the integration of GPS communication into mobile computers. For example, Intermec's CN3 includes wide-area wireless voice and data, 802.11, Bluetooth and GPS connectivity in a handheld computer small enough to fit in a shirt pocket. Together with the falling costs of

Case in Point

Stanley Steemer, a carpet cleaning franchise, automated route operations at two branches with mobile computers with integrated wide-area wireless connectivity, GPS and a magnetic stripe reader to process credit card payments in real time when service was completed. Dynamic dispatch enabled by the GPS and real-time two-way communication enabled Stanley Steemer to improve efficiency enough to eliminate a full-time dispatcher position at each branch. One location is saving between \$300 and \$700 weekly in overtime, and both branches have greatly reduced time required to complete and process paperwork.

wide area wireless coverage (including GPRS, GSM, CDMA and other technologies) and more generous data plans, computing innovations like these make it affordable and practical for many

companies to implement real-time data access systems for their delivery drivers, sales and service staff, inspectors and other personnel.

Speech Recognition

The “other” voice technology for supply chain operations – speech recognition for hands-free data entry – is also undergoing a new wave of innovation and adoption. Speech recognition helps productivity by reducing the need for users to look at a computer display. Following the larger IT trends of open systems and interoperability, speech synthesis/recognition capability can now be easily embedded into numerous legacy software packages, including warehouse management, picking and putaway, inventory, inspection, quality control and other applications. This simplified integration has been made possible by the recent development of terminal emulation (TE)-based speech recognition technology, which eliminates the need for a separate speech server and a proprietary interface between the speech system and the application software. TE enables speech synthesis to reduce the need to look at the display, and speech recognition to function as a true input technology, not as a separate application that has to be managed and integrated. By using terminal emulation to format and process speech input/output, data flows from and into existing software applications as if it had been entered by bar code scanning, key entry, or whatever method was previously used. TE-based speech recognition systems can work with warehouse management systems in real-time, which is another important innovation from traditional speech recognition technology.

Traditional speech recognition was often implemented for high-throughput operations where system planners valued speed and productivity over accuracy, especially for picking. Bar code data entry is considered more accurate, and speech input is generally acknowledged as enabling superior productivity because workers keep their hands and eyes on the picking operations and aren't interrupted by using the computer screen and keyboard or scanner to initiate and complete operations. One analysis for a high-volume distribution center concluded bar code data entry was four percent more accurate than traditional speech (99 percent compared to 95 percent), but bar coding would require 26 more full-time equivalent (FTE) workers to handle the same transaction

Case in Point

Lighthouse for the Blind, a non-profit organization in St. Louis that trains and employs non-sighted workers, improved its warehouse picking accuracy by 25 percent with a new speech recognition system. The innovative system includes audible confirmation of picked items, enabling blind workers to accurately pick orders.

volume. When a hybrid system featuring TE-based speech recognition was analyzed, it was found to match bar code data entry accuracy while requiring 22 fewer FTEs, making it the overall most efficient method when the consequences of correcting picking errors were considered.

Digital Imaging

Like cellular voice, digital imaging is another technology consumers are familiar with that has now found a place in enterprise mobile computing equipment and applications. Transportation and distribution companies are using digital cameras integrated into the mobile computers so their drivers can capture proof of delivery,

store stamped invoices, and detail conditions that prevent

Case in Point

Mission Foods is one of the world's largest producers of tortillas. Its products are sold throughout the U.S. by independent agents operating in a direct-store-delivery environment with supermarkets and retailers. Mission Foods converted from manual invoicing to creating invoices on a handheld computer and generating a copy for the customer with a mobile printer. Invoice records are sent to Mission headquarters in real-time over the Cingular wide area wireless network.

The practice eliminated the need for Mission Foods to scan in and process thousands of paper invoices. The company also expects five-figure annual savings from converting from its legacy invoices to thermal printing and supplies. Drivers use compact wearable printers, saving the time and fatigue associated with climbing in and out of the cab to print.

The application also illustrates the value of converged wireless connectivity: the handheld computers used communicate with the mobile printers via Bluetooth, transmit invoice data by GPRS, and use wireless LAN connectivity at distribution centers.

delivery. Technicians use the technology for proof of service. Other applications include capturing shelf displays and monitoring trade promotion compliance, collecting competitive information, documentation by inspectors, collecting evidence for accident reports, and recording damage and usage conditions for warranty claims.

Portable Printing

Rugged portable printers are routinely used for output when documentation is required. Common applications include providing signed delivery receipts, purchase orders, work orders and inspection reports. Using mobile printers and computers together lets sales, service and delivery personnel give customers the documentation they desire, while creating an electronic record that frees the enterprise from having to process paperwork. Mobile printers remain one of the fastest-growing segments of the entire printing industry. Traditional applications are in field service and distribution, but adoption is growing quickly in warehouses and factories for forklift-based printing for picking, putaway, shipment labeling and other activities. Mobile printing provides proven labor savings in industrial environments by saving workers from having to make an unproductive trip to a central location to pick up labels, pick tickets, manifests and other output.

2D Bar Code

Two-dimensional bar codes have long been a proven and popular technology for operations where it is desirable to present a lot of information in a limited space. However, 2D has remained a niche technology, in large part because symbols can be difficult to read in many usage environments. As reading ability has improved, so has the adoption and value of 2D bar coding. The recent emergence of auto-focus imaging technology will help bring 2D bar codes into the mainstream for item management, traceability, MRO and other operations.

Most organizations have needs for multiple bar code applications with different symbologies, symbol sizes and encoded data. For example, large-format linear symbologies are ideal for warehouse shelf location labeling, four-inch labels with a bar code field are

common for shipment labeling, and 2D bar codes are ideal for work-in-process tracking plus lifetime part identification and traceability. A traditional reader couldn't recognize both a linear shelf label from 50 feet away and a 2D symbol on a part. Carrying two separate readers is impractical, so organizations have often foregone the use of 2D symbols in favor of more common linear bar code applications.

Now users no longer have to make a tradeoff. For example, Intermec's EX25 auto-focus scan engine is the first bar code reader that can read linear and 2D bar codes alike from 50 feet away and as close as six inches. Complementary developments in illumination technology enable bar codes to be successfully read in dark environments where they couldn't be read before. These developments make bar coding available in environments previously thought to require RFID, or where automated data capture was considered impractical. The use of Data Matrix and other 2D symbologies is already growing strongly for permanent item identification, product genealogy and traceability. With a scanning infrastructure in place to process all types of codes at multiple distances, companies can start building advanced visibility and traceability features into their legacy production, inventory and distribution operations.

Case in Point

"For end users, having one scanner that reads codes in any orientation dramatically improves productivity. For IT departments, the EX25 decreases the number of data capture devices needed, reducing training and support costs."

*Steve Banker
ARC Advisory Group*

RFID

RFID is also more practical than ever before, with clear business cases being demonstrated for asset management and supply chain operations alike. For example, the U.S. Navy used RFID data entry to reduce the time for one mission-critical inventory process by 98 percent. TNT Logistics reduced its truck load verification time 24 percent by using RFID to automatically record goods loaded onto its trailers. Hundreds of other companies around the world are also implementing RFID-based shipping, receiving and inventory visibility applications. See case studies on these systems and the other organizations referenced in this white paper at www.intermec.com.

A sub-trend behind RFID adoption for inventory, warehouse and distribution operations is the use of vehicle-mounted and other mobile RFID readers to enhance or replace stationary models. With a mobile infrastructure, companies don't need to purchase, install and maintain a separate RFID reader for each dock door. Forklift-mounted and handheld readers can cover multiple docks, and be used in warehouse aisles and elsewhere throughout the facility, further reducing the required RFID investment. Plus, they put information directly in the user's hands, so they can prevent errors, rather than just record them after they occur.

Case in Point

"RFID-enabled forklifts offer an opportunity for end-users to reduce investment in reader infrastructure without compromising capability."

*Erik Michielsen
ABI Research*

The flexibility of a mobile RFID infrastructure is helping many companies who implemented EPC Gen 2 systems to meet customer requirements to make internal use of the technology. Shipment verification and inventory update systems are most common, but advanced track-and-trace applications are emerging. For example, several pharmaceutical electronic pedigree (e-pedigree) systems have been developed to take advantage of EPC technology, and pending FDA regulations favor its use for supply chain traceability.

Case in Point

The U.S. Social Security Administration (SSA) implemented RFID systems in a warehouse to track inventory and facilitate more efficient shipping to branch offices. The SSA realized a 39 percent productivity improvement and \$1 million in annual savings. An additional 70 percent labor savings is expected following completion of a system upgrade and expansion.

Compliance tagging and other RFID supply chain initiatives get considerable attention, but according to some research estimates implementation is growing even faster for asset management. These applications are fairly well established and provide a clear and strong business value, so the rapidly increasing adoption is not a surprise. Asset management applications also provide an opportunity to leverage an RFID foundation developed for compliance or other distribution activity for internal benefits.

RTLS

Real time location systems (RTLS) allow you to expand your wireless local area network into an asset tracking system. An important market driver is the Wireless Location Appliance from Cisco Systems, which enables asset tracking through a Cisco wireless LAN. Any device connected to the wireless LAN can be tracked and located. One application is to track forklifts via their vehicle-mounted computer's radio. The Wireless Location Appliance and supporting software can track the radio's location in real time to support efficient dynamic storage, routing, monitor dwell time, and gather data for productivity and asset utilization analysis. Many other expensive products and assets can be equipped with an RTLS device for real-time monitoring.

Remote Management

Using wireless LANs to track warehouse and factory assets is an example of how a mainstream IT resource has been adapted to benefit industrial environments. Another example, powerful remote management systems have been developed specifically to configure, monitor and troubleshoot bar code readers and printers, RFID equipment, ruggedized computers and other industrial

data collection and communications equipment. Network administrators have typically had little visibility or control over these remote devices because enterprise IT asset and network management systems are made for common PCs, servers, and network equipment and don't address the configurations and usage conditions specific to data collection and computing in industrial environments.

Here are a few examples of why general-purpose management systems have limited effectiveness for preserving uptime and managing equipment used in supply chain operations.

- Ruggedized computers are like their office cousins in that they periodically require software updates and security patches, and should be monitored to ensure consistency in configurations and software versions.
- Bar code and RFID smart label printers periodically need to be updated with new label templates and bar code formats, and use thermal print technology, which sometimes requires heat setting adjustments. Bar code printers have specialized command languages, so they are largely incompatible with print monitors and other applications made for office laser and inkjet printers.
- RFID readers can be optimized for their immediate environment by changing power output and making other tuning adjustments.

Device management software is available to meet all these needs plus provide real-time monitoring and notification if devices go offline, and if implemented with open systems standards, it can be accessed through your enterprise network management solution (e.g. Tivoli). Companies use such software to improve reliability and uptime in mission-critical production, distribution and service operations. Such software is also extremely valuable during rollouts and upgrades, because system administrators can use it to set configurations and install software remotely and across groups of devices, instead of having to handle each device individually. These features take a lot of the time and cost out of managing devices, making it much more cost efficient to keep systems up-to-date with new software and security enhancements.

Security

Stronger security is another mainstream business trend and requirement that is supported in supply chain technology. Mobile computers can be locked down so customer information and other data can't be accessed if the device is lost or stolen. Rugged wireless computers and data collection equipment also support many of the leading securities used to protect enterprise wireless networks, including 802.11i, 802.1x, WPA, WPA2, LEAP, FIPS-140, RADIUS servers, VPNs and more. Wireless data collection devices that support Cisco Compatible Extensions (CCX) can be fully included in a Cisco Unified Wireless Network and take advantage of all the associated management, reliability and security features, including hacker and rogue access point detection, authentication and encryption, integrated firewalls and more.

Conclusion

Business needs for security, real-time visibility, and up-to-date information don't stop at the office door. These needs extend throughout supply chain operations, so reliable information systems must extend just as far. Developments in mobile computing, wireless communication, RFID, bar code and other data collection and communications technologies are helping businesses extend visibility and control over more areas of their operations.

This white paper has provided a few examples of how organizations are taking advantage of supply chain technology trends. Intermec is helping many more companies and government agencies of all sizes improve their production, distribution service and other supply chain operations using these top 10 technologies. Contact Intermec today to learn how the latest services, technologies and trends can be adapted to help your business.

Intermec Inc. (NYSE:IN) develops, manufactures and integrates technologies that identify, track and manage supply chain assets. Core technologies include RFID, mobile computing and data collection systems, bar code printers and label media. The company's products and services are used by customers in many industries worldwide to improve the productivity, quality and responsiveness of business operations. For more information about Intermec, visit www.intermec.com or call 800-347-2636. Contact Intermec Investor Relations Director Kevin McCarty at kevin.mccarty@intermec.com, 425-265-2472.

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