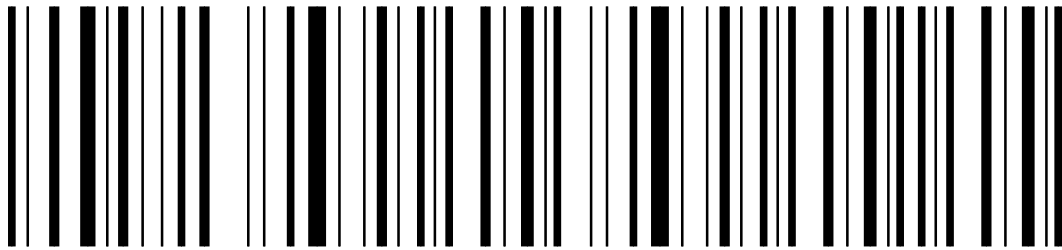


Understanding Mobile Printing Technology and Capabilities



APPLICATION WHITE PAPER



Zebra Technologies



Executive Summary

Modern mobile printers meet numerous documentation, ticketing and labeling needs, and include many of the connectivity and convenience features previously found only on desktop models. The evolution in mobile printer functionality enables users to print materials where they are needed, instead of where they can fit a desktop printer. Organizations can create new business processes which take advantage of point-of-transaction printing to improve worker productivity, labeling accuracy and customer responsiveness.

The key to successful mobile printing applications is developing a process that is convenient for workers to follow. Support the process with mobile printing tools that are easy to operate and suitable for use in the work environment, whether it is a busy outdoor receiving dock or a plush hotel lobby. There are important distinctions among printers that are moveable and printers that are truly mobile. Understanding the design and performance features that differentiate mobile printers from desktop models is critical to developing beneficial new processes and finding the right equipment.

This White Paper will:

- * Define mobile printing technology by explaining the product types, features and performance characteristics;
- * Describe wireless technology available for mobile printing;
- * Present examples of how companies have reduced operating costs, increased labor efficiency and improved customer service with new business processes enabled by mobile printing;
- * Introduce uses for mobile printing in many businesses and industries.

Introduction

Mobile printing systems offer the quality and convenience necessary to provide documentation for internal operations and customer service. Modern mobile printers can create compliance shipping labels, print receipts, invoices and tickets, conduct price audits, process credit card payments, encode magnetic-stripped cards, connect to wireless networks and even receive print jobs by e-mail—a dramatic evolution from receipt printers whose output quickly faded and curled at the edges. By handling select print jobs with small, mobile printers instead of centrally located stationary units, businesses are improving staff productivity, lowering overall printing expenses and efficiently satisfying their customers at the point of service.

Industrial companies can use mobile printers for receiving, cross docking, production test and sample tracking, pick tickets and shipment labeling. In service industries, mobile printers can be used for ticketing, transaction processing, guest and passenger check in, tableside service and more. Retailers now do shelf price auditing, returns labeling, DSD vendor management, mobile point-of-sale and line-busting with mobile printers. The mobile workforce carries printers wherever they go to issue invoices, label samples and evidence, provide delivery confirmation and other documentation. The Applications section will discuss additional uses in specific industries and business operations.

Mobile printers have many different forms and features to perform in the diverse range of environments where they are used. The following section explains the design features and performance characteristics that will determine the success of your mobile printing application.



M o b i l e P r i n t i n g T e c h n o l o g y B a s i c s

The current generation of mobile printers are lightweight, easy to use, durable, and offer outstanding print quality and graphics previously found only on stationary printers. Many offer a wireless interface that allows connection to enterprise networks and applications from anywhere in the facility, indoors or out. Many units have integrated credit card or smart card readers for payment processing. Mobile printers can be used to produce high-quality labels, receipts, coupons, and tickets using a variety of media.

Mobile printers are typically used in conjunction with handheld or wearable computers. The printer receives its commands from the portable computer through either a cabled or wireless connection. Transaction information and print jobs may be generated within the mobile equipment or be received from a wireless network.

Because mobile applications require user comfort and convenience, wireless connectivity is highly desirable. Mobile printers may use two forms of wireless connectivity. Short-range Bluetooth or infrared connectivity can be used instead of a cable to communicate between the printer and mobile computer. Printers may also have a direct connection to enterprise wireless networks. The wireless interfaces perform separate functions and can be used simultaneously.

F o r m F a c t o r s a n d E r g o n o m i c s

Printers are available in multiple designs to meet the needs and preferences of a variety of mobile workers. Available form factors include devices that may be worn on a belt or shoulder strap; combined with a mobile computer in an all-in-one, handheld unit; or securely mounted on a vehicle or a cart.

Finding the best form factor requires understanding the work environment, getting user input and establishing procedures that make printing convenient for the worker. Mobile printers must be comfortable and easy to use, or they will not deliver any productivity benefits. While overall weight is important, balance, grip, and ease of carrying and operation should not be overlooked. Printers also must operate at a rate, which will not slow down the transaction, or else operators won't make printouts unless the customer insists.

There are four primary types of mobile printers: wearable, integrated handheld, vehicle mounted and cart mounted. Each is described below.

Wearable


Users can wear their printers with either a belt clip or a shoulder strap. Wearing printers instead of carrying them keeps the user's hands free for other tasks and reduces fatigue, especially in environments where the printer is used frequently or carried constantly throughout the day. Users are able to comfortably carry larger and heavier printers when belt clips or shoulder straps are used, which is useful when extra media capacity or wider labels are desired. A wireless connection between the wearable printer and the mobile computer maximizes mobility and enhances the ergonomics of the form factor.

Zebra offers many wearable printers in its Cameo™, Encore™, PA/PT™ and QL Series™ product families. The wide assortment of printers in these product families all feature durable construction, convenient media handling and battery-saving features, and offer a variety of print widths, media capabilities and other functionality.

Handheld

Handheld models combine the printer and mobile computer in a single unit. Printer-computer combinations may offer bar code readers, wireless networking, and other options associated with mobile computers. The printer





may be a removable component that clips onto the terminal or may be integrated into a one-piece unit. The combination printer-handheld design eliminates the need for a cable or wireless connection between the printer and computer. Integrated printers are designed to fit specific handheld computers and do not offer the range of print widths that other form factors provide. Integrated printers typically print two-inch wide labels suitable for price marking, inventory picking, shelf and bin labeling, specimen and evidence marking, tickets, coupons, receipts and similar applications.

Users should test integrated units to ensure they are durable enough to perform after being dropped and that the ergonomics enable comfortable, one-hand use throughout the length of the shift. Many integrated devices offer holsters to conveniently carry the devices when they are not in use.

The Zebra TR 220™ is a two-inch wide direct-thermal mobile printer that is designed to connect with a variety of Symbol Technologies® mobile computers. The unique “pistol grip” design delivers maximum mobility and convenience. The TR 220 offers a completely integrated solution incorporating a cradle with a patented latching system designed to lock the Symbol terminal securely in place. The handle also incorporates a trigger to activate the bar code scanning function of the PDT. This ergonomic design for scanning is much easier on the hand and wrist and can reduce muscle fatigue. (Available in Europe, Africa and the Middle East through Symbol Technologies under the model name PGP1000.)

Vehicle Mounted

Mobile printers can be mounted into most vehicles, including forklifts and delivery trucks. The mount may be permanent, for in-vehicle operation, or removable so the printer can be taken out and used at the point of service, such as in delivery or route accounting. Mounted printers may be battery operated or wired to a vehicle adapter. Although it is possible to adapt stationary printers for use in trucks and material handling equipment, it is generally preferable to use a mobile printer for the operation. Mobile printers are designed to withstand the shock and vibrations of the mobile environment and have power management, media handling and user interface features that are optimized for mobile applications. Vehicle mounts are available for Zebra’s PA/PT series, Encore 4 and QL 420 mobile printers.

Cart Mounted

Desktop and tabletop printers can be mobilized by mounting them on a rolling cart. This configuration is used in circumstances that call for mobile printing but require more media capacity or added functionality that a mobile printer cannot provide. Typical applications include distribution centers, sign making, dual media, and other print jobs that require high-volume output or large media sizes. Cart-mounted printers require a power supply and are typically used with a PC or portable computer mounted with the cart.

The Zebra PS 2100™ Series products provide a fully integrated cart-mounted solution. The PS 2122 transportable system features two printers controlled by a single mobile computer for managing multiple print jobs simultaneously. A single battery powers all three devices through an 8-hour shift for maximum efficiency and printing flexibility. The high-volume printers can produce a variety of shelf and price labels, tickets, coupons, bag tags and other labels. The system also offers extra interface ports to connect bar code scanners and other peripherals. Options include wireless networking capability and a special mount to attach the equipment to a shopping cart.

Accessories

Many accessories are available to make mobile printers more comfortable and convenient to use. Accessories include shoulder straps, belt clips and holsters, stands, vehicle mounting units, cables with different lengths and connector configurations, radio modules, single- and multi-unit battery chargers, additional fonts and more.



W i r e l e s s C o m m u n i c a t i o n s

There are numerous wireless technologies available for connecting mobile printers. To replace the cable between printer and computer, the wireless connection is made either by short-range radio frequency (SRRF), such as Bluetooth™, or infrared (IR) light. For networking, the dominant industry wireless networking technology is the IEEE 802.11b (pronounced eight oh two dot eleven b) standard, although older, proprietary networking technology is still used at many locations, particularly in the retail industry.

Cable Replacement

Radio frequency applications require a radio in the printer plus a radio and controller board in the portable computer. IR applications use the standard port built into each device. Almost all infrared products can be used with one another because they use the standard set by the Infrared Data Association (IrDA). Bluetooth also offers interoperability, allowing communication between any other Bluetooth-certified device.

Using wireless technology for cable replacement improves ergonomics and productivity. Eliminating cables reduces the risks of tangles and falls. Going wireless can also improve system reliability because there is no chance for printer cables and pin connectors to break. This is a tremendous advantage in field service and route accounting applications, where users are often miles away from their headquarters and do not have immediate access to replacement parts.

A 100-store retail chain that uses five mobile printer-computer combinations in each store studied the cost-of-ownership issues related to its printer cables. The company determined its annual cable-related repair and replacement costs to be \$60,000, and calculated that lost productivity related to downtime and repair cost the company even more than the direct expenses. Another retailer studied the issue and determined that its employees spent an average of two minutes per day troubleshooting printer cables, which added up to significant non-productive labor time chain wide. In each case the company quickly converted to wireless connections between its mobile printers and computers.

The wireless technologies for cable replacement are described below.

Bluetooth

Bluetooth was developed as a low power consumption, wireless personal area networking (PAN) technology to allow computers, printers, and other devices to interface with each other in peer-to-peer networks without going through a centralized hub or server. Maximum range is about 30 feet, which could enable a mobile printer to be used away from a stationary PC in some retail settings. For enterprise applications, Bluetooth is far more effective for cable replacement than for networking technology.


There were initial concerns that Bluetooth devices would cause interference for other wireless networks used in retail and industrial settings, but testing by the Wireless LAN Association (WLANA) showed that Bluetooth and 802.11b devices could coexist without hindering their performance.

Bluetooth technology is emerging as the top choice for cable replacement because it provides excellent range, speed, and connectivity, and is cost-competitive with older short-range radio frequency and infrared technology.

Infrared Light (IR)

Infrared is the only non-radio technology used in wireless printing. It employs infrared light signals, the same technology used in television remote controls. IR is used for cable replacement but not for networking. Unlike all RF technologies, infrared communications requires a direct line of sight between the devices that are





communicating. If the line of sight is interrupted, data may be lost and the transmission must be retried. It can take up to eight seconds for IR devices to re-establish contact following an interruption.

Some portable computers that use RF for cable replacement or networking also use IR to transfer data when the computer is placed in its communications cradle (where range, line of sight, and speed limitations are not factors). In this application, IR is used in place of physical contacts, which tend to wear over time.

Wireless Networking

Mobile printers can use a wireless network connection to receive print jobs, label formats, variable data and other information from host systems. The printer has an IP address and appears like any other device on the network, which lets users take advantage of the many excellent software products available for network management and security. Zebra's QL series is unique among all mobile printers because it supports the POP3 protocol. The POP3 function enables the printers to receive print commands via an e-mail.

Wireless network printing is possible even if the mobile computer used with the printer does not have a wireless network connection. Because mobile printers can be worn on a belt or a strap, some users prefer to put the network connectivity board into the printer to keep the handheld device as light as possible.

802.11b is the most widely used wireless network standard and offers excellent performance for enterprise applications. It uses the 2.4 GHz frequency band and allows up to 11 Mbps (megabits per second) data rates. Other standards in the 802.11 wireless networking series include 802.11a and 802.11g, which are less mature than 802.11b, make up a small percentage of all wireless network installations, and are supported in far fewer products. The a and g standards have higher data rates, but the speed isn't necessary for mobile printing applications. 802.11g was developed to be backward-compatible with 802.11b, so that 802.11b printers and other devices will be supported on 802.11g networks.

Zebra Technologies supports several leading security protocols including WEP, LEAP and Kerberos to meet user preferences for securing wireless transmissions. Through Zebra's involvement with international standards committees and strong relationships with leading wireless technology developers, Zebra will continue to offer advanced wireless security features as they are introduced.

For more information about wireless technology, see the Zebra white paper [The Benefits of Wireless Printing](#).

Zebra Wireless Options

Zebra manufactures several mobile printers with 802.11b networking connectivity and also offers connectivity software, wireless network monitoring, and control tools. Zebra is committed to this market-leading technology and will support new 802.11 enhancements for security, speed, and connectivity as they become available.

Zebra Technologies supports all the wireless cable replacement and networking technologies described above. Our 802.11b radios are available in different form factors from wireless networking leaders, including Compact Flash radios from Symbol Technologies® and PCMCIA cards from Cisco Systems®.

For maximum flexibility, Zebra offers QuickLink™ removable radio modules for its QL™ series of mobile printers. QuickLink radios come in Bluetooth and 802.11b (Symbol Compact Flash) form factors. Another popular option for wireless connectivity is the Zebra Portable Radio. This clip-on unit that mates with a variety of Symbol terminals and adds Bluetooth, point-to-point radio connectivity in less than eight oz. (0.23 kg).

Wireless mobile printing systems are easy to set up and use. The only difference users notice is the lack of awkward cables connecting the printer to the portable computer. While choosing to go wireless benefits nearly every mobile printing application, there are other important factors to consider for optimum efficiency and performance of a mobile printing application. These factors are briefly described below.



Print Methods and Media

Thermal is the technology of choice for mobile printing because of its high print quality output, media flexibility and the low-maintenance, durable nature of the equipment. Impact printers break more easily in dynamic and industrial environments, often lack the print quality to produce readable bar codes and are not optimized for adhesive label media.

There are two thermal printing methods, direct thermal and thermal transfer. Each method uses a thermal print-head that applies heat to the surface being marked. Thermal-transfer printing heats a ribbon to melt durable, long-lasting images onto a wide variety of materials. No ribbon is used in direct thermal printing, which creates the image directly on the label material. Direct-thermal media is more sensitive to light, heat and abrasion, which reduces label life.

Direct thermal is the dominant method used in mobile printing because the simplicity and convenience of the technology are true advantages in mobile applications. The ribbon-free design is simpler, lighter and more reliable, and users don't have to carry spare ribbons.

Advances in media enable thermal printers to satisfy most mobile application needs. Gone are the days of portable printers that print only low-quality receipts that curl at the edges. Top-coated media resists ultraviolet light and remains readable for years, eliminating the problem of receipts that fade after a few days. Direct thermal media is also available to resist oil, water, blood, alcohol and common industrial solvents. Many types of linerless media are also available, which eliminates the waste and disposal problems associated with peel-away liners used with adhesive labels.

Modern mobile printers accept a variety of form, label, tag, ticket, and other media for producing durable receipts, invoices, return labels, inspection labels, security marks, and other labels. Custom blank label stock can be used to include color, graphics and company logos on labels and documents from mobile printers. Route accounting customers usually accept label- and ticket-size receipts in addition to full-page forms. The smaller receipts are easier to store and ultimately save the issuer money because less paper is used. Some companies use mobile printers to print variable information like invoice amounts or delivery contents on labels that are applied to forms. This satisfies customer desires to keep using familiar forms but eliminates handwriting and manual recording.

Users should resist the temptation to choose the lowest cost material and should match the media to their specific model of printer. Media optimized for the printer requires less battery power for printing, and also extends the life of the thermal printhead.


Power Management

How the printer manages its power supply is important to overall battery life and application effectiveness. It is critically important in remote applications like route accounting and parcel delivery to have enough battery life to power computers and printers for the entire shift or else workers may not be able to complete their daily jobs.

Battery life varies widely based on how the printer is used. Print volume, label size, the amount of wireless transactions, and other factors all affect how long batteries last before needing to be recharged or replaced.

Users should test their applications to ensure that the batteries they use consistently perform as needed and will not contribute hidden expenses to the total cost of ownership. For example, nickel metal-hydride (NiMH) batteries have a higher initial cost than nickel cadmium (NiCAD) products, but have less performance





degradation over time, are more efficient at holding their charge, and have a longer life span. Lithium-ion (Li-Ion) cells represent the latest in mobile battery technology. Though more expensive than either nickel cadmium or nickel metal-hydride cells, lithium-ion cells offer the highest power-to-volume and power-to-weight ratio of the three. For example, in a typical printer application, a lithium-ion battery pack producing 7.2 volts has 30 percent more power than a nickel metal-hydride pack, with half the volume and half the weight.

Some mobile printers have adapters so they can be powered from vehicle batteries. A variety of battery chargers are also available.

A p p l i c a t i o n s

Mobile printers help users bring new levels of control and agility to their operations by providing the ability to print exactly when and where the material is needed. The value of mobile printers is greatest where ready access to a central printer is inconvenient or impossible.

The best mobile printing applications result from process improvements that take advantage of the convenience the technology can provide. New processes only need to save users a little time on each transaction to provide significant productivity gains and labor savings. One Zebra retail customer implemented mobile printers so workers wouldn't have to walk from the aisles to the office to pick up new shelf labels. The new procedure saves a few minutes every time the store updates shelf labels. Improving this day-to-day operation saved the retailer 182.5 hours annually, which provided ample return on investment.

Companies that replace handwritten forms with mobile computers and printers for their route sales, delivery and field service operations typically report their drivers are able to serve a few more customers per shift, which produces revenue gains and enables expansion without adding labor. These applications also create electronic records that don't require transcription and data entry at the office, which saves labor and speeds up the billing cycle.

The following section highlights how mobile printing can benefit different operations and industries.

Field Sales and Service - Slash invoice preparation time with mobile computing and printing systems; improve the cash cycle by accepting payment on delivery with a mobile printer with card reader; prevent driver delays and wait time at the central facility by wirelessly exchanging work assignments and delivery records at the beginning and end of each shift; improve DSD efficiency with Zebra's interface to the DEX electronic data interchange (EDI) standard that looks up the EDI transaction in the retail store host system for paperless invoice reconciliation and immediate resolution.

Hospitality - Offer guests convenient mobile check-in and check-out; prevent lines and improve convenience, especially during busy convention periods by printing bag tags and claim checks wherever they are needed; turn the tables in restaurants quicker with tableside order entry and bill payment systems.

Hospitals and Labs - Label samples when they are drawn and as they are transferred among departments to ensure accuracy and traceability.

Law Enforcement - Use mobile computers and printers to issue parking tickets. The Fall River, MA, police department implemented computerized ticketing and saved \$100,000 annually in data processing. The same equipment can improve evidence management by applying bar codes to evidence as it is collected in the field.

Manufacturing - Identify samples when they are drawn for inspection, testing and quality control; label incoming material for putaway.



Postal, Parcel and Logistics - Improve documentation and control by issuing delivery receipts, pick-up notices and other documentation; offer line-busting portable POS in retail locations; turn carriers into sales agents by selling postage generated on mobile printers; label parcels at pick up to eliminate backlogs at the distribution center; offer mobile utility bill payment and other new services that use carriers to accept payments and provide receipts.

Retail - Conduct in-aisle shelf labeling and price auditing, use the same printers to create price tags and labels and eliminate marking guns; prevent lines and improve customer convenience with mobile point-of-sale and returns processing systems that use mobile printers to issue receipt and process card payments.

Transportation - Create and issue tickets and boarding passes anywhere; offer mobile passenger check-in and luggage check; process transactions and issue receipts for in-flight shopping.

Utilities - Create service and inspection stickers; produce service records and invoices for customers; process payments and issue receipts.

Warehousing and Distribution - Use forklift-mounted printers for picking and putaway operations; cross-dock incoming shipments; generate shipping labels at parcel pickup in the field or anywhere within the distribution facility.

Zebra has developed a series of white papers and case studies that fully explore the applications and benefits of mobile printing in several industries. Browse the Industry Solutions section of our Web site to find these and other resources.

C o n c l u s i o n

By now it is clear that mobile printers have evolved and can do much more than produce curly-edged receipts. Printing at the point-of-use can deliver efficiency gains and cost savings to entirely new areas of the enterprise. As a pioneer in wireless printing technology and a leading provider of mobile printing solutions, Zebra Technologies has extensive experience working with its customers to create new systems that deliver business value. Contact us to see how to take advantage of the latest mobile printing innovations to improve revenue and increase efficiency.





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