Technical White Paper
BlackBerry Exchange Edition™
version 2.0

RIM 950 Wireless Handheld™
RIM 957 Wireless Handheld™

Research In Motion Limited

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Introduction

'72% of Mobile Professional notebook PC users frequently use their devices for email.'

ResearchPortal.com, 1999

The BlackBerry mobile email solution responds to one of the biggest challenges facing today's corporate mobile professionals – staying connected to their desktop email and Personal Information Management (PIM) applications such as contacts, calendar and tasks. A close look at this market revealed a patchwork of half-solutions aiming to solve this one problem.

Since laptops have proven cumbersome to carry and slow to start up, many mobile professionals have opted to carry a PDA (personal digital assistant) instead of using the PIM software on a laptop. PDAs provide access to desktop PIM, but laptops are still the most common solution for mobile email. Typically, mobile professionals use a laptop when travelling and dial into the corporate email server from a hotel room at the end of the day to deal with an inbox full of mail. Some users dial-in more frequently to keep on top of their email. The more adventurous use special software to send email notification to a pager so they know what is in their inbox before spending the time and effort to dial-in.

Focus groups and market research on mobile email revealed common complaints with the dial-in solution – the inconvenience of lugging a laptop just for email, the difficulty of finding a connection and dialing out of a hotel and the difficulty negotiating the corporate dial-in security. IT managers in the focus groups also voiced displeasure with this solution. The challenge of managing the modem banks and RAS servers required for this solution and the risk of opening an inbound path into the corporate network topped their list of concerns. Supporting dial-up PDAs is seen by many as too risky because of the lack of security software available for the PDA end of the connection.

With this background in mind, Research In Motion's (RIM's) objective with BlackBerry was not only to create the first *complete* solution to accessing corporate email and PIM, but also to create the *best* solution. The complete solution features both ends of the connection – BlackBerry Desktop Software that includes Puma's Intellisync for access to desktop PIM information and the Desktop Redirector for access to desktop email and the RIM Wireless Handheld™ – as well as the connection itself – the desktop cradle and wireless service. BlackBerry Enterprise Server software is optional add-on software that is installed on a server. With BlackBerry Enterprise Server, email redirection occurs at the server rather than the desktop. The user benefits from a complete solution by having a simple, flat-rate monthly bill and having a single point of contact for 7 day x 24 hour support on all aspects of the mobile email solution – desktop software, handheld, billing and the wireless network. IT departments benefit since they do not have to piece together a solution for their mobile users and are able to offload support for mobile email to RIM.

As the best solution, BlackBerry features an innovation in mobile email connectivity and a breakthrough in handheld technology, including a full-featured connected organizer. While offered by RIM, the BlackBerry solution draws from the strengths of many:

- **RIM** – leader in wireless data technology. RIM's innovations have produced an integrated wireless modem with an unparalleled combination of small size, high transmit power, and long battery life.
- **BellSouth Wireless Data** – operator of the wireless network. Flat-rate airtime on their national digital data network is included in the BlackBerry solution.
- **Intel® Corporation** – world leader in microprocessors. Intel developed the low-power, small-footprint version of their 32-bit 386 processor specifically for RIM.
- **Microsoft® Corporation** – world leader in enterprise messaging. The features of Microsoft's MAPI technology are central to the BlackBerry "push" architecture and Microsoft Exchange integration.
- **PUMATECH™** – pioneer and market-leader in desktop-to-handheld PIM synchronization. PUMATECH's Intellisync™ product is an integral component of the BlackBerry solution.

Innovation in Mobile Email

The BlackBerry solution introduces a number of innovations in mobile email.

1. BlackBerry has eliminated the hassles of dial-up by moving mobile email to a "push" architecture. In the traditional "pull" model, the user periodically connects to the information to see if anything has changed. In a "push" model, the information connects to the user – notifying them immediately of any changes. When email arrives at the corporate inbox, a copy will immediately be "pushed" or sent to the handheld.
2. Unlike other wireless email solutions, BlackBerry does not use a separate email address for the mobile handheld. Mobile professionals have made it clear that they want access to their corporate email – not a second mailbox.
3. Unlike current handheld mobile email solutions, BlackBerry provides a completely secure end-to-end link between the corporate email system and the handheld.

Link to Desktop Email

Overview – Desktop Solution

The BlackBerry solution for linking the desktop and the handheld is elegant in its simplicity. Figure 1 on the next page provides an overview of the system architecture. The key pieces of the BlackBerry solution are highlighted in the diagram – the BlackBerry Desktop Software's Redirector component, the RIM Wireless Handheld and the BellSouth Wireless Data Network. Since BlackBerry supplies the software at both ends of the link, implementing end-to-end encryption is simple. (End-to-end encryption is discussed in a later section of this document.)

The general operation of the system is very simple. When mail arrives at the Exchange Server (A) for the BlackBerry user, the BlackBerry Desktop Redirector (B) is then notified by the Exchange Server. The Desktop Redirector retrieves a copy of the message, compresses and encrypts it and sends it via the Internet to the wireless network (C). The outgoing message is an unreadable email that can only be decrypted at that user's RIM Wireless Handheld. The wireless network then delivers the message to the handheld (D). At the handheld, the message is decrypted and decompressed and the user is notified of its arrival. For this email redirection system to operate, users must leave their desktop computers running. (A password protected screen saver is recommended for security.)

The path from the handheld to the desktop follows the same steps, only in reverse. When a message is composed on the handheld, it is compressed, encrypted and sent back to the user's desktop over the Internet from the wireless network. Once retrieved from the server, the Desktop Redirector decrypts and decompresses the message and places it in the Outbox. The result is that there is no difference between a message that is sent from the handheld and a message that is sent from Outlook – they both originate from the user's corporate email address and a copy is placed in the user's Sent Items folder.

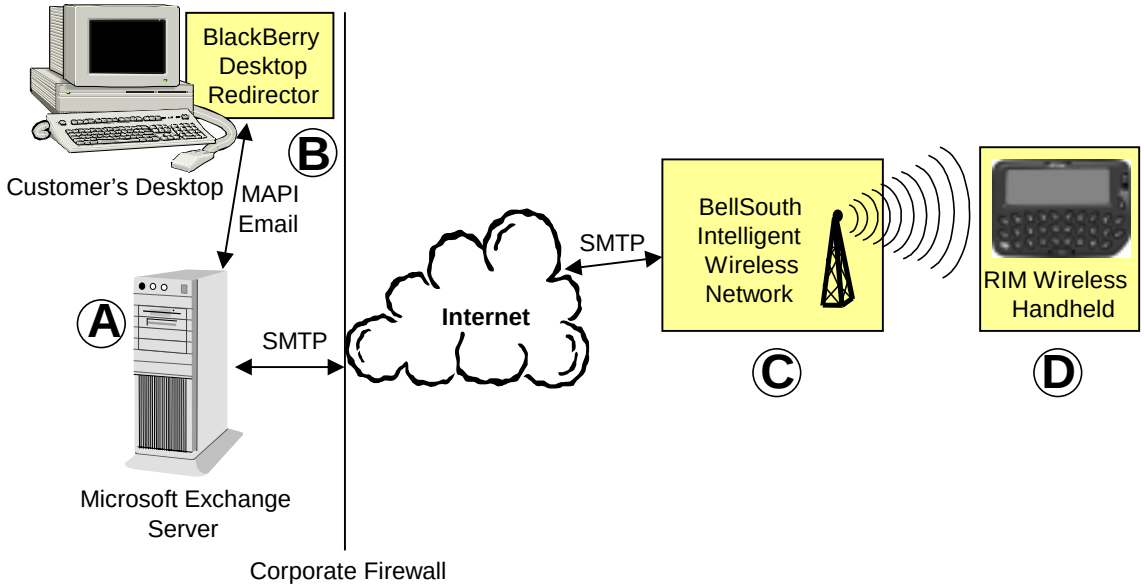

Figure 1: Overview of BlackBerry System Architecture

Overview – Enterprise Solution

The BlackBerry Enterprise Server (E) consolidates the operation of individual Desktop Redirectors into a server that the IT department can monitor and control.

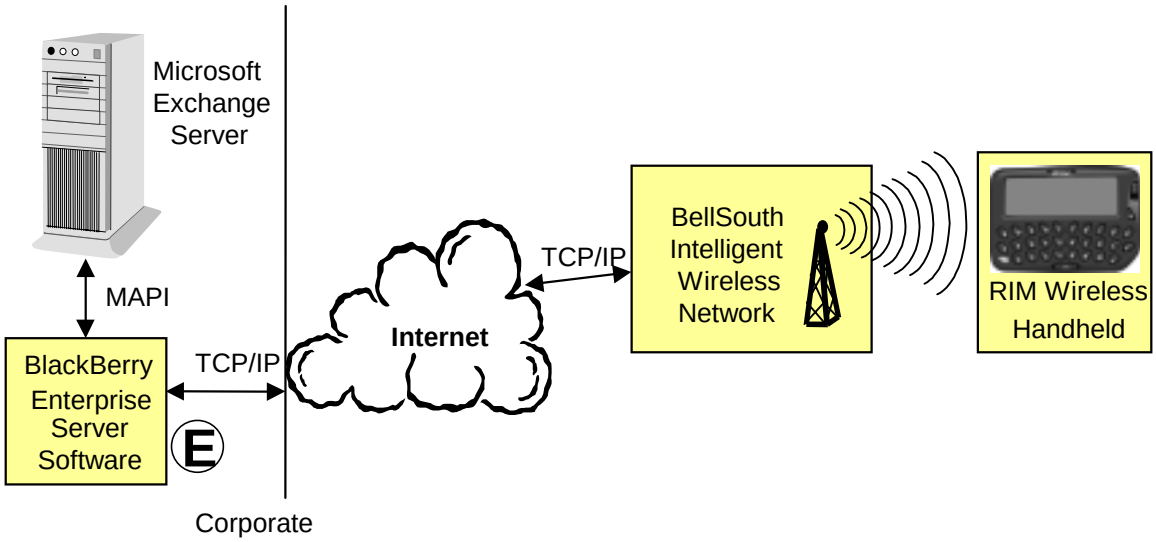

Figure 2: Overview of BlackBerry Enterprise Server System Architecture

With the BlackBerry Enterprise Server, users benefit since they don't have to leave their computer running and laptop users are supported. IT departments benefit, because administration and control of mobile email is centralized. Even though message redirection is administered in the IT Department's back room, a user can continue to configure email redirection through the BlackBerry Desktop Manager (Figure 3). This component manages non-email features to enable a user to load applications on the handheld, backup and restore the handheld contents and synchronize desktop and handheld PIM. The BlackBerry Desktop Manager is also where users configure email redirection features such as filters and handheld security.

Figure 3: The BlackBerry Desktop Manager

BlackBerry Redirector – Desktop and Server Solutions

The BlackBerry Desktop and Server Redirectors are the control center for the BlackBerry mobile email solution. The Redirector is a key component for providing BlackBerry's innovations in mobile email – the link between the corporate inbox and the handheld, remote control of the corporate inbox and message filtering.

Link to Corporate Inbox

Like Microsoft Outlook, the Redirector uses MAPI (Microsoft's Messaging API) to link to the user's email account. Because MAPI provides immediate notification of new email, it is central to the BlackBerry "push" architecture. Since new email is sent to the handheld as soon as it arrives at the desktop, the user is notified as soon as email arrives and never has to worry about connecting to their corporate server to check for new mail. By having the desktop connect to the user, time spent dialing-up and connecting to the desktop (possibly to find that there is no new email) is eliminated as users of the BlackBerry are notified virtually instantly of important messages, enabling the user to respond immediately.

As previously mentioned, the Redirector uses MAPI to place messages composed on the handheld in the user's Desktop Outbox such that the message originates from the corporate email account with a copy sent and kept in the user's Sent Items folder.

Another example of the Redirector's use of MAPI for advanced functionality is address resolution. In the normal operation of BlackBerry, users send messages to Internet email addresses whether they are internal (e.g. name@usercompany.com) or external (e.g. name@othercompany.com). However, in Microsoft Outlook, the user can send messages to non-Internet addresses as well. For example, the user can compose a message to "Accounting" and choose "Check Name". MAPI will examine the Global Address Book, the Personal Address Book and the Contacts (or a subset of these, depending on the user's configuration of MAPI) for a matching entry (e.g. a global or personal distribution list "Accounting" or the address "accounting@company.com") If found, that address will be used. The Redirector uses the same MAPI address lookup used by Microsoft Outlook. Therefore, if the user composes a message to "Accounting" on the handheld, the Redirector will perform the same address lookup and send the message to the same destination as Outlook.

The Redirector's address resolution feature allows the user to take advantage of non-Internet email addresses such as distribution lists and fax gateways. Users can create personal distribution lists and fax addresses (if the company has an Exchange fax gateway) in the Personal Address Book on their desktop

and reference these addresses by name from the handheld. For example, Outlook allows the user to create a fax address called “Joe’s Fax” that represents Joe’s fax number. If the company has a fax gateway, sending an email message to this address will result in the message being delivered to Joe’s fax number. Because the Redirector uses the same MAPI name resolution function as Outlook, addressing a message to “Joe’s Fax” on the handheld will result in the message being sent to the fax number via the company’s Exchange fax gateway.

Remote Control of the Corporate Inbox

The BlackBerry Desktop Redirector is also responsible for a number of advanced features that are not immediately visible to the user. Features such as requesting more of a message, including original messages in replies and forwarding messages provide the user with some ability to remotely control their desktop inbox.

When a long message arrives in the user’s corporate inbox, only the first 2K (approximately) of the message body will be sent initially to the handheld. If an attachment is sent in the message, only the file name and size of the attachment are sent. If the user wishes to read more of the message, the user, using the handheld, requests “more” and the Desktop Redirector will send the next 2K. The handheld will then add the additional 2K piece to the original message and inform the user (as with a new email message) that more of the message has arrived. Since most text-based communication via email is less than 2K, most messages won’t be truncated. With this advanced “more” feature, the user can judge the value of the message before memory and battery life is expended to deliver the additional information to the handheld.

Similarly, when the user selects “Reply with Text” or “Forward” on the handheld, only their response is sent from the handheld to the Desktop Redirector. Back at the desktop, the Redirector will construct a message consisting of the user’s response and the original message and send this to the list of recipients. This ensures that the recipients receive a complete copy of the original message, regardless of its size, while minimizing the data that is sent from the handheld. The remote forwarding ability allows users to ‘remotely’ forward long messages or attachments to co-workers to handle, to the company’s fax gateway (see the section above discussing sending to a fax), or a public fax gateway service for delivery to a fax machine at their location.

Filtering

While the “push” model allows for paging-like responsiveness, given the typical daily volume of email, the notification of each new message can be disruptive. The objective of the BlackBerry wireless email solution is to allow users to take control of their email, not to increase email’s control of them. To this end, extensive filtering capability is included in the Desktop Redirector to allow the user to control the flow and priority of new messages. Messages can be filtered on a wide range of criteria (see Figure 4). Filters are set in the BlackBerry Desktop Manager and stored on the Exchange Server. These filters continue to operate if redirection is moved from the desktop to the server by the installation of the BlackBerry Enterprise Server.

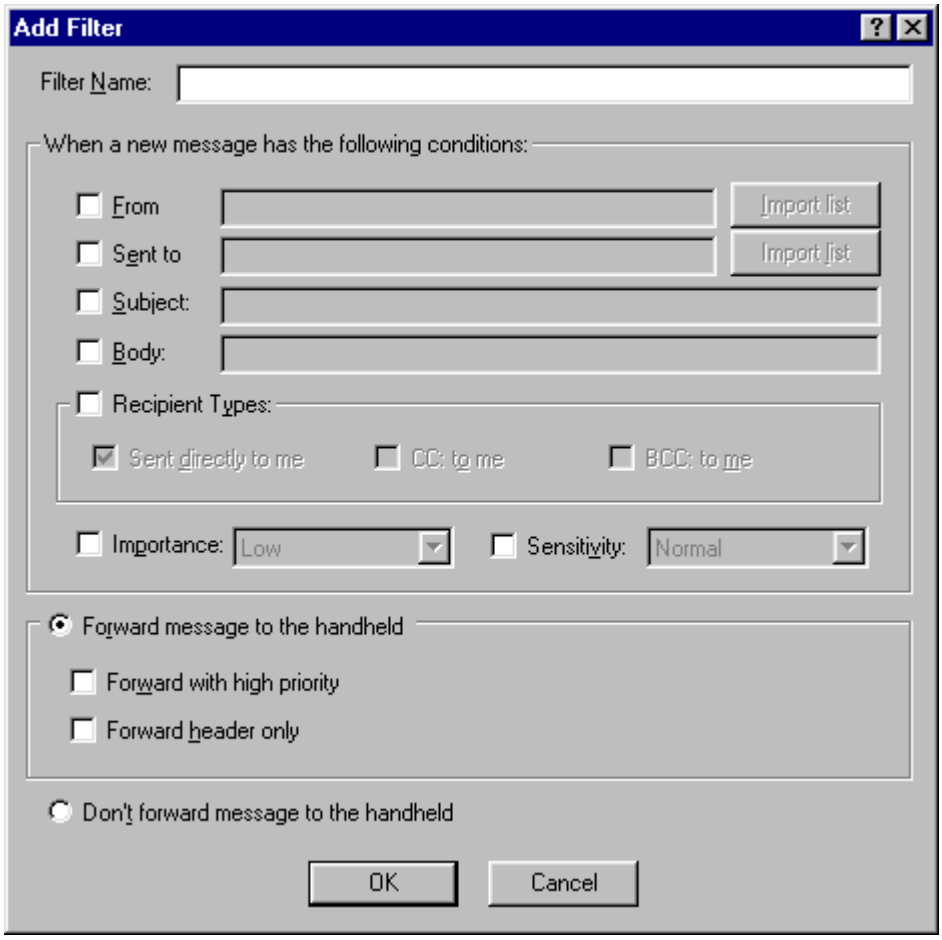

Figure 4: Filter Entry Screen

Depending on the criteria that apply, messages can be forwarded, not forwarded, or forwarded as priority messages on the handheld. Priority messages are visually distinguishable on the handheld and a complementary notification control allows the handheld's vibrating or audible notification to be limited to only these priority messages. (Appointment reminders are regarded as priority messages.)

The filter flexibility allows users to control how they use wireless email. Users could quietly receive most of their email at the handheld to read during their downtime, filter out regular "bulk" mailings that can be left until later and have messages from their superiors or immediate workgroup notify them to ensure a quick response. Still other users could set filters to only forward important email and set the handheld to notify them of every message that arrives on the handheld.

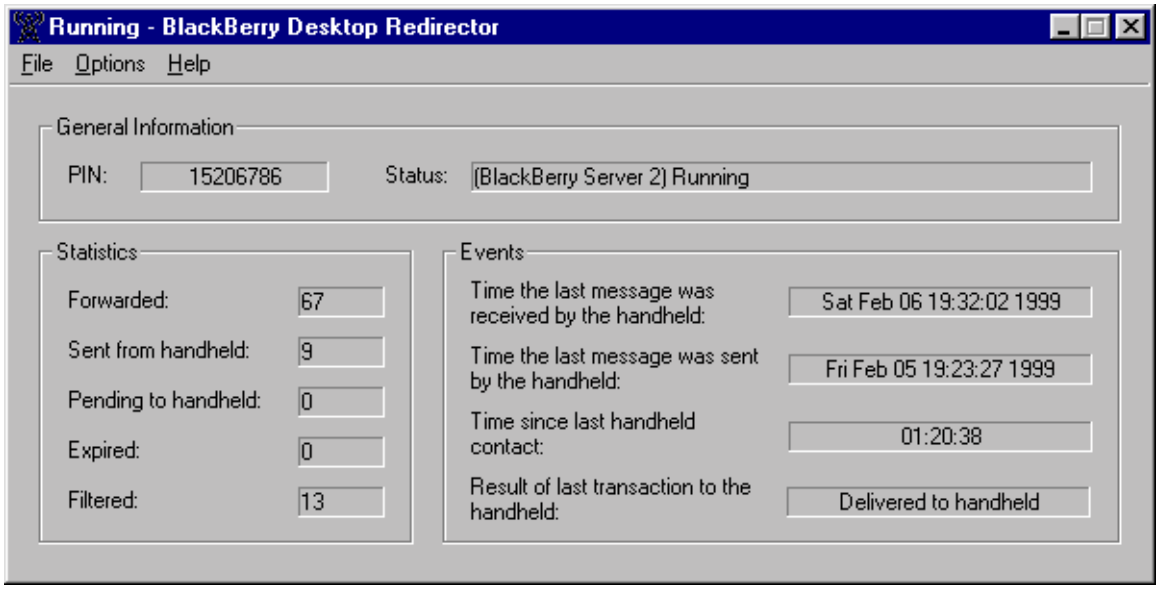

Figure 5: BlackBerry Desktop Redirector Status Window

The statistics provided in the Desktop Redirector Status Window (Figure 5) reflect the operation of the BlackBerry system. When new mail arrives in the user's inbox, it is either filtered or considered pending to the handheld. If the message is pending, it is either waiting at the wireless network for delivery to the handheld or, if the handheld's queue at the wireless network is full, waiting at the desktop for delivery to the wireless network.

As a traffic-economizing measure, if the message is read on the desktop while it is waiting at the desktop for delivery to the wireless network, it will not be forwarded to the handheld.

Once a message arrives at the wireless network, there are two possible outcomes. If the message is delivered to the handheld, a delivery acknowledgement is sent to the Desktop Redirector from the wireless network and the "pending" message is now considered "forwarded". If the handheld is out of coverage for more than 7 days (e.g. the user is on holidays and turned the handheld off), the wireless network will send a notice back to the Desktop Redirector and the message is considered "expired".

Finally, when a message is sent from the handheld, the wireless network forwards it to the Desktop Redirector where it is placed in the user's outbox for outbound delivery. At this point, the message is considered "sent from device".

Email Reconciliation

A user can manage their inbox on either the handheld or the desktop, with any changes being automatically synchronized as part of the email reconciliation feature. For example, if a user deletes a message on the handheld, this change is remembered and updated onto the desktop the next time the user syncs their handheld. This function can optionally be disabled for those users who wish to accumulate all messages in their inbox.

Additionally, a user can move a message from the inbox on the handheld to another message folder. All of the user's desktop message folders are available on the handheld. This message move will be completed the next time the user places their handheld into the cradle.

Handheld

The technical details of the RIM Wireless Handheld are discussed later, but in the discussion of the end-to-end link to the desktop there are several key points worth raising. Unlike "smartphone" mobile email solutions, the BlackBerry solution includes software on both ends of the link. This allows for advanced features such as compression and encryption as well as the filter/notification control mentioned earlier in this section. In addition, the handheld's long battery life is central to BlackBerry's unique "push" architecture. Without this battery life, the user would not be 'Always On, Always Connected™' to their corporate email.

BellSouth Intelligent Wireless Network

Based on Ericsson's Mobitex technology, the BellSouth Intelligent Wireless Network is a digital wireless data network. Historically, the Mobitex network was limited to use by corporations for specialized vertical applications. Through RIM's pioneering efforts in Mobitex radio technology, the cost, size and power of Mobitex devices are now ready for horizontal applications such as wireless email and two-way paging.

The BellSouth network offers significantly better performance and much greater capacity than "retro-fitted" one-way paging networks. And unlike circuit-switched voice networks, the Mobitex network is a packet data network like the Internet and other computer networks. This means that the connection between the handheld and the company mail server is never broken, dropped or lost.

The following is an outline of some of the key network elements.

Benefit	Network Element
Extensive Coverage	• **National Coverage** – BellSouth Wireless Data's network serves 93% of the urban U.S. business population, which covers 266 metropolitan statistical areas across the country, as well as major transportation corridors and more than 130 of the nation's top airports.
Strong Performance	• **Symmetrical Network** – a full two-way data network with the ability to send in all covered areas. • **99.95% System Availability** – using features such as hierarchical architecture, distributed intelligence, back-up power supplies and extensive redundancies in the network infrastructure. • **No Distorted Messages** – numerous fault-tolerant error detection and correction methods are embedded in the system. • **Fast Message Transmission** – offers near real-time, two-way messaging. • **Unlimited Capacity** – the core network is digital. It operates using from 10 to 30 full duplex radio channels per coverage area, with the ability to transparently add even more channels in the future. These, when combined with cellular re-use frequencies, offer virtually unlimited data handling capacity. BellSouth Wireless Data has spectrum in all 50 states, which gives it the ability to add base stations wherever it requires additional coverage.
Key Features	• **Guaranteed Delivery** – If a user's handheld is turned off or is temporarily out of coverage, the message is stored in a network "mailbox" and it is forwarded automatically when the handheld is turned on or returns to coverage. • **Seamless Nationwide Roaming** – Users simply turn on their handheld and send or receive messages to or from anywhere in the BellSouth Wireless Data service area across the U.S. They do not need to re-register with the

Benefit	Network Element
	network. The handheld automatically registers with the network, which knows with which base station the handheld is "in touch". • **Secure** –If a user's handheld is stolen, it can be automatically disabled on command from the network.

The support for Internet standards-based communication allows the user to leverage the company's existing Internet-connected infrastructure, saving both set-up time and the cost of equipment and support.

Peer-to-peer messaging is an additional capability, which allows two BlackBerry users to send messages between their handhelds using PINs (numeric network IDs of handhelds). The wireless network relays these messages directly between handhelds. With this feature, team members can communicate with each other if either the company's email server or connection to the Internet goes down. This direct messaging also facilitates "chatting" between team members – faster delivery with no record of the messages at the desktop. This method of communication is scrambled, not encrypted, so it is not as secure as the handheld-to-desktop connection.

Security

> *'…essentials such as security don't get enough attention. "And you can't just have anyone with a PDA accessing our network. You need security software on both ends," Burcham said.*
>
> Excerpt from "Got a handheld? IT doesn't want to know"
> Computerworld, Nov. 16, 1998

Few handheld email solutions give much thought to security, but since BlackBerry was designed for corporate users it has received great attention. BlackBerry's secure solution is unique in that it both provides a secure link between the desktop and the handheld and does not require configuration of, nor does it compromise, the company's firewall.

SMTP Security Concerns

As mentioned earlier, the BlackBerry desktop solution uses the desktop's existing Internet email connectivity to connect the desktop and the handheld. The benefit to the user, of BlackBerry's use of an existing connection, is the easy installation and ability to "load and go" without needing IT support.

Despite these benefits, the use of Internet email as a means of communication raises several security issues. First, confidential internal email is being sent over the Internet – a publicly accessible network. Second, allowing the handheld to communicate and control the desktop via email arriving from the Internet may not require a new opening in the firewall, but it does create a new point of attack for the outside world. Both of these issues are solved by the same solution – encryption.

Confidential

Because of BlackBerry's use of encryption, messages in transit between the desktop and the handheld are completely unreadable. In the encryption model used by BlackBerry, only the handheld and the desktop know the encryption key. Before any information is sent between the desktop and the handheld, the content is encrypted so it can only be unlocked by the desktop or handheld.

Authenticated

The user's desktop is also safe from external attack because the same shared-key encryption is used to authenticate inbound commands. The user of one RIM Wireless Handheld (or a hacker emulating commands from a RIM Wireless Handheld) cannot cause email to be sent or forwarded from another BlackBerry user's desktop because the Desktop Redirector only responds to encrypted commands. The encryption key is only known to the user's desktop and handheld.

Message Integrity

The end-to-end encryption also ensures the integrity of the message. Even if the message was to be intercepted when travelling between the desktop and handheld, an intervenor cannot alter the contents of the message. If the message is altered in transit, the decryption engine at the receiving end will reject the message.

How Secure Is It?

BlackBerry uses the Triple-DES encryption algorithm. The U.S. government created this encryption algorithm and using today's technology it would take many trillions of years to decode a message encrypted by it. In the past year, a message encrypted with Single-DES was cracked in a reasonable period of time using many computers operating in parallel. But it is important to note that Triple-DES would take a thousand trillion times longer than Single-DES to break. Triple-DES is used by the banking industry to protect sensitive transactions and is the only widely-used and tested encryption algorithm.

Guarding the Back Doors

The encryption algorithm itself is only part of a secure private key encryption system. Potential areas of weakness in any encryption system include generation of the key, transfer of the key, and security of the key. Since computers are too deterministic to be able to generate a purely random encryption key, all good private key solutions require human-produced randomness to generate a key. When BlackBerry is installed, a dialog box will appear, asking the user to move the mouse. At this point, enough random mouse movements are captured to ensure a truly random key (Figure 6).

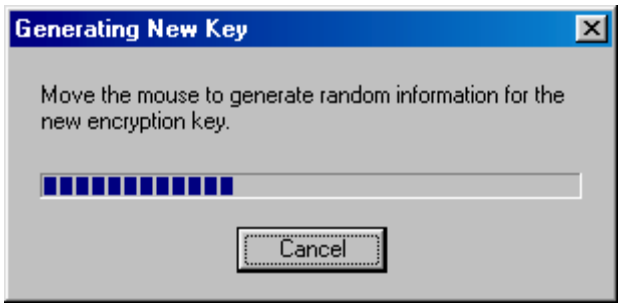

Figure 6: Encryption Key Generation

Because of the importance that the key is known only to the desktop and the handheld, the security of the key transfer between the desktop and handheld is also extremely important. If the key is not transferred over a secure link, there is potential for "eavesdroppers" to intercept the key exchange. The BlackBerry solution uses the cradle's private serial connection between the desktop and the handheld to transfer keys.

The final area of potential weakness in a secure end-to-end solution is perhaps the most obvious – security of the "ends" where the keys are held. Setting a user password on the handheld can protect the contents of the RIM Wireless Handheld. Once set, the user can easily lock the handheld to protect against unauthorized access, including access through the serial port on the handheld. If the user accidentally leaves the handheld unlocked, password protection automatically begins after a brief period of inactivity if the password is set. Should an incorrect password be entered more than ten times, the handheld's memory will automatically be erased, leaving the handheld unusable. If the legitimate owner forgot the password, the handheld's applications can be reloaded at the desktop. The password itself is stored on the handheld in a secure manner so if the contents of memory were somehow downloaded from the handheld, it would not be possible to determine the password. As an added measure of security, the IT department can enforce the use of passwords and even the length of passwords for all BlackBerry users.

Conclusion

The only security concern left is the requirement of leaving the computer on. This desktop requirement can be eliminated with the deployment of the BlackBerry Enterprise Server. In any event, security of the user's desktop can be achieved by means that are likely already in place – physical security within the company's

premises and a screen-saver password that protects against unauthorized access. Compare this concern to the risks created with the use of laptop dial-in solutions – TCP/IP level access to the corporate network via dial-up, users who check “Save Password” in the dial-up network settings dialog box, and users who store their time-stamping password cards in their laptop case. While desktops with screen saver passwords and laptops with dial-up networking are both one password away from access to the company LAN, desktops locked away inside companies are inherently more secure than laptops being toted around the country.

Breakthrough in Handheld Technology

By packing a 32-bit Intel386™ processor, a large amount of memory, an easy-to-use QWERTY keyboard and an embedded wireless modem into a palm-sized or pager-sized device, the RIM Wireless Handhelds clearly break new ground in portable technology. These innovations and others are reviewed below.

Size

A key feature in any *mobile* email solution is portability. With this in mind, the RIM Wireless Handhelds were designed to be the first wearable handhelds and hence the most portable method of taking access to your email, contacts, and appointments with you. Wearability means that it is always at hand and the vibrating notification is able to discretely notify you of important email and appointment reminders. For the RIM 950 Wireless Handheld™, with a size of 3.5" x 2.5" x 0.93" and weighing less than 5 ounces with the single AA battery, the handheld provides a welcome break from lugging a laptop for email. For the RIM 957 Wireless Handheld™, with a size of 4.6" x 3.1" x 0.70" and weighing less than 5.3 ounces, the handheld is a convenient palm-sized solution that can be easily worn or carried in a purse or pocket.

32-bit Intel386 Processor

The RIM Wireless Handheld is the world's first handheld to be powered by the 32-bit Intel386 microprocessor. Even though the user does not see the processor, the benefits from its use provide an important characteristics of the handheld, power. Using this processor allows RIM to provide more computing power than the desktop PCs of recent years in a mobile device.

The use of the Intel processor standard also simplifies third-party application development for BlackBerry. Developers use Microsoft Developer Studio to create DLLs that can easily be loaded on the handheld. A desktop handheld simulator allows developers to debug applications at the source-level in Developer Studio before downloading the final DLL to the handheld.

Wireless Modem

Research In Motion is a world leader in wireless data technology and has achieved a major breakthrough in wireless technology by creating an extremely small wireless modem that includes a powerful 2-watt transmitter, yet allows incredible battery life. The wireless modem operates on the BellSouth Wireless Network. The combination of a leading-edge RIM wireless modem with the BellSouth Wireless Network means that the user is always connected to their desktop and dial-in hassles are eliminated.

Superior Battery Life

Battery life is the single most important issue for mobile professionals considering the purchase of a handheld device. RIM Wireless Handhelds are always connected to a packet data network and can last up to a week on a single battery or charge. RIM Wireless Handhelds represent a breakthrough in power consumption yielding unparalleled battery life.

Memory

With 2 MB (RIM 950™-2), 4 MB (RIM 950™-4), or 5 MB (RIM 957™) of Flash memory, the handheld can store thousands of contacts, appointments, tasks, and email messages. The persistent flash memory saves battery life and retains the information on the handheld even when the battery is dead or removed.

Ergonomic QWERTY Keyboard

The ergonomically designed keyboard uses the standard QWERTY layout and the "click and roll" trackwheel, controls the user interface and navigation through messages. The keyboard design itself is a breakthrough in mobility and usability. It provides the fastest, most familiar way of composing emails and entering new contacts and appointments. The functionality of the keyboard and the ergonomic layout is

better for composing messages than the pen-based character recognition of other PDAs. Experienced "thumb typers" have reached over 40 words per minute. The addition of the trackwheel makes scrolling through long messages and navigating pop-up menus extremely easy.

Superior LCD Display

The RIM 950 provides 8 lines x 30 character display (typical number of characters per line, using proportional font) while the RIM 957 provides 160 x 160 resolution display (16 or 20 lines of text). The high resolution, high-quality display uses Electro-Luminescent backlighting which provides bright, even lighting for viewing the display in low-light conditions, making it easy and practical to read both long and short messages. The compact display and trackwheel make reading long messages quick and easy. The lines of text that the user is reading are isolated for viewing while the trackwheel allows the user to easily control the pace of reading.

Desktop Synchronization

'Puma Technology's Intellisync® product series has become the de facto standard for synchronizing personal digital assistant (PDA) and hand-held computing data with conventional PCs.'

Bruce Brown, PC Magazine, April 7, 1998

To ensure fast and reliable synchronization of organizer information between the user's desktop and RIM Wireless Handheld, Research In Motion has partnered with Puma Technology™, a leader in the Mobile Data Exchange™ software category. Powered by Puma's patented DSX (data synchronization extensions) Technology™, Puma's information synchronization software product, Intellisync, intelligently moves and synchronizes information between computers and the new wave of smart devices (phones, pagers, PDAs).

Puma has invested over 250 developer years to offer the DSX Technology and it is this technology which gives users the assurance that they can safely, accurately, and with minimal effort synchronize their data no matter what format or platform it needs.

DSX Technology offers an intelligent synchronization process that is "content aware." It looks at the database information in detail on both sides. To perfect the product, Puma had to identify and solve many complex problems.

Puma's Intellisync® software with DSX Technology has the following features:

- Examines the details of the database records, from disparate environments, down to the field level, to determine equivalencies.
- Handles the mapping of fields from one system to another, even when they are not named or structured the same, or when the user has chosen non-standard mappings.
- Translates fields where needed (e.g. Priority: High = 1).
- Maps a single field into more than one (e.g. Full Name to First/Last).
- Recognizes recurring items and reflects them accurately across platforms.
- Selects only the fields for synchronization that the user has chosen.
- Detects additions, deletions, conflicts, and duplicates, and reports them to you, as you have requested.
- Allows you to intervene on the spot to correct any discovered conflicts, or to select from alternative, automatic conflict resolution methods.
- Maintains a synchronization history and, when necessary, uses it to ensure complete and accurate synchronization.