1

System Architecture

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It is always important to understand the architecture of any product that you must support or on which you may develop. Understanding the different components that make up the Research In Motion (RIM) BlackBerry platform will help you visualize how it integrates with your e-mail system, how the handheld units communicate with your network, and where to place the different components that make up the BlackBerry infrastructure so that they maximize performance and security.

We will start by discussing the latest version of the BlackBerry platform, version 4.0, which shipped in early December 2004. This new version offers significant improvements in performance, management, user features, and application development. Because not everyone will upgrade immediately to version 4.0, we will also discuss the previous version of the BlackBerry platform, which is version 3.6 for Microsoft Exchange and version 2.2 for Lotus Domino.

Current Architecture (Version 4.0)

BlackBerry 4.0 represents a big leap forward in the BlackBerry platform technology. It offers substantial benefits to organizations in many areas, including operations, development, user features, handheld software improvements, BlackBerry administration, and internal network design.

In Figure 1-1, you can see the current BlackBerry 4.0 architecture. It shows how all of the BlackBerry components remain behind the corporate firewall with the mail servers and application servers while communicating with the handheld units through the firewall, via the BlackBerry infrastructure. You will also notice two paths from the handheld units to the BlackBerry components. Path 1 is from the BlackBerry components behind the firewall, through the BlackBerry infrastructure to the handheld units on the wireless networks. Path 2 is through the local area network (LAN) to the handheld unit connected to a USB or serial port on a computer. We will discuss these different components and the methods of communication in more detail later in this chapter.

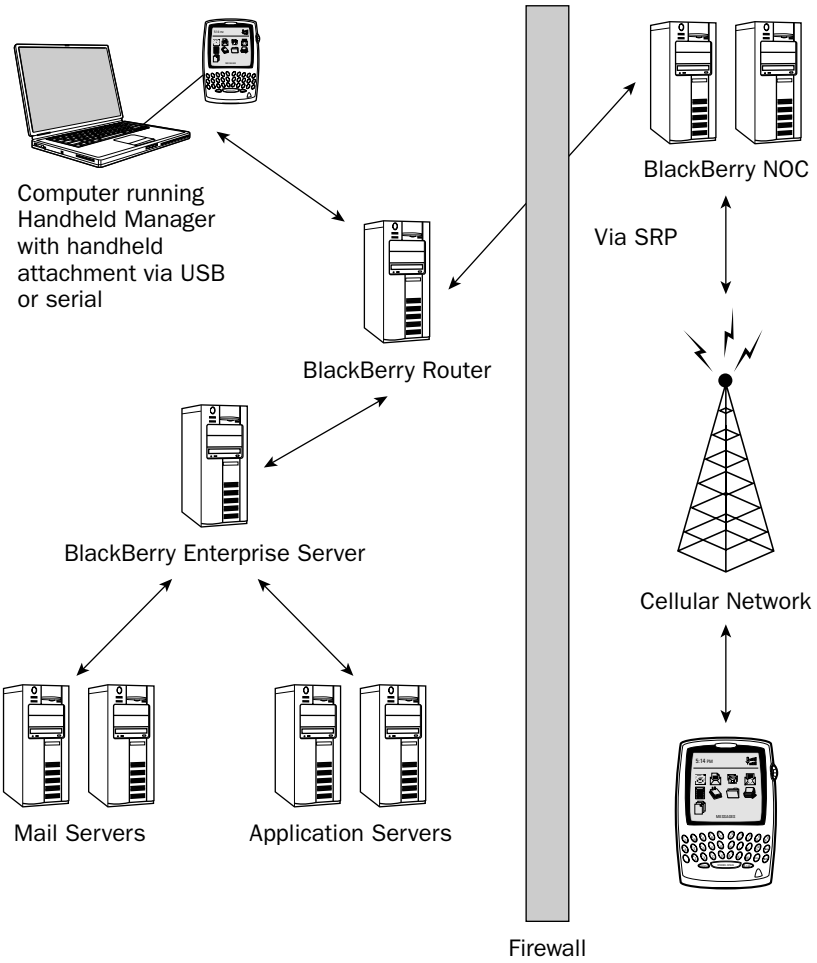

Figure 1-1: BlackBerry architecture

This section describes the basic components included in BlackBerry 4.0:

- Handheld unit
- BlackBerry Enterprise Server (BES)
- BlackBerry Network Operations Center (NOC)
- Data network
- Attachment Service
- Mobile Data Service (MDS)

- ❑ BlackBerry Router
- ❑ Configuration Database

Handheld Unit

The name *BlackBerry* can be traced back to Lexicon, a company that had been contracted in 1998 by RIM to develop a name for RIM's new wireless e-mail device. The company presented RIM with approximately 75 name candidates, but the word that immediately stood out was *blackberry*. The name has perfect symmetry in that *black* and *berry* have five letters each. RIM felt that words that ended in *y* were approachable. They liked the playfulness of the name, and the color scheme fit well with the color of the device. In those beginning days, the handheld devices connected to two data-only networks run by Bell South and Motient, which operated in the United States and Canada. The Bell South network was called the Mobitex network. Bell South later merged with Cingular and so the network fell under the Cingular flag. The Mobitex network is still running and there are still data-only BlackBerrys available, such as the RIM 950, RIM 957, and the BlackBerry 5790, that connect to it. Motient ran the other network, called the DataTAC network. It still runs today in the USA and the RIM 850 and RIM 857 connect to it. In December 2004 the DataTAC network was shut down in Canada.

The data-only BlackBerry handheld units have no telephone. Because they do not run on a cellular network, they can be used only within the United States and Canada. These handheld units still have a place in today's always-connected world. They can be used in many situations where the company doesn't need the employee to use the telephone, and the employee does not travel outside North America. These situations include employees who travel extensively, but must stay in touch through e-mail. These same employees may need to use the BlackBerry to keep schedules current and they may need to use custom applications to perform data-entry tasks on job sites or to fill out work reports.

One final point about these older handheld units (such as the RIM 850, RIM 857, RIM 950, and RIM 957) is that they run on an operating system that is built on the C++ programming language. This means that any development for these handheld devices must be done using C++. The Web browser on these handheld units can interpret only Wireless Markup Language (WML) and cannot process Hypertext Markup Language (HTML), Extensible Hypertext Markup Language (XHTML), or JavaScript. One exception to this rule is the new BlackBerry 5790, which is a data-only BlackBerry that runs on the Cingular Mobitex network, but is a Java device. Because of this, it shares its feature set with all of the other Java handheld units (which we will discuss next), with the exception of having no phone.

The next generation of BlackBerry handheld devices was the Java handheld units. These handheld devices run on an operating system built entirely in Java. This means that all development for these handheld units must be done using Java 2 Mobile Edition (J2ME). The Web browser on these handheld units can process WML and WMLScript if operated through a WAP gateway. (Appendix B discusses WMLScript in more detail.) If operating through a BlackBerry Enterprise Server gateway, or the BlackBerry Internet Browsing Service (BIBS) gateway, the BlackBerry Browser can also process HTML, cHTML, and XHTML pages. It can also process JavaScript and use style sheets in limited form if the handheld unit is running the BlackBerry version 3.8 or 4.0 software.

The first J2ME BlackBerry handheld units were built to connect to the Global System for Mobile Communications (GSM) cellular voice network and the data network that runs on top of GSM, General Packet Radio Service (GPRS). After a few models of the GSM/GPRS BlackBerry were released, RIM

designed J2ME BlackBerrys that ran on other cellular technologies such as Motorola's Integrated Digital Enhanced Network (iDEN) and Code Division Multiple Access (CDMA).

All of the C++ handheld devices have monochrome displays, while the J2ME handheld units feature either monochrome or color displays. The handheld devices with monochrome displays have a screen resolution of 160 × 160 pixels, while the color devices range in screen resolution from 160 × 240 pixels to 240 × 260 pixels.

The actual physical size of the screen may not always convey the screen resolution or bit density. For example, the BlackBerry 5790 and 6710/6720 models have large screens, but the actual bit density is 160 × 160 pixels. The BlackBerry 7700 series has the same physical screen dimensions, but the bit density is 240 × 240 pixels. The BlackBerry 7100 series has an even more tightly packed bit density, squeezing 240 × 260 pixels into a physical screen that is actually smaller than the older BlackBerrys.

Besides BlackBerry handheld devices made by RIM, you can purchase handheld units from other manufacturers that have the BlackBerry Connect or BlackBerry Built-In technology. *BlackBerry Connect* is software that can be loaded onto a cellular telephone or other wireless device that allows it to be used as a BlackBerry. The native e-mail, calendar, and address book applications on the handheld units are used, but the transport mechanism is provided by BlackBerry.

The BlackBerry Connect software allows the user of the handheld device to have the BlackBerry experience of real-time push e-mail and real-time Personal Information Manager (PIM) synchronization while utilizing the handheld device's native applications.

The *BlackBerry Built-In* technology is software that is built into the ROM of a telephone that allows it to use the BlackBerry software normally running on a real BlackBerry handheld device. The end result of this is that the user can have a telephone or handheld device that is not a BlackBerry, but still enjoy the BlackBerry experience of always-on push e-mail and real-time PIM synchronization.

The advantage of these two technologies to the BlackBerry administrator is that he or she will not have to learn how to support new handheld or telephone devices. The BlackBerry Enterprise Server (BES) will treat all handheld devices the same, and all management techniques will apply, no matter what kind of hardware is being used by the end user.

BlackBerry Enterprise Server

The BlackBerry Enterprise Server (BES) is a service that works with a Lotus Domino Server, Microsoft Exchange, or Novell GroupWise mail server. The BES is a critical part of the BlackBerry infrastructure. Without it, secure access to corporate e-mail (including PIM data) would not be possible. The BES performs many functions and some of them are handled by the following BES components:

- ❑ BlackBerry Dispatcher
- ❑ GroupWise Connector (Novell GroupWise-specific)
- ❑ BlackBerry Attachment Service
- ❑ Mobile Data Service (MDS)

- ❑ BlackBerry Router
- ❑ Configuration Database
- ❑ BlackBerry Messaging Agent
- ❑ BlackBerry Synchronization Service

Let's take a look at these in more detail.

BlackBerry Dispatcher

The BlackBerry Dispatcher encrypts and compresses all data that passes between the BlackBerry handheld units and the BES. Incoming data is unencrypted, then uncompressed, and finally passed to the appropriate BES component. Outgoing data is received from the BES component, compressed, encrypted, and passed to the BlackBerry Router to be delivered to the BlackBerry handheld unit through the BlackBerry NOC.

GroupWise Connector

The GroupWise Connector is specific to the Novell GroupWise BES. A trusted application key is generated against the primary GroupWise domain. This key is then used by the GroupWise Connector to authenticate with GroupWise. The GroupWise Connector's function is to monitor all users' mailboxes and collect PIM and e-mail changes. Any PIM or e-mail that must be sent to the handheld device is placed in a work queue table that resides in the Configuration Database. This extra table within the Configuration Database is specific to Novell GroupWise and does not exist in the Lotus Domino or Microsoft Exchange Configuration Databases.

BlackBerry Attachment Service

The Attachment Service is an NT service that takes care of handling all aspects of viewing attachments on the BlackBerry. If a user receives an e-mail that has one or more attachments, the BES does not send these attachments to the user's handheld device with the message. Instead, it places a flag in the message that indicates to the user and the operating system on the handheld device that there are attachments. In addition to the attachment flag, the BES also places the names of the attachments in the message.

If the user wants to view the attachments on the handheld unit, he or she can request to open the attachment. Upon this request, the handheld unit sends data back to the BES indicating that the user would like to open a particular attachment. The BES goes back to the user's mailbox, retrieves the e-mail, extracts the attachment into a particular directory, and asks the Attachment Service to process the attachment.

Like many other wireless devices, a BlackBerry handheld has a limited amount of memory. Therefore, the BlackBerry does not have the capacity to receive a full attachment. Because of this, it is the job of the Attachment Service to reduce the attachment down to a very small size, but still retain enough of the formatting to make it worth viewing on the handheld device.

The Attachment Service employs many techniques to achieve this. For example, if the attachment is a Microsoft Word document, the Attachment Service performs a binary conversion of the document into

the *Universal Content Stream* (UCS) format. UCS is an efficient, proprietary format that is optimized for wireless delivery. It supports text, image, vector, and hybrid content. Any text content retains most of its original formatting. These rich text files are much smaller than a Microsoft Word document, since they do not contain any of the Microsoft Word formatting data. However, the resultant UCS file does contain minimal formatting, which includes bold, italic, and underline text.

After the attachment has been sufficiently processed, the Attachment Service informs the BES that it is ready. The BES takes the processed attachment and sends it to the user's handheld device with a flag that references the original message to which it was attached.

Any images embedded in the document are stripped out. However, in the case of Microsoft Word documents, a flag indicating their presence will be placed into the attachment viewed on the handheld unit. This enables the user to request these images separately if desired.

If the attachment is an image, or if the user wants to view an image that is embedded in another document, the same process will be followed. This time, the Attachment Service simply reduces the physical size of the image to conform to the BlackBerry handheld unit's screen size and resolution (160×240, 240×240, or 240×260).

Because attachments can be very big and complex, the Attachment Service can produce large CPU spikes on the server as it distills through attachments.

Mobile Data Service

Mobile Data Service (MDS) is a secure conduit that exists between all BlackBerry handheld units and their home BES. Data is sent from MDS to the BES, which sends it to the handheld units. Returning data is sent to the BES and then on to MDS.

You can also think of the MDS as an HTTP and TCP/IP proxy with special features. These special MDS features allow developers to easily push content out to the BlackBerry handheld devices. For example, a developer can write an application to send what is called a *channel* out to a handheld unit without knowing anything about the handheld unit itself. All the developer does is create two icons and a Web page, post them all on a Web server, and issue a `POST` command to the MDS service with certain parameters. The MDS service takes care of fetching the icons and the Web page, as well as pushing them to the handheld device as a channel through the BES.

The original name of MDS was actually *IP Proxy*, and thus the reason that the protocol used is called IP Proxy Protocol (IPPP). It is an IP Proxy, more specifically, an HTTP and TCP/IP proxy.

We will cover all the ways that you can use MDS later, because this is a very powerful component of the BlackBerry architecture. In Chapter 9, we will cover MDS in greater detail, while in Chapter 10 we will discuss how to use MDS to your advantage by building an intranet portal that is accessible from the BlackBerry. In Chapters 11 and 12, we will learn about the different special MDS features that allow you to easily push content out to BlackBerry devices.

After MDS has been enabled for a particular BlackBerry user, he or she will see a new icon on the handheld device called *BlackBerry Browser* (although this can be renamed later by the administrator). If the

user uses the BlackBerry Browser to view Web pages on the BlackBerry, he or she is unknowingly using MDS. This is because the requests for the Web pages go from the handheld unit to the BES to MDS. The MDS service forwards the requests to the internal IP infrastructure to be processed.

If the request is for an internal intranet Web site, it is dealt with inside the company's intranet. However, if the request is for an external Web server, it will be forwarded out of the firewall and onto the Internet. When the data from the request returns, it goes back to the MDS, which sends it to the handheld device through the BES. This small feature alone can allow you to create an internal mobile portal that users can access from anywhere in the world.

BlackBerry Router

The BlackBerry Router is an NT service that facilitates the idea of Least Cost Routing (LCR). You can think of the BlackBerry Router as a broker. It ensures that the data is going between the handheld devices and the BES along the fastest path possible.

When the handheld device is communicating over the cellular data network, the BlackBerry Router will know this and will send data to the handheld unit over that network. If the handheld device is plugged into a USB or serial port on a PC on the internal network, the BlackBerry Router will stop routing data over the cellular network and start using the internal LAN to route data. If the handheld device uses WiFi, it will use the internal WiFi network to route all data and will facilitate all Voice over IP (VoIP) calls to and from the handheld unit.

This feature offers many advantages, especially when the BlackBerry user is communicating on a cellular network that does not implement a flat fee for data, or is communicating on a network where the user's company has chosen not to purchase a flat-fee data plan. When the handheld device is communicating on the internal network, no data is sent or received over the cellular network. This saves the user (or the company) money on cellular data charges.

This feature also allows BlackBerry administrators to provision new devices either wirelessly or on a LAN. It also allows administrators to distribute new handheld applications by either forcing the user to be connected to the LAN to receive the application, or by allowing the user a choice of whether to receive the application over the air or while connected to the internal LAN.

Configuration Database

The Configuration Database is a database that contains all configuration data for each BES component, BlackBerry user, and handheld device. Today, this database can exist on either a Microsoft SQL database server or on a Microsoft Database Engine (MSDE) server. Future releases of the BES may use IBM DB2, Oracle, or other database servers.

The information contained in the configuration database includes the data obtained during wireless backups of the handheld unit and all configurations for the user (including the handheld signature, e-mail filters, handheld ribbon positions, asset trail information about each handheld device, and more).

You can design your BlackBerry infrastructure in such a way that all of your BESs communicate with the same Configuration Database. This is advantageous because it allows you to move users between BlackBerry Enterprise Servers very easily, set a global IT policy that applies to all of your BlackBerry

users, and query one database to see asset trail information on every handheld device in your organization. IT Policies are very powerful and they allow you to control every aspect of the user's handheld experience. We will discuss the IT policy in greater detail in Chapter 2.

If you design your infrastructure in this way, you must remember that currently the BES 4.0 servers do not function if you enable two-way SQL replication. This means that you must designate one SQL server to be used exclusively for all administrative functions. If the connections between your offices are too slow or too congested, you may choose to design your infrastructure so that each office has its own SQL server. If the offices are small, you may even choose to use MSDE instead of a full-blown SQL server. In this scenario, you would not be able to move users between BES servers at all. There would be no way to have a global IT Policy, but the IT Policy would have to be unique to each office. The asset trail information would pertain to only the handheld devices in that office. So, if your company needed to keep track of all handheld devices no matter which office they were in, you would need to query the Configuration Databases in each office and build one combined list manually. In future BES releases, RIM will add support for two-way SQL replication. Once this is available, the design of your BlackBerry infrastructure will be simplified.

Neither of the described implementation scenarios is right or wrong. You must determine the best fit for your organization according to your requirements and network topology.

In a Novell GroupWise environment, the Configuration Database includes a work queue. This work queue is used for all interactions between the BES and the user's mailbox. Because of this, the Configuration Database is unique to each BES and each BES can only have one configuration database. Multiple BESs cannot share one database.

BlackBerry Messaging Agent

Depending on the e-mail system, the BlackBerry Messaging Agent (BMA) either continuously scans users' mailboxes looking for new unread e-mail, scans the work queue in the Configuration Database for new items, or it receives a Messaging Application Programming Interface (MAPI) notification through a User Datagram Packet (UDP) from the mail server telling it that new mail has arrived. Once it receives the MAPI notification (or if it finds new, unread e-mail during a scan of the user's mail files or the work queue table), the BMA sends a copy of the e-mail to the BlackBerry Dispatcher. Here the first 2 KB of information is extracted, compressed down to approximately 1 KB, encrypted, and sent to the user's BlackBerry handheld unit. If that e-mail contains one or more attachments, the BMA places a special flag in the e-mail and inserts the attachment names.

If a user receives an e-mail with one or more attachments, the user can request to open the attachment. When that request is received from the user's handheld unit, the BMA goes back to the user's mailbox (or in the case of Novell GroupWise, the BMA places the request in the work queue table for the GroupWise Connector), retrieves the original message, extracts any attachments, and passes the attachments to the Attachment Service for processing. After the attachments have been processed, the BMA will send the resultant rich text of the attachments to the user's handheld unit. The attachments are formatted using the UCS format.

If the user forwards an e-mail from the handheld unit, the BMA returns to the user's mailbox, retrieves the original message (including any attachments), appends the forwarded text (if any) to the e-mail, and sends it using the normal mechanisms of the e-mail system. At the user's request, it will also place a

copy of the e-mail in the user's Sent folder. In the case of Novell GroupWise, the BMA will return a request to the work queue and the GroupWise Connector will retrieve the original message.

If the user does a reply to an e-mail, the attachments are never sent. RIM decided to do this with replies because it is assumed that all of the recipients already have the attachments.

The BMA also monitors the user's calendar and looks for new entries. In the case of GroupWise, the BMA monitors the work queue looking for pending calendar entries. If the BMA finds new calendar entries, it takes a copy of the new entry and sends it to the BlackBerry Dispatcher, where it is compressed, encrypted, and sent to the user's BlackBerry handheld unit.

Since the user can create new meetings and appointments on the handheld unit, the BMA will receive this data and make the necessary changes to the user's calendar. It will also send out any meeting requests, meeting acceptances, or denials. In the case of GroupWise, the BMA places these changes in the work queue. The GroupWise Connector then makes the changes in the user's calendar.

BlackBerry Synchronization Service

The BlackBerry Synchronization Service (BSS) allows a user's Memo Pad (Journal in Lotus Notes, Notes in Outlook, or Posted Note in GroupWise), Personal Address Book, and Tasks to be wirelessly synchronized with his or her BlackBerry handheld device. Like the other BES components, the BSS sends and receives all data via the BlackBerry Dispatcher, which compresses, encrypts, and sends outgoing data, as well as de-encrypting and decompressing all incoming data.

BlackBerry Network Operations Center

All communications between the BES and the BlackBerry handheld device go through the BlackBerry NOC.

Each cellular carrier that supports the RIM BlackBerry sets up a secure Virtual Private Network (VPN) connection between the carriers' data centers and the BlackBerry NOC. All communication between the BlackBerry handheld units and the BlackBerry NOC is securely transmitted through these VPN connections.

All BlackBerry Enterprise Servers have a unique Server Relay Protocol (SRP) ID. This number identifies them to the BlackBerry NOC. When the BES sends data to the BlackBerry NOC, it is sent over the Internet as Triple Data Encryption Standard (3DES) encrypted data. 3DES (pronounced triple DES) encryption is based on the DES algorithm developed by IBM in 1974. Three 64-bit keys are used in 3DES. The data is encrypted with all three keys one after the other.

With BlackBerry 4.0, 3DES and Advanced Encryption System (AES) are now supported. AES is a block cipher algorithm adopted as a data encryption standard by the United States Government for information up to Top Secret level when it is encrypted using 192-bit or 256-bit key lengths. When you set up your BES, you can choose whether to support one or both encryption methods.

All BlackBerry handheld devices have a unique Personal Identification Number (PIN). This number identifies them to the BlackBerry NOC and the BES. All BlackBerry handheld units have a Service Book entry that identifies the SRP ID of their home BES. When a BlackBerry handheld unit is turned on, or

when it comes into wireless coverage, it identifies itself to the BlackBerry NOC. At that point, the BlackBerry NOC knows how to communicate with it. More specifically, the BlackBerry NOC knows which cellular carrier the handheld unit is on, and, therefore, which VPN connection to use to communicate with the handheld device.

If a handheld device is roaming to a foreign cellular carrier, and that carrier has a GPRS Roaming Exchange (GRX) roaming agreement with the handheld device's home carrier (even if the roaming carrier does not support the BlackBerry), the handheld unit will be able to connect to the BlackBerry NOC. More specifically, the data from the handheld unit will travel to the roaming carrier's data backbone network, then to the home carrier's backbone network, and finally to the BlackBerry NOC through the VPN connection.

When the BES sends data to the user's handheld device, it already knows the PIN of the handheld unit. It addresses the data to the PIN, as opposed to the user's e-mail address or name. When the BES sends the data to the handheld unit, it actually sends it to the BlackBerry NOC. The BlackBerry NOC already knows where to find the handheld device and relays the data to it. If the handheld unit is out of coverage, the BlackBerry NOC queues the data and sends it when the handheld device is once again connected.

Data Network

The Data Network is the network that allows the BlackBerry handheld units to communicate. In the beginning, these networks were data-only networks called Mobitex (BellSouth/Cingular) and DataTAC (Motient).

As mentioned earlier, the first BlackBerrys were data-only devices. The Mobitex and DataTAC networks were (and still are) slow data networks specifically designed for small amounts of live data. In addition to BlackBerrys, they support devices such as soda vending machines that send current stock information to their manufacturers.

All data on the Mobitex and DataTAC networks are layer 2 of the Open Systems Interconnection (OSI) Model, also known as the Media Access Control (MAC) layer. This means that there is no layer 3 (also known as the Network layer) protocol such as the Internet Protocol (IP). All communication between the BlackBerry NOC and the handheld device is done using the device's MAC address, which is its unique PIN.

Later, RIM created BlackBerry devices that operated on cellular networks. The most popular and widely used cellular network by far is the GSM network. The GSM technology is used in about 70 percent of all countries around the world, and so it made sense for RIM to create GSM BlackBerry devices.

The data layer on the GSM network is GPRS. All data on the GPRS network is IP traffic, and it is this network that the BlackBerry handheld units use.

All communications on these networks is done with IP. The data networks take care of ensuring that the IP communications do not become interrupted when the handheld device is carried by the user when he or she travels. Applications on the handheld unit simply see a constant layer 3 IP network. However, as the handheld user travels between cellular communications towers, the communication data must be

handed off from tower to tower while maintaining the IP connection. This is done quite elegantly in most cases. On GSM networks, which are based on Time Division Multiple Access (TDMA) technology, the handoffs are hard. On CDMA networks, the handoffs are soft. A *hard handoff* occurs when an existing connection to a base station is closed before a new connection has been opened. A *soft handoff* occurs when a new connection to a base station is opened before the previous connection has been closed. Technically speaking, it is more likely that a call or data connection will be dropped when hard handoffs are used.

Putting It All Together

Figure 1-2 shows how the different components of the BlackBerry 4.0 platform communicate with each other and the mail servers in a Lotus Domino mail environment. It also shows how the data flows out from the different BlackBerry components, through the BlackBerry Dispatcher, then to the BlackBerry Router, and finally on through the firewall and to the handheld.

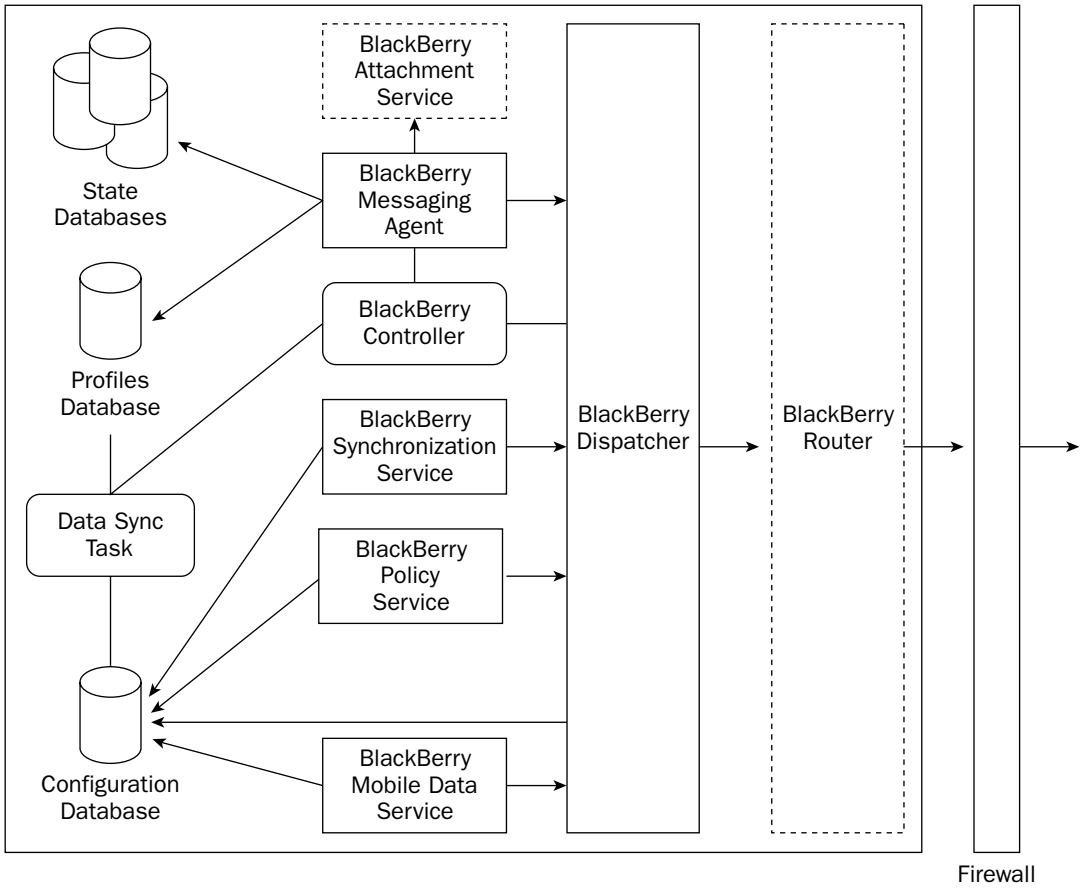

Figure 1-2: The Lotus Domino BES Components

Figure 1-3 shows how the different components work together in a Microsoft Exchange e-mail environment.

Figure 1-4 shows the different components in the Novell GroupWise e-mail environment. Note the addition of the GroupWise Connector and its interaction with the Configuration Database.

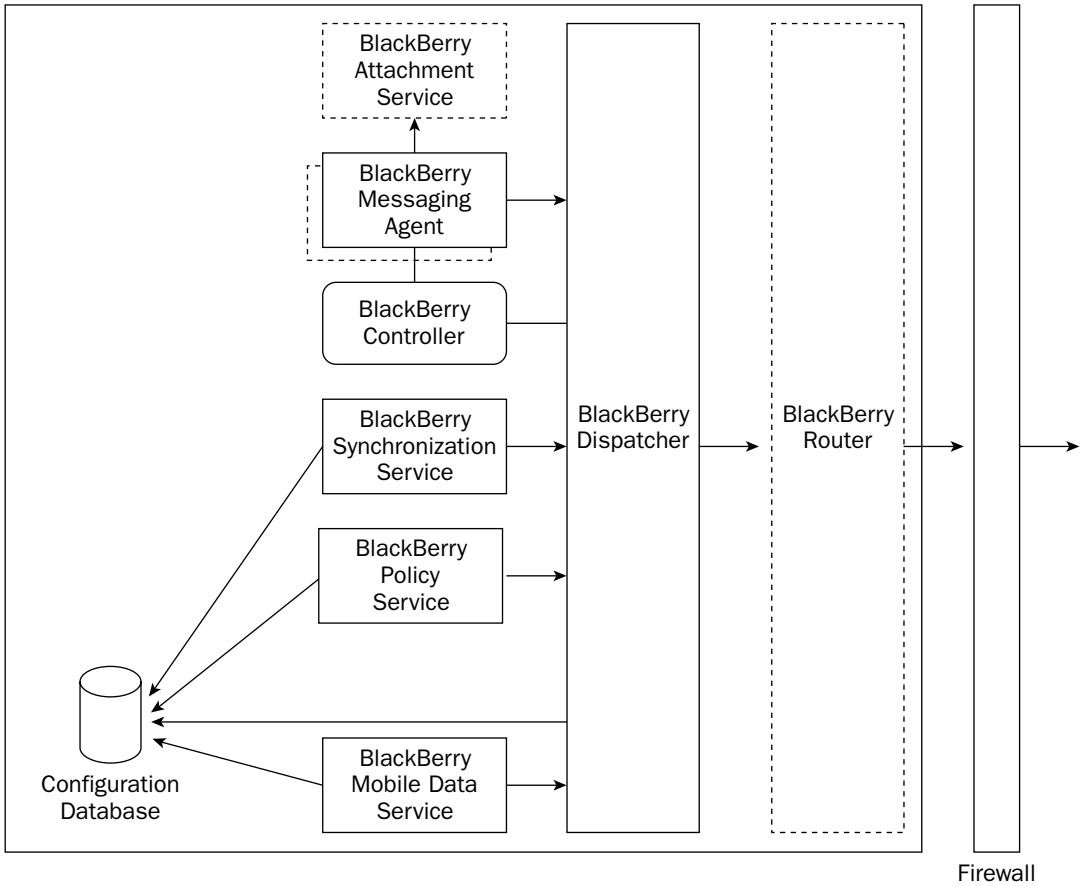

Figure 1-3: The Microsoft Exchange BES 4.0 Components

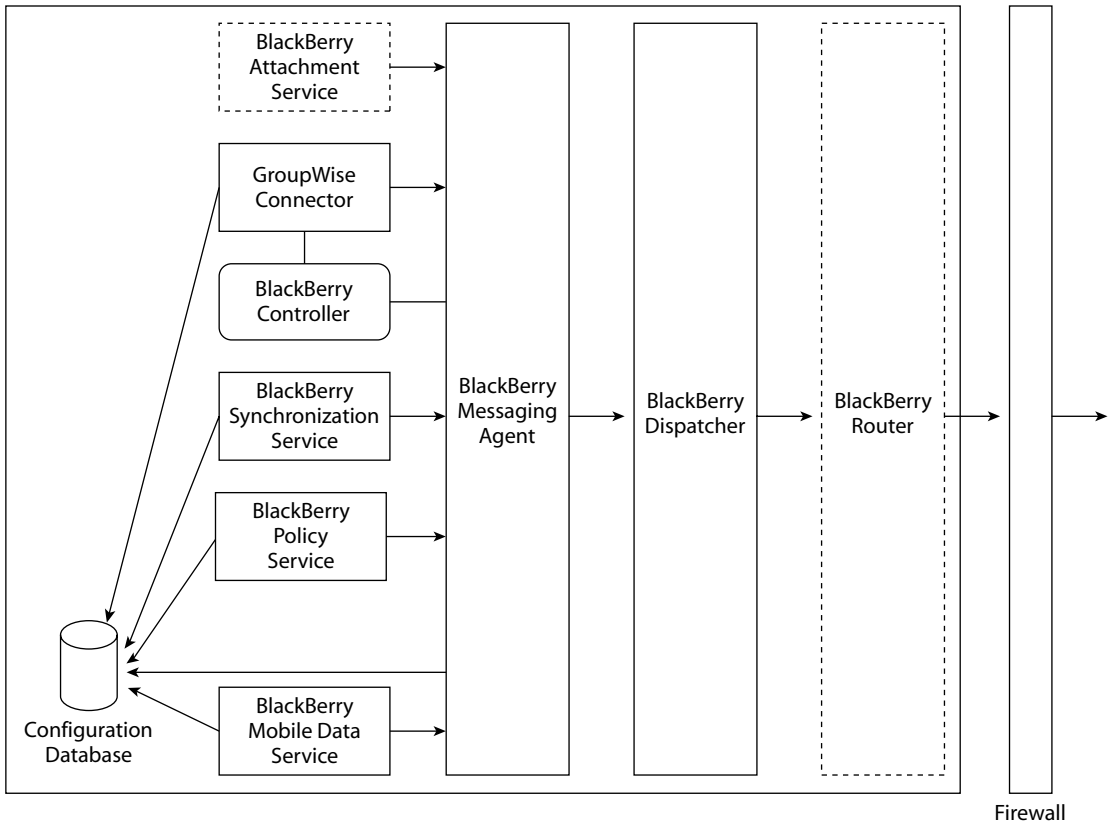

Figure 1-4: The Novell GroupWise BES 4.0 Components

Legacy Architecture (Versions 2.2 and 3.6)

When BES 4.0 shipped, it added support for Novell GroupWise and also added many new features to the BlackBerry experience. Depending on whether you were using the Lotus Domino version or the Microsoft Exchange version, the number of new features differed. However, one of the main aims of BES 4.0 was to match the feature sets between all mail platforms.

Differences Between BES 4.0 and Older BES Versions

If you are running the Lotus Domino version of the BES, you may still be using the pre-4.0 version (BES 2.2). If you are running the Microsoft Exchange version of the BES, you may be using the pre-4.0 version (BES 3.6). The Microsoft Exchange BES 3.6 has a few more features than the Lotus Domino BES 2.2.

The main differences between Microsoft Exchange BES 3.6 and Lotus Domino BES 2.2 are in the area of read/unread flags and IT Commands. While Exchange BES 3.6 wirelessly synchronized the read/unread flags for e-mails, Domino BES 2.2 did not. Exchange BES 3.6 also allowed for the use of IT Commands

(which are commands that could be sent to the handheld units from the BES, such as a command to erase all handheld data, or to change the password for the handheld device if the user forgot it). Domino BES 2.2 did not allow these IT Commands. When BES 4.0 shipped, all features were offered on all BES platforms.

The pre-4.0 Domino BES infrastructure is also missing the BlackBerry Router and the capability to use an SQL server for the Configuration Database. The Configuration Database is completely absent and the Domino database (called BlackBerry Profiles) is used to store all user configuration.

Putting It All Together

Figures 1-5 and 1-6 shows how the different BlackBerry components work together with the e-mail system and how they communicate with the handheld units.

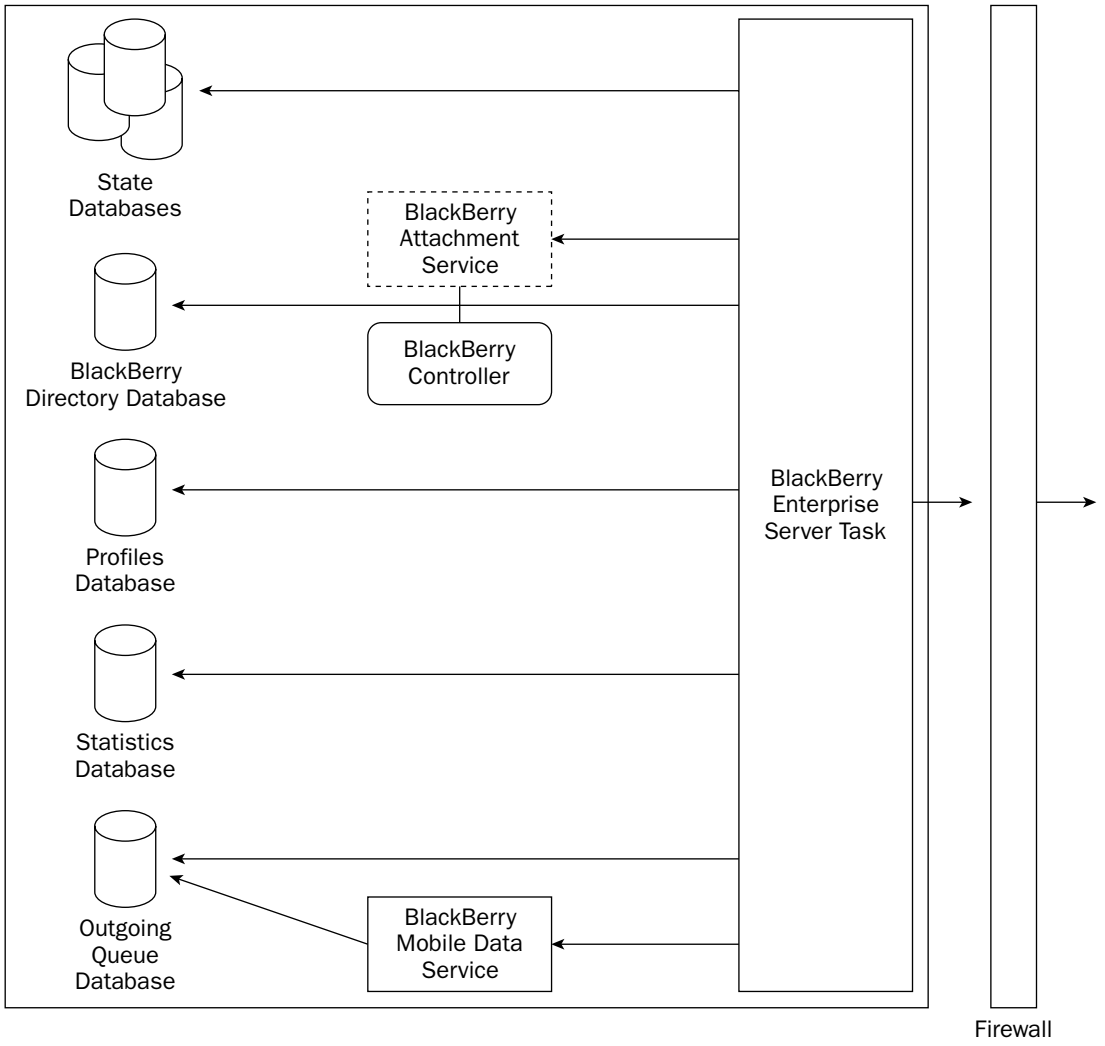

Figure 1-5: Lotus Domino BES 2.2 Components

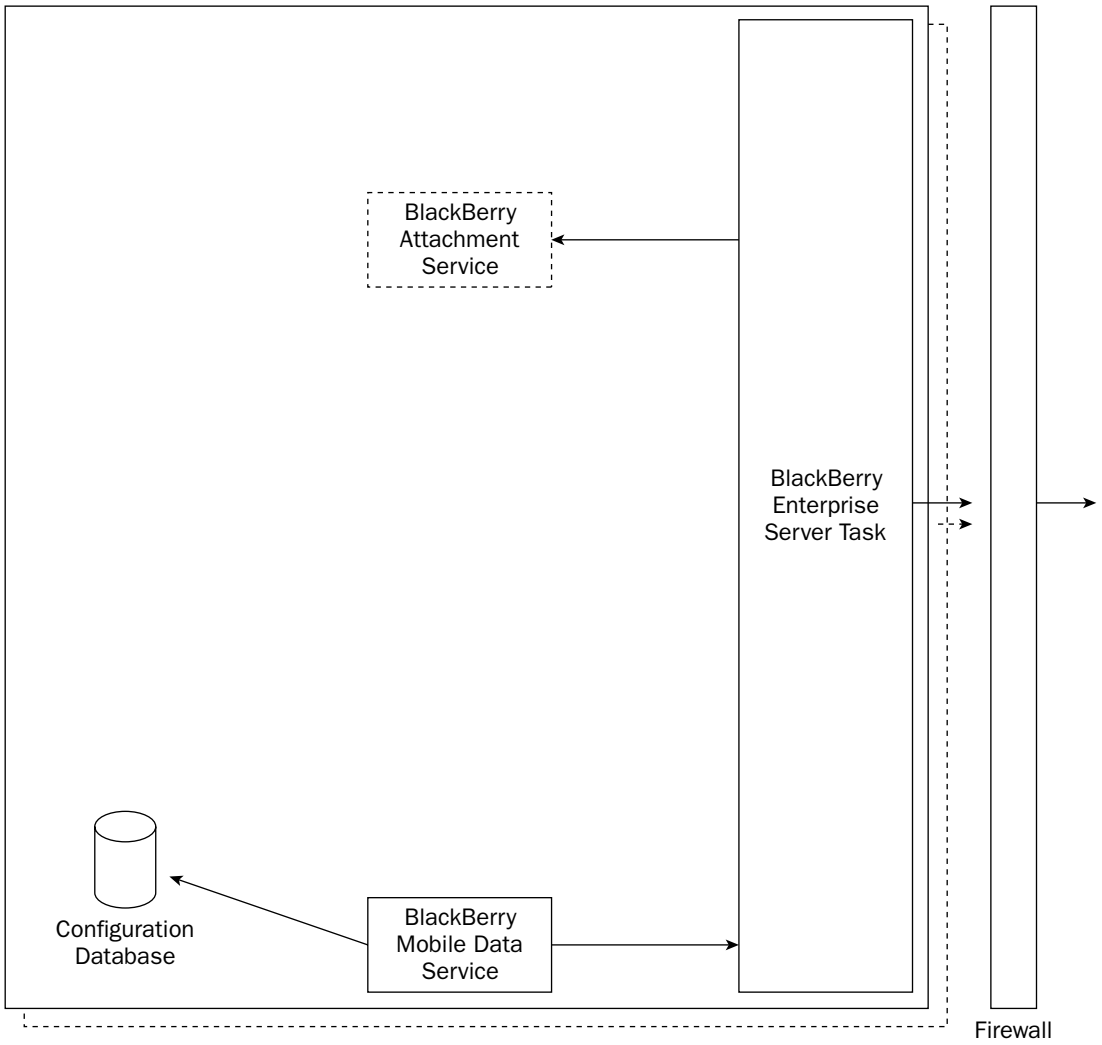

Figure 1-6: Microsoft Exchange BES 3.6 Components

Mail System-Specific Differences

No matter which e-mail system your BES is operating in, all of the components are the same. However, there are small differences in how some of the components are implemented.

In a Lotus Domino environment, the main BES component runs as a Domino add-in task. Much of the user configuration information in pre-4.0 BES is kept in a Domino database called the BlackBerry Profiles. To keep accurate track of data that is on the network (for example, in the user's mail file) and on the

handheld device simultaneously, the Domino version of the BES makes use of a State Database. Each BlackBerry user has a State Database that is created on the BlackBerry server. When the BlackBerry user replies to an e-mail on the handheld unit or forwards an e-mail, the BES must look in the user's state database to figure out how to go back to the mail file to retrieve the original message. In the pre-4.0 BES, the State Database held pointers for calendar entries, e-mails, and folders within the user's mail file that the BES had processed.

In BES 4.0, the State Database also keeps track of the user's personal outgoing queue. This means that the State Database now keeps track of any messages that have been sent to the user's handheld device, as well as their status (sent, pending, failed). This function was previously handled in the pre-4.0 BES by a single outgoing queue database for all BlackBerry users. The State Database also keeps track of pointers between the user's `journal.nsf` (Notes Journal), `names.nsf` (personal address book) files, and Tasks or To-Dos and the handheld.

As mentioned before, the Novell GroupWise BES 4.0 operates slightly different than the other two BES implementations. The GroupWise BES resides on a Windows server along with the GroupWise Client 6.5.4 or later. All interactions with the user's data are done through the GroupWise Connector. The BES uses a unique work queue table within the Configuration Database (BESMgmt) for all transactions and, because of this, the BESMgmt database cannot be shared among multiple BlackBerry Enterprise Servers.

Summary

So far, you have learned about the architecture of the BlackBerry environment. You know that there are many components working together to provide the BlackBerry experience.

The BlackBerry NOC is the heart of the architecture because it facilitates the communication between the handheld unit and the BES. The BES has the most work because it is constantly looking for changes to synchronize between the handheld device and the mailbox. Working closely with the BES is the Mobile Data Service (MDS), which provides a secure conduit for applications to communicate between the corporate network and the handheld unit.

The Attachment Service acts as a "distiller" that provides a way to view attachments on a handheld device. The Configuration Database acts as the dumping ground for all user configuration data and a place for the wireless backups to be stored.

The Data Network provides the necessary transport that allows the handheld unit to communicate while the user is out of the office. Finally, the BlackBerry Router provides a "broker" service to ensure that the handheld device is always communicating with the BES using the fastest possible method.

In Chapter 2, we will cover how to plan your first BlackBerry installation. We will discuss topics such as how the BlackBerry platform communicates with your e-mail system and where to place the different BES components. We will go into detail about the IT Policy and will discuss both the new BES 4.0 and the older BES 3.6 and 2.2 versions.