



Technical White Paper BlackBerry Corporate Data Access

How BlackBerry extends the enterprise wirelessly

Research In Motion

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Introduction

This white paper provides an introduction to the BlackBerry™ architecture, and explains how you can use it as a platform for developing wireless enterprise applications. It is intended for technical readers who are already familiar with the BlackBerry solution for wireless email.

The BlackBerry platform for corporate data access consists of four key components:

- ◆ BlackBerry Wireless Handheld
- ◆ BlackBerry Enterprise Server with the Mobile Data Service for secure network access to the enterprise
- ◆ BlackBerry Browser for access to wireless web content and services
- ◆ BlackBerry Java Development Environment for custom application development

Unless otherwise stated, the information in this document applies to the following product versions.

Product	Versions
BlackBerry Wireless Handheld	Version 2.5 or later for Mobitex and DataTAC networks Version 3.2 or later for GPRS, CDMA, and iDEN networks
BlackBerry Enterprise Server	BlackBerry Enterprise Server for Microsoft Exchange version 3.5 or later BlackBerry Enterprise Server for Lotus Domino version 2.2 or later

Data access beyond email

BlackBerry eases the complexities of wireless networks so that you can focus on creating reliable, usable and cost-efficient applications that are independent of particular wireless networks. You do not need knowledge or expertise of wireless network communications. Instead, you can focus on what matters most — creating useful content and services for end users.

Extending the BlackBerry solution

The success of the BlackBerry solution for wireless email has demonstrated the important productivity benefits for mobile users who have continuous access to information when and where they need it. Two features that are central to the BlackBerry solution are:

- ◆ users have secure access to corporate email
- ◆ new email messages are sent to users' handhelds automatically, without users having to dial into the network or poll for new messages.

The BlackBerry solution now extends these central features to other types of corporate data. Mobile users can now have the same quick and easy access to other information and services that they now have with email. Application and content developers can now enable secure information exchange and collaboration between users in their organizations.

BlackBerry is already used successfully in areas such as sales force automation, field service, and law enforcement. The demand now is for increased connectivity options to support an ever-expanding variety of information.



Evolution of IT strategies

At the same time as wireless technologies have emerged, corporate computing has progressed through several distinct eras:

- ♦ Mainframe computers with online terminals gave users more immediate visibility of dynamic information.
- ♦ Client/server technology introduced more powerful ways to distribute information processing and sharing among many users.
- ♦ Internet technology provides much more ubiquitous information access, with many options for information management and presentation using an array of technologies and standards.

Using the fundamental building blocks of HTTP (for network connectivity) and XML (for content management and exchange), web services hold the promise of providing the next era of information exchange and collaboration in a mobile wireless environment. In this environment, any IT system must be flexible enough to support a diverse array of applications and legacy systems. These systems need to be extensible enough to support the IT infrastructure as it evolves.

Wireless considerations

Given the rapidly evolving world of wireless technology, the challenge has been to provide an effective platform for application and content developers to provide wireless information access. Such a platform must provide the following key features:

- ♦ a secure connectivity and information exchange
- ♦ a superior user experience, that overcomes inherent limitations of wireless networks through features such as automatic information alerts (push)
- ♦ uniform information access and exchange, providing a consistent mechanism for global reach, regardless of the underlying wireless technology
- ♦ extensibility, to deliver an increasingly rich user experience as technology and capabilities continue to evolve
- ♦ maintainability, to minimize cost of ownership by providing consistent and effective management of handhelds, applications, and data

The realities of these demands have only now culminated in a platform that can provide organizations and users the freedom of mobility they require.

Meeting corporate needs

By extending the capabilities of the widely accepted BlackBerry solution, Research In Motion® now provides an increasingly global wireless platform that organizations can use to deploy additional applications and content to their users.

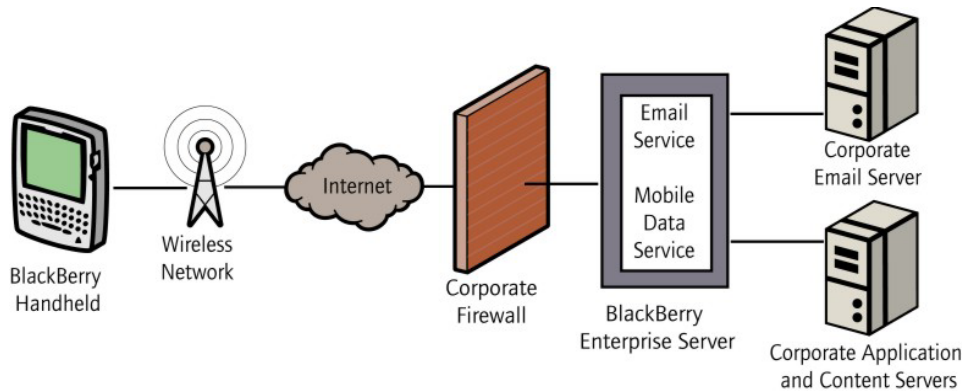
The key elements of this platform range from the increased application and content abilities of the handheld through to the new Mobile Data Service connectivity feature of the BlackBerry Enterprise Server, all of which provide the necessary technology for more effective mobilization of data.

This white paper provides an overview of the components of the BlackBerry solution and their capabilities, and demonstrates RIM's commitment to providing the best wireless solution platform for today's needs.

Extending the enterprise wirelessly

BlackBerry is a leading wireless email solution and has been deployed in thousands of organizations. You can now use this same proven platform to extend enterprise systems wirelessly, providing secure, mobile access to critical corporate data and applications.

The BlackBerry solution combines a highly usable handheld, wireless network, and back-end server software to provide seamless mobile access to the enterprise.



BlackBerry architecture

BlackBerry handheld

The BlackBerry Wireless Handheld™ combines advanced wireless technology and innovative design to create a superior user experience. Its lightweight design, long battery life, and integrated wireless modem make the handheld ideally suited for mobile users.

The BlackBerry Wireless Handheld was designed specifically for data services. It has an intuitive, menu-driven interface, an easy-to-read screen, a standard keyboard, and a thumb-operated trackwheel for easy navigation.

BlackBerry users are always connected to the network. Users do not have to dial in, and new data can be sent out to users automatically. You can use this same push model for your own applications by sending out critical enterprise data to users as it becomes available.

BlackBerry handhelds provide a wide range of options for giving mobile users access to corporate data and applications. A fully-featured, graphical Browser enables you to provide wireless access to web content. On BlackBerry handhelds that support GPRS, CDMA, or iDEN networks, standard Java support enables you to add custom corporate applications to the handheld.



BlackBerry wireless service

The BlackBerry solution is deployed by carriers around the world on advanced wireless networks. The BlackBerry service provides a single, reliable connection from the corporate network to multiple wireless networks. The BlackBerry service includes a high-quality connection between the wireless and wired networks to minimize the issues of intermittent connectivity, poor reception, and network performance.

The BlackBerry infrastructure provides the following key features:

- ◆ **Reliable delivery**

The BlackBerry solution delivers pending enterprise data to users as soon as they are in an area of sufficient wireless network coverage. This capability minimizes the impact of intermittent connectivity or network reception on your applications.

- ◆ **Managed connections**

The BlackBerry solution manages multiple, geographically diverse connections to multiple wireless networks. As a result, enterprises can deploy a variety of handhelds on different networks without added complexity. Applications can be network-independent.

- ◆ **Security**

Communication between the BlackBerry Wireless Handheld and the BlackBerry Enterprise Server in the corporate network is encrypted using the Triple Data Encryption Standard (Triple DES), based on a symmetric key that is unique to each handheld.

The BlackBerry solution converts between wireless and wired network protocols. The underlying wireless transport is hidden. As a result, you can develop wireless applications for BlackBerry that operate on multiple networks, using standard protocols, such as HTTP, for network communication.

Enterprise integration

The BlackBerry Enterprise Server is installed behind the corporate firewall to provide secure, end-to-end connections between mobile users' handhelds and the corporate network. It centralizes control of handhelds as well as the data that flows to and from them, within the enterprise. With the BlackBerry Enterprise Server in place, email and corporate data can be sent and received from handhelds within a controlled, secure environment.

All communication between the BlackBerry Enterprise Server and the wireless network, for both email and other applications, passes through the same point in the corporate firewall, so no additional configuration is required.

The BlackBerry Enterprise Server provides built-in support for various corporate email systems, as well as standard HTTP and TCP/IP interfaces to content and application servers on the corporate intranet or Internet.

Network communication

The handhelds support network communication using HTTP. Network communication has been abstracted so that the same HTTP connection can be used to send and receive data over the wireless network, regardless of the underlying protocols or network technology.

Because of the complexities involved in combining wired and wireless networks, the handheld cannot communicate directly with the Internet. It must connect using one of two gateways:

- ♦ BlackBerry Enterprise Server
- ♦ WAP gateway

BlackBerry Enterprise Server

The BlackBerry Enterprise Server is installed at each enterprise location to provide secure access to corporate intranets, as well as the Internet. Typically, if you are writing enterprise applications, you will use the BlackBerry Enterprise Server as your network gateway.

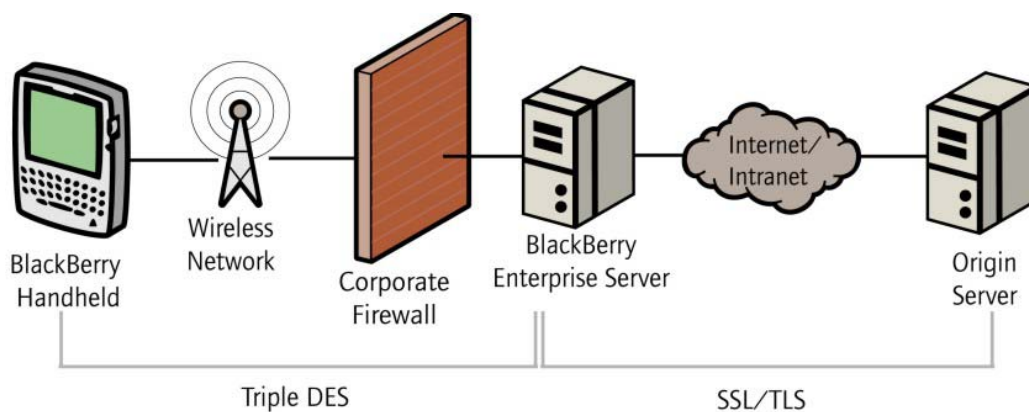
Note: You cannot host applications or services outside the enterprise using the BlackBerry Enterprise Server. To deploy services using an applications service provider (ASP) model, you can consider using a WAP gateway

The BlackBerry Enterprise Server uses the Mobile Data Service to provide HTTP connectivity between the wireless network and the enterprise intranet or Internet. The BlackBerry service maintains the connection between the handheld and the BlackBerry Enterprise Server, so you do not need to do anything special to set up an HTTP connection. Communication between the handheld and the corporate network uses the same Triple DES encryption that is used for the BlackBerry wireless email service. You can also use HTTP over Secure Sockets Layer (SSL) or Transport Layer Security (TLS) for additional security over the Internet.

When your application connects to the network using the BlackBerry Enterprise Server, communication between the handheld and the corporate network is Triple DES encrypted automatically.

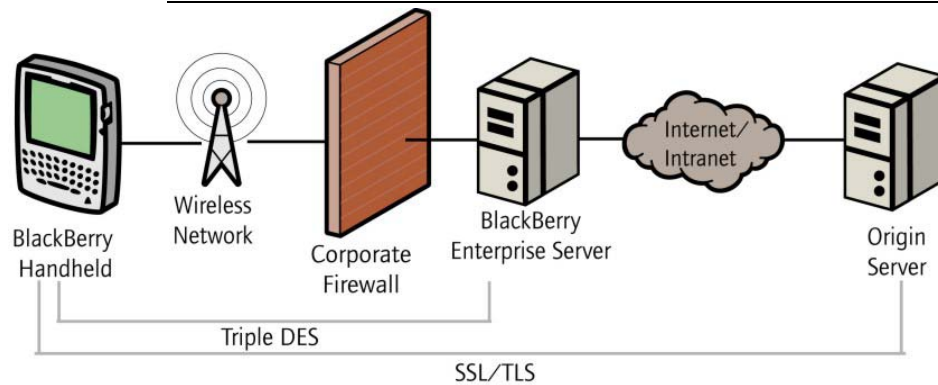
In addition, you can set up an HTTP connection over SSL/TLS. This provides additional authentication and security if your application is accessing servers on the Internet. The handheld supports HTTPS communication in one of two modes, on corporate security requirements:

- ♦ **Proxy SSL mode.** The BlackBerry Enterprise Server sets up the SSL connection on behalf of the handheld. Communication over the wireless network between the handheld and BlackBerry Enterprise Server is not encrypted using SSL, but it is still Triple DES encrypted. A point exists behind the corporate firewall where data is not encrypted.



SSL/TLS security: proxy mode

- ♦ **End-to-end mode.** Data is encrypted over SSL for the entire connection between the handheld and the origin server. This type of connection is very secure, because data is always encrypted.



SSL/TLS security: end-to-end mode

Which SSL option to use depends on the level of trust for the intermediate points in the connection. With proxy SSL, the user experiences faster response times, and but the corporate IT administrator must be trusted with the data. End-to-end SSL is appropriate when only the endpoints of the transaction are trusted (for example, with banking services).

Note: End-to-end SSL mode is supported only on BlackBerry handhelds with handheld software version 3.5 or later.

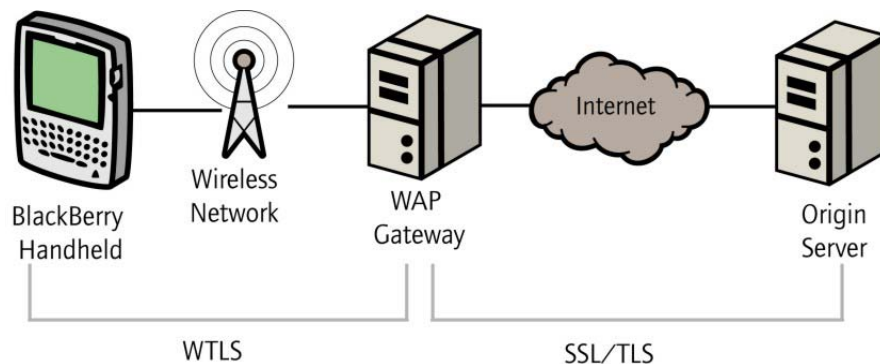
WAP gateway

Note: BlackBerry handhelds for the Mobitex and DataTAC networks do not support WAP gateways.

A WAP gateway can provide standard WAP access to the Internet. To use a WAP gateway, you must work with the network operator or service provider. The handheld supports WAP 1.1. WAP push applications are not supported. In contrast to connections using the BlackBerry Enterprise Server, communication is not encrypted between the handheld and the network.

Wireless TLS

If your application connects to the network using a WAP gateway, the handheld can use the Wireless TLS (WTLS) protocol for network security, if this is supported by the network operator or service provider. The handheld supports WTLS Class 2. The handheld supports both DES and RC5 encryption (40, 56, 64, 128 and 168-bit).



WTLS security

Communication over the wireless network between the handheld and the WAP gateway is encrypted in WTLS. Communication over the Internet between the WAP gateway and the origin server is encrypted in SSL or TLS.

The WAP gateway decrypts data that it receives from either the handheld or the origin server and re-encrypts it using the appropriate protocol. In the WAP gateway, at the network operator or service provider location, data is not



encrypted. This limitation, known as the “WAP gap”, means that you must trust the network operator or service provider with your data.

A closer look at the Mobile Data Service

As part of the BlackBerry Enterprise Server, the Mobile Data Service provides an optimized platform for mobile applications running on advanced wireless, packet-data networks by providing a secure gateway between the wireless network and corporate intranets and the Internet. The BlackBerry Enterprise Server provides four important functions for enabling wireless applications:

- ♦ network connectivity
- ♦ encryption
- ♦ data transcoding
- ♦ push support

Network connectivity

As part of BlackBerry Enterprise Server, the Mobile Data Service provides standard HTTP and TCP/IP connections from the handhelds to corporate intranets or the Internet. The use of standard protocols minimizes the need for you to learn or apply new connectivity techniques and allows new or existing corporate applications to be extended to BlackBerry handhelds easily.

The Mobile Data Service performs the necessary address translation to route data between the wireless and IP networks, so you do not need to worry about the details of addressing between various networks. The BlackBerry Enterprise Server maintains information about all BlackBerry users in the enterprise. For example, push applications can continue to send corporate data to specific users even when they change handhelds, SIM cards, or networks.

The Mobile Data Service supports multiple wireless networks and BlackBerry handhelds, which enables an organization to deploy and manage its wireless data applications on a single, consistent architecture.

Encryption

The BlackBerry Enterprise Server provides a secure, private connection between the enterprise and the handheld. Using Triple DES symmetric key encryption, data flowing between the handheld and the corporate network is fully encrypted. Data is not decrypted at any intermediate point.

As part of the BlackBerry Enterprise Server, the Mobile Data Service uses the same secure architecture. Your applications can use standard HTTP to access the corporate intranet, but sensitive corporate data remains confidential.

Data transcoding

As an HTTP proxy and transformation engine, the BlackBerry Enterprise Server can convert and process data that passes between handheld applications and the content server. With the Mobile Data Service, you can write plug-in transcoders to perform custom filtering that delivers content to the handhelds in the most efficient and appropriate format.

Push support

With the BlackBerry solution, users' handhelds remain continuously connected to the wireless network. Data can be sent without users having to request it explicitly. This push capability is fundamental to enabling wireless enterprise applications that can increase users' productivity and make efficient use of the network.

In the same way that the BlackBerry Enterprise Server sends new email messages to users' handhelds automatically, the Mobile Data Service enables you to write push applications that send new corporate content and alerts to specific users. Information can be delivered to the handheld as it becomes available; users do not have to initiate data exchange and download.



Data can be pushed to the handheld BlackBerry Browser or to custom handheld applications.

The BlackBerry application platform

BlackBerry supports two distinct application models to give you the flexibility to design sophisticated wireless enterprise applications:

- ♦ Browser
- ♦ custom Java applications

Creating Browser applications

The BlackBerry handheld includes the BlackBerry Browser, which provides secure access to corporate intranets and the Internet, using the BlackBerry Enterprise Server Mobile Data Service.

Standard Content Support

The BlackBerry Browser displays web content in standard web markup languages.

On handhelds for GPRS, CDMA, and iDEN networks, the Browser supports the WML 1.3 and compact HTML (cHTML) markup languages, and WMLScript 1.2. The Browser supports images in the following formats: monochrome WAP Bitmap, GIF, and PNG formats.

On handhelds for Mobitex and DataTAC networks, the Browser supports WML 1.3 and WAP bitmaps only.

Using the Browser

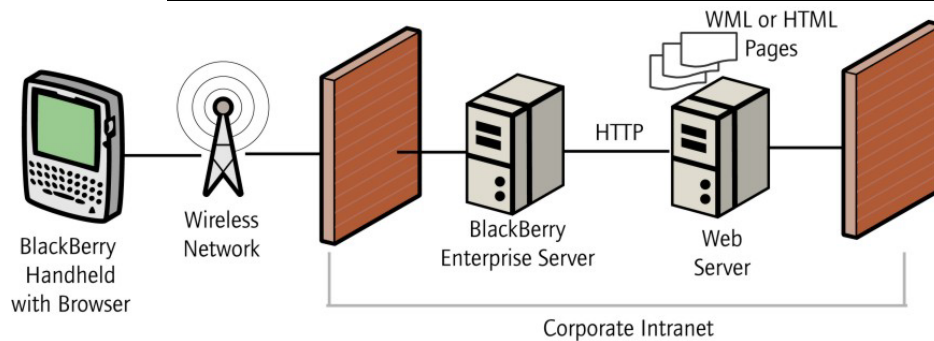
The Browser provides a standard way to display server-based content on the handheld. Developing applications using the Browser is easier and quicker than creating custom Java applications, and enables you to provide seamless integration of existing server-based content. Flexible support for multiple content types and security protocols provide many options for designing wireless web content and services. The Browser can provide secure access to corporate intranets using the same Triple DES encryption that is used for BlackBerry email. The Browser also supports HTTPS for additional security across the Internet.

Without any custom development, the BlackBerry solution enables mobile users to access web content on the intranet using the handheld Browser. Using the BlackBerry Enterprise Server, the corporate IT administrator configures Mobile Data Service and enables the Browser for users.

On a corporate web server, content developers create WML or compact HTML (cHTML) content. Users then use the handheld Browser to view this intranet content securely. The Browser stores web pages in its cache. After users have viewed pages on the intranet, they can view them again, even if they are not in an area of sufficient wireless coverage.

Using Basic Authentication, users can be authenticated before accessing the intranet. Web developers can create a web form with which users submit their user information, including a password.

How BlackBerry extends the enterprise wirelessly



Secure intranet access

The support for standard web content in WML or HTML means that you extend your existing web services wirelessly, and then use advanced capabilities of the BlackBerry platform, including push. In addition, no provisioning is required on the handheld, which makes it easier to deploy and maintain your application.

At the same time, the Browser approach has several limitations. In particular, most web services do not work well when the user is out of coverage, although you can mitigate this somewhat by using the Browser cache effectively. You cannot do any local processing, and the query-response model of HTTP means the network is used even for simple operations, which uses network airtime and can introduce delays for users. Moreover, the user interface is limited to what you can create using WML and compact HTML markup.

You can use the push capabilities of the BlackBerry solution to send data to users proactively. Web developers can write a server-side application that retrieves content from a web server, based on a specific trigger or time interval, and sends it to specific users through the BlackBerry Enterprise Server.

Writing custom handheld applications

For BlackBerry handhelds on GPRS, CDMA, or iDEN networks, you can develop your own custom Java applications using the BlackBerry Java Development Environment (JDE). Compared to using the Browser, custom applications provide a richer feature set, including customized user interfaces and navigation, robust data management, custom data transfer, and support for content beyond text. If you design your application carefully, you can perform local processing to minimize the use of network so that users can continue to use your application even when they are out of wireless coverage.

- ♦ The BlackBerry JDE provides a complete set of APIs and tools that you can use to develop custom Java applications. Standard BlackBerry applications for these handhelds are written in Java, so you can create a custom application that extends existing enterprise applications to BlackBerry for mobile users. In addition to full support for the Java 2 Micro Edition (J2ME) CLDC 1.0 and MIDP 1.0 APIs, the BlackBerry JDE provides powerful BlackBerry API extensions. Using the BlackBerry APIs, you can take advantage of advanced BlackBerry features, such as the user interface, multi-threading, internationalization, and more robust data storage, to integrate your applications into the BlackBerry user experience. You can also still write standard MIDP applications, called MIDlets, to run on the BlackBerry Wireless Handheld and other J2ME-enabled wireless devices.

The BlackBerry system hides the complexities of the wireless network, so that you can communicate with the network using standard TCP/IP and HTTP connections, regardless of the underlying wireless network. In addition to the standard HTTP support in MIDP, the BlackBerry implementation also supports HTTPS and sockets.

A complete development environment

The BlackBerry JDE includes the following items:

- ♦ integrated development environment (IDE)
- ♦ BlackBerry simulation tools
- ♦ Mobile Data Service simulation tools
- ♦ CLDC, MIDP and BlackBerry APIs
- ♦ sample applications

The integrated development environment (IDE) provides a full suite of editing and debugging tools that are optimized for developing BlackBerry applications. It provides a complete development environment for writing BlackBerry applications, with tools for editing, building, and debugging programs, and integrated simulation tools for the handheld and network gateway. The IDE provides many advanced features for writing, compiling, debugging, and deploying applications.

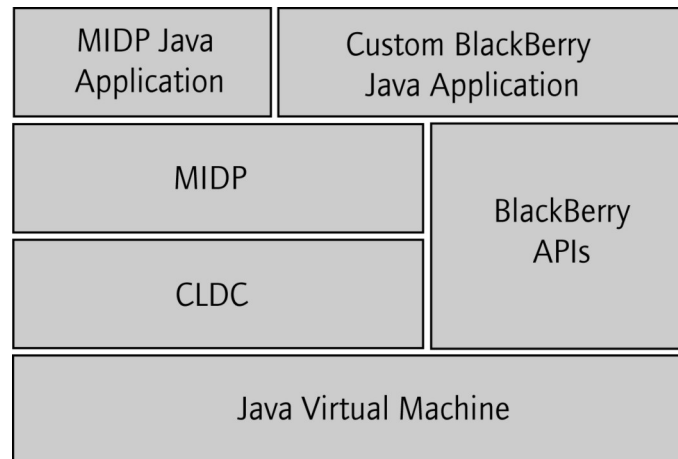
You can also use IDE tools to quickly convert existing MIDP applications, known as MIDlets, into the compressed byte code format required by the handheld.

You can download the BlackBerry JDE from <http://www.blackberry.com/developers>.

Overview of BlackBerry APIs

The BlackBerry Wireless Handheld provides a J2ME run-time environment based on the CLDC 1.0 and MIDP 1.0 specifications. In addition, BlackBerry API extensions provide additional capabilities and tighter integration with the BlackBerry handheld.

You can use both CLDC/MIDP APIs and the BlackBerry APIs in your application. If you want your application to run on any J2ME-enabled device, you can write standard MIDP applications using the CLDC/MIDP APIs. On the other hand, if you want to write a sophisticated enterprise application for the BlackBerry platform, you can use the BlackBerry APIs.



BlackBerry handheld software components

Adding push capabilities

Using either the Browser or a custom Java application, you can integrate push capabilities to deliver critical corporate data to your users proactively.

For example, instead of creating web content for users to retrieve, you can proactively send out critical data. Users do not have to connect to corporate servers to check for new content; instead, you can send an alert to the user when new content is available.

You can send web pages to the BlackBerry Browser in one of the three ways:

- ♦ **Message push** — Applications can push web pages to the handheld so that they appear as a Browser message in the handheld Messages screen, along with email messages. The pushed object includes either the content for display or only the URL for the Browser to fetch when the user requests it.
- ♦ **Channel push** — Applications can push web pages to the handheld that create or update “channels,” which appear on the handheld Home screen with a custom icon. This method effectively creates a Browser-based application on the handheld for regular updates of certain types of pushed data.
- ♦ **Cache push** — Applications can push web pages directly to the Browser’s persistent cache. There is no indication to the user that the content has been updated. The next time that the user visits the specified URL, the Browser retrieves the content from the cache. Pushing data to the cache enables users to access the content quickly, even when they are outside an area of sufficient wireless network coverage

Custom Java applications give developers even more flexibility for integrating push capabilities. Java applications give you the flexibility to receive and render many types of content, including web content, graphics, spreadsheets, or database content. You can write a server-side application that retrieves content from any corporate web or application server and sends it to the handheld.

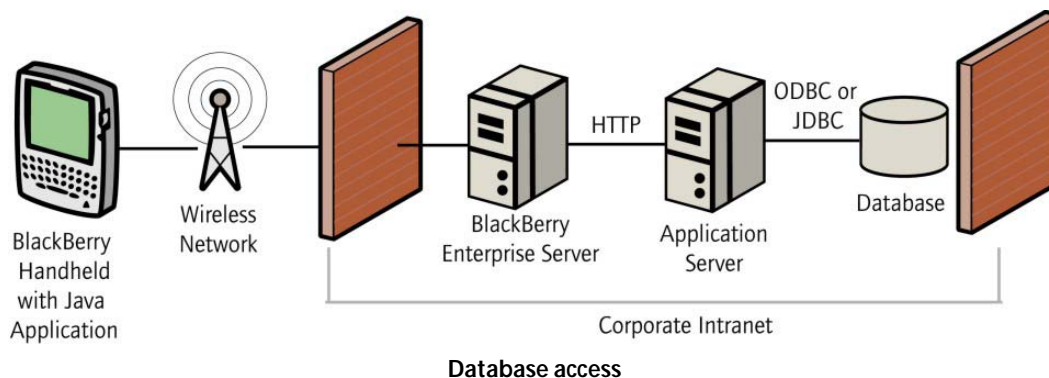
The BlackBerry Enterprise Server, with the Mobile Data Service, manages the flow of data from the push application to the handheld using the same encrypted channel that is used for all other BlackBerry communication. Your push application specifies users’ email addresses. With its central database of all BlackBerry users in an organization, the BlackBerry Enterprise Server directs content to the appropriate handhelds. The BlackBerry service manages the connection to the wireless network and verifies that content is delivered to users as soon as they are in an area of sufficient wireless coverage.

Examples of corporate applications

This section provides a few examples of how the BlackBerry system enables wireless enterprise applications.

Database access

Mobile users can access corporate databases using either the Browser or a custom or third-party Java application. Instead of connecting to the database directly, the handheld application communicates with an intermediate application behind the corporate firewall. This server-side application runs on web servers on the corporate network to provide a gateway to back-end database systems.



The handheld application establishes an HTTP connection with the back-end application or web server by specifying the appropriate URL.

How BlackBerry extends the enterprise wirelessly

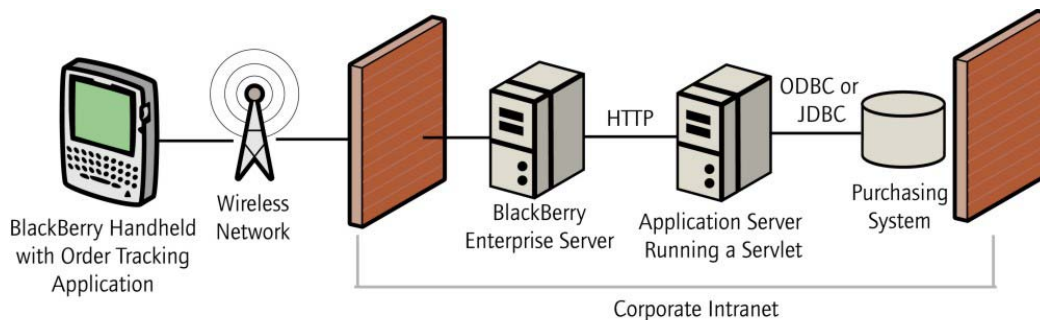
The server application can be written using any technology, such as a Java servlet, a dynamic web page using JSP or ASP, .NET, CGI scripts, and so on. The application establishes a connection to the database, queries or updates content at the request of the client application, and performs any necessary processing, such as data filtering and sorting.

The handheld submits data to the back-end application using HTTP POST requests. The back-end application then submits data to the database using a database query. The handheld retrieves data from the back-end application using an HTTP GET request. The back-end application queries data from the database.

Sales order tracking

By adding push capabilities, you can create more sophisticated wireless enterprise applications. For example, Java developers could create a handheld application that enables sales people to submit requests to be notified when the status of their customers' orders changes. Sales people could define the list of customers or orders in which they are interested, and then define conditions for receiving updates on those orders, such as a minimum value of orders and the frequency with which to send notifications.

The sales person submits the order list and conditions to a servlet running on a corporate application server. The relevant information is stored in a database. A server-side order push application monitors the purchasing system for changes and sends out updates to users. Whenever sales people open their order tracking application on the handheld, they can see the most current status of the orders in which they are interested.



Sales order tracking

An ongoing vision

The elements described in this white paper are only the beginning of RIM's vision for fulfilling the needs of organizations that require an "Always On, Always Connected®" capability. Key areas of increased platform capability will include:

- ◆ greater range of handheld support along with increased capabilities as technology improves and matures
- ◆ greater management control and administration flexibility, including increased wireless capabilities
- ◆ use of advanced network services as these technologies become available
- ◆ evolution of the wireless development and deployment environments enabling the developer to provide a richer user experience with less effort
- ◆ increased global data reach as more network providers offer BlackBerry

The components available today and these efforts collectively demonstrate RIM's vision to deliver the best wireless solutions.



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