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Chapter 6
Network communication for mobile devices

Objectives
• Identify the various network transport routes
• Describe least cost routing
• Describe how to make an HTTP connection
• Describe how to make a socket connection

This chapter outlines the various network connections that you can make from BlackBerry® smartphones. In addition to network connections, least cost routing is discussed. Finally, examples of creating HTTP and socket connections are included.
Network transport routes

When you connect to a web site on a BlackBerry® smartphone, that connection appears as it would on a desktop computer. Because the BlackBerry is a wireless device, specific details of the network connection can vary significantly between individual BlackBerry smartphones and operating environments.

A BlackBerry smartphone can use various radio communication technologies such as **Wi-Fi**, **CDMA** or **GPRS** to establish a wireless connection. The wireless connection is transferred to a wired network and connected to an intranet or the Internet through a proxy or gateway. A BlackBerry smartphone can support different types of gateways and each gateway provides a unique set of configurable features. After the connection is transferred to an intranet or the Internet, it is like a connection established by a typical desktop computer.

Although BlackBerry smartphones are designed so the user does not have to know anything about the underlying networking technologies, the network API that enables you to establish networking connections exposes that complexity. You can specify the type of wireless transport and gateway to use.

BlackBerry smartphones that run BlackBerry® Device Software version 5.0 or later include the network API that simplifies how you create network connections. You can create **HTTP**, **HTTPS**, and socket connections by specifying a web address and an optional list of preferred transport types. If you specify a list of transport types, the network API checks the availability and the coverage of each transport type in the specified order and tries to create a connection. This process continues until a connection is created or the end of the list is reached. If you do not specify a transport type, the network API tries to create a connection with all transport types. You can use the updated API to determine the availability and coverage of the wireless transport types.

Most of the functionality of the 5.0 version of the Network API is implemented in the ConnectionFactory and TransportInfo classes. All of the Network API classes are located in the net.rim.device.api.io.transport and net.rim.device.api.io.transport.options packages.

This section describes the following network connections:

- **WAP** network gateways
- **The BlackBerry MDS Connection Service network gateway**
- **The BlackBerry Internet Service Browsing network gateway**
- **Direct TCP** networks
- Wi-Fi connections

WAP network gateways

Wireless Application Protocol network gateways are hosted by wireless service providers. WAP network gateways must support WTP-level segmentation and reassembly. Proprietary WAP extensions are not
The BlackBerry® Browser accesses WAP network gateways using the WAP Browser configuration. To browse the Internet through a WAP network gateway, users must specify the WAP Browser configuration in the Browser Configuration settings.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAP1.2.1</td>
<td>The WAP Browser configuration caches the WSP headers to decrease the transmission time of requests. The WAP Browser configuration sends common HTTP headers to the WAP network gateway when it sets up the WAP connection. In subsequent requests, the WAP Browser configuration sends only headers that are specific to the request or that contain values that are different from the initial values.</td>
</tr>
<tr>
<td>WAP2.0</td>
<td>The WAP Browser configuration sends HTTP over wTCP. The BlackBerry Browser sends the HTTP request to a WAP 2.0 proxy, which then forwards the request to the server. The WAP network gateway determines the content types that the BlackBerry Browser can access. For example, some WAP network gateways might convert HTML content into a series of WML pages or impose a limit on the size of content that the BlackBerry Browser can request.</td>
</tr>
</tbody>
</table>
The BlackBerry MDS connection service network gateway

The BlackBerry® mobile data system Connection Service is designed to provide users with secure access to the organization's intranets and access to the Internet. The BlackBerry MDS Connection Service is a component of the BlackBerry® Enterprise Server that exists on the organization's network behind a firewall.

The BlackBerry MDS Connection Service acts as a proxy for the BlackBerry® Browser and makes requests on behalf of the BlackBerry Browser. The BlackBerry MDS Connection Service optimizes the content in the response, to enhance network efficiency and improve display on smaller screens, before it sends the content to the BlackBerry Browser. The BlackBerry Browser uses the Browser configuration to access the BlackBerry MDS Connection Service network gateway.

The BlackBerry Browser configuration communicates with the BlackBerry MDS Connection Service using HTTP/ IPPP.

To browse the Internet or an intranet through the BlackBerry MDS Connection Service network gateway, users must specify the BlackBerry Browser configuration in the Browser Configuration settings.

Because the BlackBerry MDS Connection Service is a component of the BlackBerry Enterprise Server,
administrators can specify a number of settings for the BlackBerry Browser configuration. For example, to help control the bandwidth, administrators can specify whether the BlackBerry Browser supports JavaScript®.

The BlackBerry Internet Service Browsing network gateway

Wireless service providers can use the BlackBerry® Internet Service Browsing network gateway to offer BlackBerry smartphone users access to the content optimization and compression features, provided by the BlackBerry® Infrastructure, without using the BlackBerry® Enterprise Server.

The BlackBerry Internet Service Browsing network gateway acts as a proxy for the BlackBerry Browser and makes requests on behalf of the BlackBerry Browser. The BlackBerry Internet Service Browsing network gateway optimizes content in the response, to enhance network efficiency and improve display on the smaller screens, before it relays the content to the BlackBerry Browser.

The BlackBerry Browser uses the Internet browser configuration to access the BlackBerry Internet Service Browsing network gateway. The Internet browser configuration uses HTTP/IPPP to communicate with the BlackBerry Internet Service Browsing network gateway.
To browse the Internet through the BlackBerry Internet Service Browsing network gateway, users must specify the Internet browser configuration in the Browser Configuration settings.

To use the Internet browser configuration, a BlackBerry smartphone user requires a service book that the BlackBerry® Provisioning System issues to the BlackBerry device.

**Note:**
Developers must be part of the RIM ISV Alliance program and apply for access to use the Internet browser configuration for each of their applications.

**Figure 8.3** BlackBerry Internet Service example

### Direct TCP networks

TCP is a widely used internet protocol that provides a reliable, in-order byte stream delivery. TCP is a duplex protocol, so it supports a pair of byte streams—one stream flowing in each direction. Included in TCP is a flow-control mechanism that allows the receiving node to limit the quantity of data the sender can transmit at one time.
TCP supports a demultiplexing mechanism that permits multiple application programs on a host to conduct simultaneous conversations with peers. TCP also supports a congestion control mechanism, that limits the speed TCP sends data.

In a direct TCP network, the BlackBerry smartphone accesses the Internet through a wireless service provider connection. In certain situations, when you configure direct Internet connections, you must specify the **APN Gateway**.

![Direct TCP connection example](image)

**Figure 8.4 Direct TCP connection example**

### Wi-Fi connections

Wi-fi is a local area network that uses high frequency radio signals to transmit and receive data over small distances. It uses Ethernet protocol.

There are three possible Wi-Fi network configurations for BlackBerry smartphones
- connection to the wireless access point through the Internet and to an Internet content server
- connection to the access point through the BlackBerry® Infrastructure
- connection to the access point through a corporate firewall, and through a BlackBerry Enterprise Server with BlackBerry MDS Services
Figure 8.5 Wi-Fi connection examples
Least cost routing

Least cost routing is an effort to find the lowest cost path between two network nodes with the least number of links between nodes.

In a simple network, such as in the preceding feature, link costs could be stored on each node. This is a static approach, and it does not resolve the following issues:

- node and link failures
- changes in the numbers of links and nodes in the network
- no allowance for temporary changes in link costs

To overcome these issues, a variety of routing protocols is used among the nodes of most networks. Routing protocols must provide dynamic and distributed solutions for finding lowest cost paths, and overcome failures and changes in link costs. The solutions must be *distributed*, because it is more efficient to distribute the solution throughout the network than to attempt to manage a centralized and scalable routing protocol.
Serial bypass

Serial bypass is another form of least cost routing, because it eliminates an organization's cost of using the BlackBerry Infrastructure. Although the BlackBerry solution enables wireless BlackBerry connectivity through serial bypass, you must have a network connection in place to establish communication.

When the least cost routing solution is implemented, the following situations can occur:

- multiple BlackBerry smartphones can connect through the same BlackBerry Device Manager.
- you can deploy BlackBerry smartphones and use all normal functions, with the exception of wireless enterprise activation, through the BlackBerry Device Manager and the BlackBerry Router without use of the radio. After wireless enterprise activation is initiated, you can connect the BlackBerry smartphone to the computer to enable enterprise activation to continue without the use of the radio.

When you implement least cost routing while the BlackBerry Router is in the DMZ, the computer that runs the BlackBerry Device Manager must be able to make a TCP connection to port 4101 of the server that runs the BlackBerry Router that the BlackBerry smartphone uses.

You can install the BlackBerry Router in a remote location outside the firewall and configure the SRP connections so all traffic bypasses the firewall. The SRP connections between the BlackBerry Enterprise Server and BlackBerry Router and between the BlackBerry Router and the BlackBerry Infrastructure are stored in the BlackBerry Router local registry. The location outside the firewall is referred to as the DMZ.

The DMZ is a neutral subnetwork between the trusted organization’s LAN and the untrusted external wireless network and public Internet. You can implement the BlackBerry Router securely in the DMZ, because all traffic that passes through the BlackBerry Router is encrypted, and all connections to the BlackBerry Router are authenticated. The BlackBerry Router does not store or transfer keys.
Creating an HTTP connection

The following task describes how to configure an HTTP connection:

1. Import the following classes:
   • net.rim.device.api.system.CoverageInfo
   • javax.microedition.io.Connector
   • net.rim.device.api.ui.UiApplication
   • net.rim.device.api.ui.component.Dialog
   • java.lang.String

2. Import the following interfaces:
   • javax.microedition.io.HttpConnection
   • net.rim.device.api.system.CoverageStatusListener
   • javax.microedition.io.StreamConnection

3. Use the Coverage Info class and CoverageStatusListener interface of the net.rim.device.api.system package to verify that the BlackBerry smartphone is in wireless network coverage area.

4. Use the HTTP location of the protected resource to invoke Connector.open().

5. Cast and store the returned object as a StreamConnection.

   StreamConnection s = (StreamConnection)Connector.open("http://mysite.com/myProtectedFile.txt");

6. Cast and store the StreamConnection object as an HTTPConnection object.

   HttpConnection httpConn = (HttpConnection)s;

7. Invoke HttpConnection.getResponseCode().

   int status = httpConn.getResponseCode();

8. If the server requires HTTP basic authentication, create code to manage an unauthorized HTTP connection attempt.

   int status = httpConn.getResponseCode();
   switch (status)
   case (HttpConnection.HTTP_UNAUTHORIZED);

9. Create a run() method and within it implement a dialog object to ask the BlackBerry smartphone user for login information.

   UiApplication.getUiApplication().invokeAndWait(new Runnable())
public void run()
{
    dialogResponse = Dialog.ask;
    (Dialog.D_YES_NO,"Unauthorized Access:\n Do you wish to login?");
}

10. To process the login information, create code to manage a Yes dialog response.

    A. Retrieve the login information and close the current connection.

        if (dialogResponse == Dialog.YES)
            {String login = "username:password";
             //Close the connection.
             s.close();

11. Encode the login information.

        byte[] encoded = Base64OutputStream.encode(login.getBytes(),
            0, login.length(), false, false);

12. Invoke HTTPConnection.setRequestProperty() using the encoded login information to access the
    protected resource.

        s = (StreamConnection)Connector.open("http://mysite.com/myProtectedFile.txt");
        httpConn = (HttpConnection)s;
        httpConn.setRequestProperty("Authorization", "Basic " + new String(encoded));
Configuring a socket connection

The following task describes how to configure socket connections:

1. Import the following classes:
   - net.rim.device.api.system.CoverageInfo
   - javax.microedition.io.Connector
   - java.lang.String
   - java.io.OutputStreamWriter
   - java.io.InputStreamReader

2. Import the following interfaces:
   - net.rim.device.api.system.CoverageStatusListener
   - javax.microedition.io.StreamConnection

3. Use the CoverageInfo class and CoverageStatusListener interface of the net.rim.device.api.system package to verify that the BlackBerry smartphone is in a wireless network coverage area.

4. Invoke Connector.open(), specifying socket as the protocol and appending the deviceside=false parameter to the end of the URL.
   - To open a socket connection using BlackBerry MDS Services, append deviceside=false to the end of the URL.
   - BlackBerry smartphone applications must input the destination IP explicitly, because localhost is not supported.

   ```java
   private static String URL = "socket://local_machine_IP:4444;deviceside=false";
   StreamConnection conn = null;
   conn = (StreamConnection)Connector.open(URL);
   ```
   - To open a socket connection over direct Internet connection, append the deviceside=true parameter to the end of the URL.
private static String URL = "socket://local_machine_IP:4444;deviceside=true;apn=internet.com;tunnelauthusername=user165;tunnelauthpassword=user165password";

StreamConnection conn = null;
conn = (StreamConnection)Connector.open(URL);

Note:
If you don't specify the APN, the device attempts to use the APN configured under Options, (Advanced Options), TCP.

- To open a socket connection over direct Internet connection, specifying APN information, append the deviceside=true parameter to the end of the URL and specify the APN where you establish the connection. Specify the user name to connect to the APN and the password, if required by the APN.

private static String URL = "socket://local_machine_IP:4444;deviceside=true;apn=internet.com;apnnetauthusername=user165;apnnetauthpassword=user165password";

StreamConnection conn = null;
conn = (StreamConnection)Connector.open(URL);

5. Use openInputStream() and openOutputStream() to send and receive data.

OutputStreamWriter _out = new OutputStreamWriter(conn.openOutputStream());
String data = "This is a test";
int length = data.length();
_out.write(data, 0, length);
InputStreamReader _in = new InputStreamReader(conn.openInputStream());
char[] input = new char[length];
for (int i = 0; i < length; ++i) {
    input[i] = (char) _in.read();
}
6. Invoke close() on the input and output streams and the socket connection. Each of the close() methods throws an IOException. Verify that the BlackBerry smartphone application implements exception handling.

    _in.close();
    _out.close();
    conn.close();
BlackBerry smartphones use the following connections:

- WAP network gateways
- The BlackBerry MDS Connection Service network gateway
- The BlackBerry Internet Service Browsing network gateway
- Direct TCP networks
- Wi-Fi connections

WAP1.2.1 and WAP2.0 network gateways are hosted by wireless service providers. WAP network gateways must support WTP-level segmentation and reassembly.

The BlackBerry MDS Connection Service is designed to provide users with secure access to their organization's intranets and access to the Internet. The BlackBerry MDS Connection Service is a component of the BlackBerry Enterprise Server that exists on the organization's network behind a firewall.

Wireless service providers can use the BlackBerry Internet Service Browsing network gateway to offer BlackBerry smartphone users access to the content optimization and compression features provided by the BlackBerry Infrastructure without using the BlackBerry Enterprise Server.

In a direct Internet connection network, the BlackBerry smartphone accesses the Internet through a wireless service provider connection. In certain situations, when you configure direct Internet connections, you must specify an Access Point Name Gateway.

Wi-Fi is a local area network that uses high frequency radio signals to transmit and receive data over small distances. It uses Ethernet protocol. Wi-Fi access points provide multiple network connection options.

Least cost routing is an effort to find the lowest cost path between two network nodes with the least number of links between nodes. Serial bypass is another form of least cost routing. It eliminates the organization's cost of using the BlackBerry Infrastructure. Although the BlackBerry solution enables wireless BlackBerry connectivity through serial bypass, you must have a network connection in place to enable the communication to occur.
Review Questions

1. Which network connection are you using when you connect your BlackBerry smartphone to the internet through your wireless provider?
   A. MDS
   B. Direct TCP
   C. WAP
   D. All of the above.

2. Other than MDS, which of the following network connections allows access your corporate LAN?
   A. WAP
   B. Direct TCP
   C. Wi-Fi
   D. BlackBerry Internet Service Browsing network gateway

3. Which describes the BlackBerry Internet Service Browsing network gateway?
   A. It facilitates corporate firewalls.
   B. It offers least cost routing.
   C. It optimizes content for a BlackBerry smartphone.
   D. It is the fastest connection.

4. Which of the following eliminates the organization's cost of using the BlackBerry Infrastructure?
   A. Direct TCP connections
   B. Wi-Fi connections
   C. Serial Bypass
   D. WAP connections