Wireless Messaging API (WMA)

for Java™ 2 Micro Edition

Version 1.1

JSR 120 Expert Group
JSR-120-EG@JCP.ORG

Java Community Process (JCP)

Contents

Preface

This book provides information on the messaging API which is included in the JSR 120 Wireless Messaging API (WMA) specification. It also describes Sun Microsystem's reference implementation (RI) of the API.

Who Should Use This Book

This book is intended primarily for those individuals and companies who want to implement WMA, or to port the WMA RI to a new platform.

Before You Read This Book

This book assumes that you have experience programming in the C and Java™ languages, and that you have experience with the platforms to which you are porting the RI. It also assumes that you are familiar with the Mobile Information Device Profile (MIDP), the Connected, Limited Device Configuration (CLDC), and the Connected Device Configuration (CDC).

Familiarity with multimedia processing recommended, but not required.

References

GSM 03.40 v7.4.0 Digital cellular telecommunications system (Phase 2+); Technical realization of the Short Message Service (SMS). ETSI 2000

TS 100 900 v7.2.0 (GSM 03.38) Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information. ETSI 1999

Mobile Information Device Profile (MIDP) Specification, Version 1.0 , Sun Microsystems, 2000

GSM 03.41, ETSI Digital Cellular Telecommunication Systems (phase 2+); Technical realization of Short Message Service Cell Broadcast (SMSCB) (GSM 03.41)

Wireless Datagram Protocol , Version 14-Jun-2001, *Wireless Application Protocol WAP-259-WDP-20010614-aWAP (WDP)*

TIA/EIA-637-A: Short Message Service for Spread Spectrum Systems (IS637)

Connected Device Configuration (CDC) and the Foundation Profile, a white paper, (Sun Microsystems, Inc., 2002)

J2ME™ CDC Specification, v1.0, (Sun Microsystems, Inc., 2002)

Porting Guide for the Connected Device Configuration, Version 1.0, and the Foundation Profile, Version 1.0; (Sun Microsystems, Inc., 2001)

Related Documentation

The Java™ Language Specification by James Gosling, Bill Joy, and Guy L. Steele (Addison-Wesley, 1996), ISBN 0-201-63451-1

The Java™ Virtual Machine Specification (Java Series), Second Edition by Tim Lindholm and Frank Yellin (Addison-Wesley, 1999), ISBN 0-201-43294-3

Terms, Acronyms, and Abbreviations Used in this Book

SMS - Short Message Service

URL - Uniform Resource Locator

Typographic Conventions

Typeface	Meaning	Examples
`AaBbCc123`	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
`AaBbCc123`	What you type, when contrasted with on-screen computer output	`% su` `Password:`
AaBbCc123	Book titles, new words or terms, words to be emphasized Command-line variable; replace with a real name or value	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be superuser to do this. To delete a file, type `rm` *filename* .

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CHAPTER 1

Overview

Description

The messaging API is based on the Generic Connection Framework (GCF), which is defined in the Connected Limited Device Configuration (CLDC) 1.0 specification. The package `javax.microedition.io` defines the framework and supports input/output and networking functionality in J2ME profiles. It provides a coherent way to access and organize data in a resource-constrained environment.

The design of the messaging functionality is similar to the datagram functionality that is used for UDP in the Generic Connection Framework. Like the datagram functionality, messaging provides the notion of opening a connection based on a string address and that the connection can be opened in either client or server mode. However, there are differences between messages and datagrams, so messaging interfaces do not inherit from datagram. It might also be confusing to use the same interfaces for messages and datagrams.

The interfaces for the messaging API have been defined in the `javax.wireless.messaging` package.

Representation of a message

A message can be thought of as having an address part and a data part. A message is represented by a class that implements the interface defined for messages in the API. This interface provides methods that are common for all messages. In the `javax.wireless.messaging` package, the base interface that is implemented by all messages is named `Message`. It provides methods for addresses and timestamps.

For the data part of the message, the API is designed to handle both text and binary messages. These are represented by two subinterfaces of `Message`: `TextMessage` and `BinaryMessage`. These subinterfaces provide ways to manipulate the payload of the message as Strings and byte arrays, respectively.

Other subinterfaces of `Message` can be defined for message payloads which are neither pure text nor pure binary. It is also possible to create further subinterfaces of `TextMessage` and `BinaryMessage` for possible protocol-specific features.

Sending and receiving messages

As defined by the Generic Connection Framework, the message sending and receiving functionality is implemented by a `Connection` interface, in this case, `MessageConnection`. To make a connection, the application obtains an object implementing the `MessageConnection` from the `Connector` class by providing a URL connection string that identifies the address.

If the application specifies a full destination address that defines a recipient to the `Connector`, it gets a `MessageConnection` that works in a “client” mode. This kind of `Connection` can only be used for sending messages to the address specified when creating it.

The application can create a “server” mode `MessageConnection` by providing a URL connection string that includes only an identifier that specifies the messages intended to be received by this application. Then it can use this `MessageConnection` object for receiving and sending messages.

The format of the URL connection string that identifies the address is specific to the messaging protocol used.

For sending messages, the `MessageConnection` object provides factory methods for creating `Message` objects. For receiving messages, the `MessageConnection` supports an event listener-based receive mechanism, in addition to a synchronous blocking `receive()` method. The methods for sending and

receiving messages can throw a `SecurityException` if the application does not have the permission to perform these operations.

The generic connection framework includes convenience methods for getting `InputStream` and `OutputStream` handles for connections which are `StreamConnections`. The `MessageConnection` does not support stream based operations. If an application calls the `Connector.open*Stream` methods, they will receive an `IllegalArgumentException`.

Bearer-specific Adapter

The basic `MessageConnection` and `Message` framework provides a general mechanism with establishing a messaging application. The appendices describe the specific adapter requirements for URL connection string formatting and bearer-specific message handling requirements.

- JavaDoc API Documentation
- Appendix A - GSM SMS Adapter
- Appendix B - GSM CBS Adapter
- Appendix C - CDMA IS-637 SMS Adapter

The appendices of this specification include the definition of SMS and CBS URL connection strings. These connection schemes MAY be reused in other adapter specifications, as long as the specified syntax is not modified and the usage does not overlap with these specified adapters (that is, no platform can be expected to implement two protocols for which the URI scheme would be the same, making it impossible for the platform to distinguish which is desired by the application). Other adapter specifications MAY define new connection schemes, as long as these do not conflict with any other connection scheme in use with the Generic Connection Framework.

The appendices describe how the SMS and CBS adpaters MUST be implemented to conform to the requirements of their specific wireless network environments and how these adapters supply the functionality defined in the *javax.wireless.messaging package*.

When a GSM SMS message connection is established, the platform MUST use the rules in Appendix A for the syntax of the URL connection string and for treatment of the message contents.

When a GSM CBS message connection is established, the platform MUST use the rules in Appendix B for the syntax of the URL connection string and for treatment of the message contents.

When a CDMA SMS message connection is established, the platform MUST use the rules in Appendix C for the syntax of the URL connection string and for treatment of the message contents.

Security

To send and receive messages using this API, applications MUST be granted a permission to perform the requested operation. The mechanisms for granting a permission are implementation dependent.

The permissions for sending and receiving MAY depend on the type of messages and addresses being used. An implementation MAY restrict an application’s ability to send some types of messages and/or sending messages to certain recipient addresses. These addresses can include device addresses and/or identifiers, such as port numbers, within a device.

An implementation MAY restrict certain types of messages or connection addresses, such that the permission would never be available to an application on that device.

The applications MUST NOT assume that successfully sending one message implies that they have the permission to send all kinds of messages to all addresses.

An application should handle `SecurityException`s when a connection handle is provided from `Connector.open(url)` and for any message `receive()` or `send()` operation that potentially engages with the network or the privileged message storage on the device.

Permissions for MIDP 1.0 Platform

When the JSR120 interfaces are deployed on a MIDP 1.0 device, there is no formal mechanism to identify how a permission to use a specific feature can be granted to a running application. On some systems, the decision to permit a particular operation is left in the hands of the end user. If the user decides to deny the required permission, then a `SecurityException` can be thrown from the `Connector.open()`, the `MessageConnection.send()`, or the `MessageConnection.receive()` method.

How to Use the Messaging API

This section provides some examples of how the messaging API can be used.

Sending a text message to an end user

The following sample code sends the string “Hello World!” to an end user as a normal SMS message.

```
try {
  String addr = “sms://+358401234567”;
  MessageConnection conn = (MessageConnection) Connector.open(addr);
  TextMessage msg =
    (TextMessage)conn.newMessage(MessageConnection.TEXT_MESSAGE);
  msg.setPayloadText(“Hello World!”);
  conn.send(msg);
} catch (Exception e) {
...
}
```

A server that responds to received messages

The following sample code illustrates a server application that waits for messages sent to port `5432` and responds to them.

```
try {
  String addr = “sms://:5432”;
  MessageConnection conn = (MessageConnection) Connector.open(addr);
  Message msg = null;

  while (someExitCondition) {
  // wait for incoming messages

  msg = conn.receive();
  // received a message
  if (msg instanceof TextMessage) {
     TextMessage tmsg = (TextMessage)msg;

     String receivedText = tmsg.getPayloadText();
     // respond with the same text with “Received:”
     // inserted in the beginning
     tmsg.setPayloadText(“Received:” + receivedText);
     // Note that the recipient address in the message is
     // already correct as we are reusing the same object

     conn.send(tmsg);
     } else {
     // Received message was not a text message, but e.g. binary

       ...
     }
   }
} catch (Exception e) {
   ...
}
```

Package Summary

Messaging Interfaces

javax.wireless.messaging	This package defines an API which allows applications to send and receive wireless messages.

Networking Package

javax.microedition.io	This pacakge includes the platform networking interfaces which have been modified for use on platforms that support message connections.

CHAPTER 2

Package javax.microedition.io

Description

This pacakge includes the platform networking interfaces which have been modified for use on platforms that support message connections.

This package includes the `Connector` class from MIDP 2.0. This class includes `SecurityException` as an expected return from calls to `open()` which may require explicit authorization to connect.

When the message connection is implemented on a MIDP 1.0 platform, the `SecurityException` can be provided by a platform-dependent authorization mechanism. For example, the user *might* be prompted to ask if the application can send a message and the user's denial interpretted as a `SecurityException`.

Since: MIDP2.0

Class Summary	
Interfaces	
Classes	
`Connector`	This class is factory for creating new `Connection` objects.
Exceptions	

javax.microedition.io
Connector

Declaration

```
public class Connector

java.lang.Object
  |
  +--javax.microedition.io.Connector
```

Description

This class is factory for creating new `Connection` objects.

The creation of connections is performed dynamically by looking up a protocol implementation class whose name is formed from the platform name (read from a system property) and the protocol name of the requested connection (extracted from the parameter string supplied by the application programmer). The parameter string that describes the target should conform to the URL format as described in RFC 2396. This takes the general form:

`{scheme}:[{target}][{parms}]`

where:

- `scheme` is the name of a protocol such as *HTTP*.
- `target` is normally some kind of network address.
- `parms` are formed as a series of equates of the form `;x=y`. For example: `;type=a`.

An optional second parameter may be specified to the open function. This is a mode flag that indicates to the protocol handler the intentions of the calling code. The options here specify if the connection is going to be read (`READ`), written (`WRITE`), or both (`READ_WRITE`). The validity of these flag settings is protocol dependent. For example, a connection for a printer would not allow read access, and would throw an `IllegalArgumentException`. If the mode parameter is not specified, `READ_WRITE` is used by default.

An optional third parameter is a boolean flag that indicates if the calling code can handle timeout exceptions. If this flag is set, the protocol implementation may throw an `InterruptedIOException` when it detects a timeout condition. This flag is only a hint to the protocol handler, and it does not guarantee that such exceptions will actually be thrown. If this parameter is not set, no timeout exceptions will be thrown.

Because connections are frequently opened just to gain access to a specific input or output stream, convenience functions are provided for this purpose. See also: `DatagramConnection` for information relating to datagram addressing

Since: CLDC 1.0

Member Summary
Fields
`static int READ`
`static int READ_WRITE`
`static int WRITE`

Member Summary	
Methods	
static Connection	open(java.lang.String name)
static Connection	open(java.lang.String name, int mode)
static Connection	open(java.lang.String name, int mode, boolean timeouts)
static java.io.DataInputStream	openDataInputStream(java.lang.String name)
static java.io.DataOutputStream	openDataOutputStream(java.lang.String name)
static java.io.InputStream	openInputStream(java.lang.String name)
static java.io.OutputStream	openOutputStream(java.lang.String name)

Inherited Member Summary
Methods inherited from class `Object`
`equals(Object), getClass(), hashCode(), notify(), notifyAll(), toString(), wait(), wait(), wait()`

Fields

READ

Declaration:
`public static final int READ`

Description:
Access mode READ.

READ_WRITE

Declaration:
`public static final int READ_WRITE`

Description:
Access mode READ_WRITE.

WRITE

Declaration:
`public static final int WRITE`

Description:
Access mode WRITE.

Methods

open(String)

Declaration:
```
public static javax.microedition.io.Connection open(java.lang.String name)
            throws IOException
```

Description:
Creates and opens a Connection.

Parameters:
`name` - the URL for the connection

Returns: a new Connection object

Throws:
`java.lang.IllegalArgumentException` - if a parameter is invalid

`ConnectionNotFoundException` - if the requested connection cannot be made, or the protocol type does not exist

`java.io.IOException` - if some other kind of I/O error occurs

SecurityException - if a requested protocol handler is not permitted

open(String, int)

Declaration:
```
public static javax.microedition.io.Connection open(java.lang.String name, int mode)
            throws IOException
```

Description:
Creates and opens a Connection.

Parameters:
`name` - the URL for the connection

`mode` - the access mode

Returns: a new `Connection` object

Throws:
`java.lang.IllegalArgumentException` - if a parameter is invalid

`ConnectionNotFoundException` - if the requested connection cannot be made, or the protocol type does not exist

`java.io.IOException` - if some other kind of I/O error occurs

SecurityException - if a requested protocol handler is not permitted

open(String, int, boolean)

Declaration:
```
public static javax.microedition.io.Connection open(java.lang.String name, int mode,
            boolean timeouts)
            throws IOException
```

Description:
Creates and opens a Connection.

Parameters:

`name` - the URL for the connection

`mode` - the access mode

`timeouts` - a flag to indicate that the caller wants timeout exceptions

Returns: a new `Connection` object

Throws:

`java.lang.IllegalArgumentException` - if a parameter is invalid

`ConnectionNotFoundException` - if the requested connection cannot be made, or the protocol type does not exist

`java.io.IOException` - if some other kind of I/O error occurs

SecurityException - if a requested protocol handler is not permitted

openDataInputStream(String)

Declaration:

```
public static java.io.DataInputStream openDataInputStream(java.lang.String name)
            throws IOException
```

Description:

Creates and opens a connection input stream.

Parameters:

`name` - the URL for the connection

Returns: a `DataInputStream`

Throws:

`java.lang.IllegalArgumentException` - if a parameter is invalid

`ConnectionNotFoundException` - if the connection cannot be found

`java.io.IOException` - if some other kind of I/O error occurs

SecurityException - if access to the requested stream is not permitted

openDataOutputStream(String)

Declaration:

```
public static java.io.DataOutputStream openDataOutputStream(java.lang.String name)
            throws IOException
```

Description:

Creates and opens a connection output stream.

Parameters:

`name` - the URL for the connection

Returns: a `DataOutputStream`

Throws:

`java.lang.IllegalArgumentException` - if a parameter is invalid

`ConnectionNotFoundException` - if the connection cannot be found

`java.io.IOException` - if some other kind of I/O error occurs

SecurityException - if access to the requested stream is not permitted

openInputStream(String)

Declaration:

```
public static java.io.InputStream openInputStream(java.lang.String name)
            throws IOException
```

Description:
Creates and opens a connection input stream.

Parameters:
`name` - the URL for the connection

Returns: an `InputStream`

Throws:
`java.lang.IllegalArgumentException` - if a parameter is invalid

`ConnectionNotFoundException` - if the connection cannot be found

`java.io.IOException` - if some other kind of I/O error occurs

SecurityException - if access to the requested stream is not permitted

openOutputStream(String)

Declaration:

```
public static java.io.OutputStream openOutputStream(java.lang.String name)
            throws IOException
```

Description:
Creates and opens a connection output stream.

Parameters:
`name` - the URL for the connection

Returns: an `OutputStream`

Throws:
`java.lang.IllegalArgumentException` - if a parameter is invalid

`ConnectionNotFoundException` - if the connection cannot be found

`java.io.IOException` - if some other kind of I/O error occurs

SecurityException - if access to the requested stream is not permitted

CHAPTER 3

Package javax.wireless.messaging

Description

This package defines an API which allows applications to send and receive wireless messages. The API is generic and independent of the underlying messaging protocol. The underlying protocol can be, for example, GSM Short Message Service, CDMA SMS, and so on.

Overview

This package is designed to work with `Message` objects that may contain different elements depending on the underlying messaging protocol. This is different from `Datagrams` that are assumed always to be blocks of binary data.

An adapter specification for a given messaging protocol may define further interfaces derived from the `Message` interfaces included in this generic specification.

Unlike network layer datagrams, the wireless messaging protocols that are accessed by using this API are typically of store-and-forward nature. Messages will usually reach the recipient, even if the recipient is not connected at the time of sending. This may happen significantly later if the recipient is disconnected for a long period of time. Sending and possibly also receiving these wireless messages typically involves a financial cost to the end user that cannot be neglected. Therefore, applications should not send unnecessary messages.

The MessageConnection and Message Interfaces

The `MessageConnection` interface represents a `Connection` that can be used for sending and receiving messages. The application opens a `MessageConnection` with the Generic Connection Framework by providing a URL connection string.

The `MessageConnection` can be opened either in “server” or in “client” mode. A “server” mode connection is opened by providing a URL that specifies an identifier for an application on the local device for incoming messages. A port number is an example of an identifier. Messages received with this identifier will then be delivered to the application by using this connection. A “server” mode connection can be used both for sending and for receiving messages.

A “client” mode connection is opened by providing a URL that points to another device. A “client” mode connection can only be used for sending messages.

The messages are represented by the `Message` interface and interfaces derived from it. The `Message` interface has the very basic functions that are common to all messages. Derived interfaces represent messages of different types and provide methods for accessing type-specific features. The kinds of derived interfaces that are supported depends on the underlying messaging protocol. If necessary, interfaces derived from `Message` can be defined in the adapter definitions for mapping the API to an underlying protocol.

The mechanism to derive new interfaces from the `Message` is intended as an extensibility mechanism allowing new protocols to be supported in platforms. Applications are not expected to create their own classes that implement the `Message` interface. The only correct way for applications to create object instances implementing the `Message` interface is to use the `MessageConnection.newMessage` factory method.

Since: WMA 1.0

Class Summary

Interfaces

`BinaryMessage`	An interface representing a binary message.
`Message`	This is the base interface for derived interfaces that represent various types of messages.
`MessageConnection`	The `MessageConnection` interface defines the basic functionality for sending and receiving messages.
`MessageListener`	The `MessageListener` interface provides a mechanism for the application to be notified of incoming messages.
`TextMessage`	An interface representing a text message.

javax.wireless.messaging
BinaryMessage

Declaration
```
public interface BinaryMessage extends Message
```

All Superinterfaces: Message

Description
An interface representing a binary message. This is a subinterface of `Message` which contains methods to get and set the binary data payload. The `setPayloadData()` method sets the value of the payload in the data container without any checking whether the value is valid in any way. Methods for manipulating the address portion of the message are inherited from `Message`.

Object instances implementing this interface are just containers for the data that is passed in.

Member Summary	
Methods	
`byte[]`	`getPayloadData()`
`void`	`setPayloadData(byte[] data)`

Inherited Member Summary
Methods inherited from interface `Message`
`getAddress()`, `getTimestamp()`, `setAddress(String)`

Methods

getPayloadData()

Declaration:
```
public byte[] getPayloadData()
```

Description:
Returns the message payload data as an array of bytes.

Returns `null`, if the payload for the message is not set.

The returned byte array is a reference to the byte array of this message and the same reference is returned for all calls to this method made before the next call to `setPayloadData`.

Returns: the payload data of this message or `null` if the data has not been set

See Also: `setPayloadData(byte[])`

setPayloadData(byte[])

Declaration:
```
public void setPayloadData(byte[] data)
```

Description:
Sets the payload data of this message. The payload may be set to `null`.

Setting the payload using this method only sets the reference to the byte array. Changes made to the contents of the byte array subsequently affect the contents of this `BinaryMessage` object. Therefore, applications should not reuse this byte array before the message is sent and the `MessageConnection.send` method returns.

Parameters:
`data` - payload data as a byte array

See Also: `getPayloadData()`

javax.wireless.messaging
Message

Declaration
```
public interface Message
```

All Known Subinterfaces: BinaryMessage, TextMessage

Description
This is the base interface for derived interfaces that represent various types of messages. This package is designed to work with `Message` objects that may contain different elements depending on the underlying messaging protocol. This is different from `Datagram`s that are assumed always to be just blocks of binary data. An adapter specification for a given messaging protocol may define further interfaces derived from the `Message` interfaces included in this generic specification.

The wireless messaging protocols that are accessed via this API are typically of store-and-forward nature, unlike network layer datagrams. Thus, the messages will usually reach the recipient, even if the recipient is not connected at the time of sending the message. This may happen significantly later if the recipient is disconnected for a long time. Sending, and possibly also receiving, these wireless messages typically involves a financial cost to the end user that cannot be neglected. Therefore, applications should not send many messages unnecessarily.

This interface contains the functionality common to all messages. Concrete object instances representing a message will typically implement other (sub)interfaces providing access to the content and other information in the message which is dependent on the type of the message.

Object instances implementing this interface are just containers for the data that is passed in. The `setAddress()` method just sets the value of the address in the data container without any checking whether the value is valid in any way.

Member Summary	
Methods	
`java.lang.String`	`getAddress()`
`java.util.Date`	`getTimestamp()`
`void`	`setAddress(java.lang.String addr)`

Methods

getAddress()

Declaration:
```
public java.lang.String getAddress()
```

Description:
Returns the address associated with this message.

If this is a message to be sent, then this address is the recipient's address.

If this is a message that has been received, then this address is the sender's address.

Returns `null`, if the address for the message is not set.

Note: This design allows responses to be sent to a received message by reusing the same `Message` object and just replacing the payload. The address field can normally be kept untouched (unless the messaging protocol requires some special handling of the address).

The returned address uses the same URL string syntax that `Connector.open()` uses to obtain this `MessageConnection`.

Returns: the address of this message, or `null` if the address is not set

See Also: `setAddress(String)`

getTimestamp()

Declaration:
```
public java.util.Date getTimestamp()
```

Description:
Returns the timestamp indicating when this message has been sent.

Returns: `Date` indicating the timestamp in the message or `null` if the timestamp is not set or if the time information is not available in the underlying protocol message

setAddress(String)

Declaration:
```
public void setAddress(java.lang.String addr)
```

Description:
Sets the address associated with this message, that is, the address returned by the `getAddress` method. The address may be set to `null`.

The address MUST use the same URL string syntax that `Connector.open()` uses to obtain this `MessageConnection`.

Parameters:
`addr` - address for the message

See Also: `getAddress()`

javax.wireless.messaging
MessageConnection

Declaration

```
public interface MessageConnection extends javax.microedition.io.Connection
```

All Superinterfaces: `javax.microedition.io.Connection`

Description

The `MessageConnection` interface defines the basic functionality for sending and receiving messages. It contains methods for sending and receiving messages, factory methods to create a new `Message` object, and a method that calculates the number of segments of the underlying protocol that are needed to send a specified `Message` object.

This class is instantiated by a call to `Connector.open()`. An application SHOULD call `close()` when it is finished with the connection. An `IOException` is thrown when any method (except `close`) is called on the `MessageConnection` after the connection has been closed.

Messages are sent on a connection. A connection can be defined as *server* mode or *client* mode.

In a *client* mode connection, messages can only be sent. A client mode connection is created by passing a string identifying a destination address to the `Connector.open()` method. This method returns a `MessageConnection` object.

In a *server* mode connection, messages can be sent or received. A server mode connection is created by passing a string that identifies an end point (protocol dependent identifier, for example, a port number) on the local host to the `Connector.open()` method. If the requested end point identifier is already reserved, either by some system application or by another Java application, `Connector.open()` throws an `IOException`. Java applications can open `MessageConnection`s for any unreserved end point identifier, although security permissions might not allow it to send or receive messages using that end point identifier.

The *scheme* that identifies which protocol is used is specific to the given protocol. This interface does not assume any specific protocol and is intended for all wireless messaging protocols.

An application can have several `MessageConnection` instances open simultaneously; these connections can be both client and server mode.

The application can create a class that implements the `MessageListener` interface and register an instance of that class with the `MessageConnection`(s) to be notified of incoming messages. With this technique, a thread does not have to be blocked, waiting to receive messages.

Member Summary

Fields

static java.lang.String	BINARY_MESSAGE
static java.lang.String	TEXT_MESSAGE

Methods

Message	newMessage(java.lang.String type)
Message	newMessage(java.lang.String type, java.lang.String address)

Member Summary	
int	numberOfSegments(Message msg)
Message	receive()
void	send(Message msg)
void	setMessageListener(MessageListener l)

Inherited Member Summary
Methods inherited from interface `Connection`
`close()`

Fields

BINARY_MESSAGE

Declaration:
`public static final java.lang.String` **`BINARY_MESSAGE`**

Description:
Constant for a message type for **binary** messages (value = “binary”). If this constant is used for the `type` parameter in the `newMessage()` methods, then the newly created `Message` will be an instance implementing the `BinaryMessage` interface.

TEXT_MESSAGE

Declaration:
`public static final java.lang.String` **`TEXT_MESSAGE`**

Description:
Constant for a message type for **text** messages (value = “text”). If this constant is used for the `type` parameter in the `newMessage()` methods, then the newly created `Message` will be an instance implementing the `TextMessage` interface.

Methods

newMessage(String)

Declaration:
`public javax.wireless.messaging.Message` **`newMessage`**`(java.lang.String type)`

Description:
Constructs a new message object of a given type. When the string `text` is passed in, the created object implements the `TextMessage` interface. When the `binary` constant is passed in, the created object implements the `BinaryMessage` interface. Adapter definitions for messaging protocols can define new constants and new subinterfaces for the `Message`s. The type strings are case-sensitive. The parameter is compared with the `String.equals()` method and does not need to be instance equivalent with the constants specified in this class.

For adapter definitions that are not defined within the JCP process, the strings used MUST begin with an inverted domain name controlled by the defining organization, as is used for Java package names. Strings that do not contain a full stop character "." are reserved for specifications done within the JCP process and MUST NOT be used by other organizations defining adapter specification.

When this method is called from a *client* mode connection, the newly created `Message` has the destination address set to the address identified when this `Connection` was created.

When this method is called from a *server* mode connection, the newly created `Message` does not have the destination address set. It must be set by the application before trying to send the message.

If the connection has been closed, this method returns a `Message` instance.

Parameters:

`type` - the type of message to be created. There are constants for basic types defined in this interface.

Returns: `Message` object for a given type of message

Throws:

`java.lang.IllegalArgumentException` - if the type parameters is not equal to the value of `TEXT_MESSAGE`, `BINARY_MESSAGE` or any other type value specified in a private or publicly standardized adapter specification that is supported by the implementation

newMessage(String, String)

Declaration:

```
public javax.wireless.messaging.Message newMessage(java.lang.String type, java.lang.
            String address)
```

Description:

Constructs a new `Message` object of a given type and initializes it with the given destination address. The semantics related to the parameter `type` are the same as for the method signature with just the `type` parameter.

If the connection has been closed, this method returns a `Message` instance.

Parameters:

`type` - the type of message to be created. There are constants for basic types defined in this interface.

`address` - destination address for the new message

Returns: `Message` object for a given type of message

Throws:

`java.lang.IllegalArgumentException` - if the type parameters is not equal to the value of `TEXT_MESSAGE`, `BINARY_MESSAGE` or any other type value specified in a private or publicly standardized adapter specification that is supported by the implementation

See Also: `newMessage(String)`

numberOfSegments(Message)

Declaration:

```
public int numberOfSegments(javax.wireless.messaging.Message msg)
```

Description:

Returns the number of segments in the underlying protocol that would be needed for sending the specified `Message`.

Note that this method does not actually send the message. It will only calculate the number of protocol segments needed for sending the message.

This method will calculate the number of segments needed when this message is split into the protocol segments using the appropriate features of the underlying protocol. This method does not take into account possible limitations of the implementation that may limit the number of segments that can be sent using this feature. These limitations are protocol-specific and are documented with the adapter definition for that protocol.

If the connection has been closed, this method returns a count of the message segments that would be sent for the provided `Message`.

Parameters:
`msg` - the message to be used for the calculation

Returns: number of protocol segments needed for sending the message. Returns `0` if the `Message` object cannot be sent using the underlying protocol.

receive()

Declaration:
```
public javax.wireless.messaging.Message receive()
            throws IOException, InterruptedIOException
```

Description:
Receives a message.

If there are no `Message`s for this `MessageConnection` waiting, this method will block until either a message for this `Connection` is received or the `MessageConnection` is closed.

Returns: a `Message` object representing the information in the received message

Throws:
`java.io.IOException` - if any of these situations occur:

- there is an error while receiving a message
- this method is called while the connection is closed
- this method is called on a client mode `MessageConnection`

`java.io.InterruptedIOException` - if this `MessageConnection` object is closed during this receive method call

java.lang.SecurityException - if the application does not have permission to receive messages using the given port number

See Also: `send(Message)`

send(Message)

Declaration:
```
public void send(javax.wireless.messaging.Message msg)
            throws IOException, InterruptedIOException
```

Description:
Sends a message.

Parameters:
`msg` - the message to be sent

Throws:

`java.io.IOException` - if the message could not be sent or because of network failure or if the connection is closed

`java.lang.IllegalArgumentException` - if the message is incomplete or contains invalid information. This exception is also thrown if the payload of the message exceeds the maximum length for the given messaging protocol. One specific case when the message is considered to contain invalid information is if the `Message` is not of the right type to be sent using this `MessageConnection`; the `Message` should be created using the `newMessage()` method of the same `MessageConnection` as will be used for sending it to ensure that it is of the right type.

`java.io.InterruptedIOException` - if a timeout occurs while either trying to send the message or if this `Connection` object is closed during this `send` operation

java.lang.NullPointerException - if the parameter is null

java.lang.SecurityException - if the application does not have permission to send the message

See Also: `receive()`

setMessageListener(MessageListener)

Declaration:

```
public void setMessageListener(javax.wireless.messaging.MessageListener l)
            throws IOException
```

Description:

Registers a `MessageListener` object that the platform can notify when a message has been received on this `MessageConnection`.

If there are incoming messages in the queue of this `MessageConnection` that have not been retrieved by the application prior to calling this method, the newly registered listener object will be notified immediately once for each such incoming message in the queue.

There can be at most one listener object registered for a `MessageConnection` object at any given point in time. Setting a new listener will de-register any previously set listener.

Passing `null` as the parameter will de-register any currently registered listener.

Parameters:

`l` - `MessageListener` object to be registered. If `null`, any currently registered listener will be de-registered and will not receive notifications.

Throws:

java.lang.SecurityException - if the application does not have permission to receive messages using the given port number

`java.io.IOException` - if the connection has been closed, or if an attempt is made to register a listener on a client connection

javax.wireless.messaging
MessageListener

Declaration
`public interface` **`MessageListener`**

Description
The `MessageListener` interface provides a mechanism for the application to be notified of incoming messages.

When an incoming message arrives, the `notifyIncomingMessage()` method is called. The application MUST retrieve the message using the `receive()` method of the `MessageConnection`. `MessageListener` should not call `receive()` directly. Instead, it can start a new thread which will receive the message or call another method of the application (which is outside of the listener) that will call `receive()`. For an example of how to use MessageListener, see A Sample MessageListener Implementation.

The listener mechanism allows applications to receive incoming messages without needing to have a thread blocked in the `receive()` method call.

If multiple messages arrive very closely together in time, the implementation has the option of calling this listener from multiple threads in parallel. Applications MUST be prepared to handle this and implement any necessary synchronization as part of the application code, while obeying the requirements set for the listener method.

A Sample MessageListener Implementation

The following sample code illustrates how lightweight and resource-friendly a `MessageListener` can be. In the sample, a separate thread is spawned to handle message reading. The MIDlet life cycle is respected by releasing connections and signalling threads to terminate when the MIDlet is paused or destroyed.

```
// Sample message listener program.
import java.io.IOException;
import javax.microedition.midlet.*;
import javax.microedition.io.*;
import javax.wireless.messaging.*;
public class Example extends MIDlet implements MessageListener {
    MessageConnection messconn;
     boolean done;
    Reader reader;
    // Initial tests setup and execution.
    public void startApp() {
try {
    // Get our receiving port connection.
    messconn = (MessageConnection)
Connector.open("sms://:6222");
    // Register a listener for inbound messages.
    messconn.setMessageListener(this);
    // Start a message-reading thread.
    done = false;
    reader = new Reader();
    new Thread(reader).start();
} catch (IOException e) {
    // Handle startup errors
}
    }
    // Asynchronous callback for inbound message.
    public void notifyIncomingMessage(MessageConnection conn) {
if (conn == messconn) {
    reader.handleMessage();
}
    }
    // Required MIDlet method - release the connection and
    // signal the reader thread to terminate.
    public void pauseApp() {
done = true;
try {
    messconn.close();
} catch (IOException e) {
    // Handle errors
}
    }
    // Required MIDlet method - shutdown.
    // @param unconditional forced shutdown flag
    public void destroyApp(boolean unconditional) {
done = true;
try {
    messconn.setMessageListener(null);
    messconn.close();
} catch (IOException e) {
    // Handle shutdown errors.
}
    }
    // Isolate blocking I/O on a separate thread, so callback
    // can return immediately.
    class Reader implements Runnable {
 private int pendingMessages = 0;

 // The run method performs the actual message reading.
 public void run() {
    while (!done) {
 synchronized(this) {
    if (pendingMessages == 0) {
 try {
    wait();
 } catch (Exception e) {
    // Handle interruption
 }
    }
```

```
        pendingMessages--;
    }

    // The benefit of the MessageListener is here.
    // This thread could via similar triggers be
    // handling other kind of events as well in
    // addition to just receiving the messages.

    try {
        Message mess = messconn.receive();
    } catch (IOException ioe) {
        // Handle reading errors
    }
        }
    }

    public synchronized void handleMessage() {
        pendingMessages++;
        notify();
    }

        }
    }
```

Member Summary	
Methods	
void	notifyIncomingMessage(MessageConnection conn)

Methods

notifyIncomingMessage(MessageConnection)

Declaration:
`public void notifyIncomingMessage(javax.wireless.messaging.MessageConnection conn)`

Description:
Called by the platform when an incoming message arrives to a `MessageConnection` where the application has registered this listener object.

This method is called once for each incoming message to the `MessageConnection`.

NOTE: The implementation of this method MUST return quickly and MUST NOT perform any extensive operations. The application SHOULD NOT receive and handle the message during this method call. Instead, it should act only as a trigger to start the activity in the application's own thread.

Parameters:
`conn` - the `MessageConnection` where the incoming message has arrived

javax.wireless.messaging
TextMessage

Declaration
```
public interface TextMessage extends Message
```

All Superinterfaces: Message

Description
An interface representing a text message. This is a subinterface of `Message` which contains methods to get and set the text payload. The `setPayloadText` method sets the value of the payload in the data container without any checking whether the value is valid in any way. Methods for manipulating the address portion of the message are inherited from `Message`.

Object instances implementing this interface are just containers for the data that is passed in.

Character Encoding Considerations

Text messages using this interface deal with `String`s encoded in Java. The underlying implementation will convert the `String`s into a suitable encoding for the messaging protocol in question. Different protocols recognize different character sets. To ensure that characters are transmitted correctly across the network, an application should use the character set(s) recognized by the protocol. If an application is unaware of the protocol, or uses a character set that the protocol does not recognize, then some characters might be transmitted incorrectly.

Member Summary	
Methods	
`java.lang.String`	`getPayloadText()`
`void`	`setPayloadText(java.lang.String data)`

Inherited Member Summary
Methods inherited from interface `Message`
`getAddress()`, `getTimestamp()`, `setAddress(String)`

Methods

getPayloadText()

Declaration:
```
public java.lang.String getPayloadText()
```

Description:
Returns the message payload data as a `String`.

Returns: the payload of this message, or `null` if the payload for the message is not set

See Also: `setPayloadText(String)`

setPayloadText(String)

Declaration:
`public void` **`setPayloadText`**`(java.lang.String data)`

Description:
Sets the payload data of this message. The payload data may be `null`.

Parameters:
`data` - payload data as a `String`

See Also: `getPayloadText()`

APPENDIX A

GSM SMS Adapter _

This appendix describes an adapter that uses the messaging API with the GSM Short Message Service.

A.1.0 GSM SMS Message Structure

The GSM SMS messages are defined in the GSM 03.40 standard [1]. The message consists of a fixed header and a field called TP-User-Data. The TP-User-Data field carries the payload of the short message and optional header information that is not part of the fixed header. This optional header information is contained in a field called User-Data-Header. The presence of optional header information in the TP-User-Data field is indicated by a separate field that is part of the fixed header.

The TP-User-Data can use different encodings depending on the type of the payload content. Possible encodings are a 7-bit alphabet defined in the GSM 03.38 standard, 8-bit binary data, or 16-bit UCS-2 alphabet.

A.1.1 Message Payload Length

The maximum length of the SMS protocol message payload depends on the encoding and whether there are optional headers present in the TP-User-Data field. If the optional header information specifies a port number, then the payload which fits into the SMS protocol message will be smaller. Typically, the message is displayed to the end user. However, this Java API supports the use of port numbers to specify a Java application as the message target.

The messages that the Java application sends can be too long to fit in a single SMS protocol message. In this case, the implementation MUST use the concatenation feature specified in sections 9.2.3.24.1 and 9.2.3.24.8 of the GSM 03.40 standard [1]. This feature can be used to split the message payload given to the Java API into multiple SMS protocol messages. Similarly, when receiving messages, the implementation MUST automatically concatenate the received SMS protocol messages and pass the fully reassembled payload to the application via the API.

A.1.2 Message Payload Concatenation

The GSM 03.40 standard [1] specifies two mechanisms for the concatenation, specified in sections 9.2.3.24.1 and 9.2.3.24.8. They differ in the length of the reference number. For messages that are sent, the implementation

can use either mechanism. For received messages, implementations MUST accept messages with both mechanisms.

Note: Depending on which mechanism is used for sending messages, the maximum length of the payload of a single SMS protocol message differs by one character/byte. For concatenation to work, regardless of which mechanism is used by the implementation, applications are recommended to assume the 16-bit reference number length when estimating how many SMS protocol messages it will take to send a given message. The lengths in Table 1 below are calculated assuming the 16-bit reference number length.

Implementations of this API MUST support at least 3 SMS protocol messages to be received and concatenated together. Similarly, for sending, messages that can be sent with up to 3 SMS protocol messages MUST be supported. Depending on the implementation, these limits may be higher. However, applications are advised not to send messages that will take up more than 3 SMS protocol messages, unless they have reason to assume that the recipient will be able to handle a larger number. The `MessageConnection.numberOfSegments` method allows the application to check how many SMS protocol messages a given message will use when sent.

Table 1: Number of SMS protocol messages needed for different payload lengths

Optional Headers Encoding	No port number present (message to be displayed to the end user)		Port number present (message targeted at an application)	
	Length	**SMS messages**	**Length**	**SMS messages**
GSM 7-bit alphabet	0-160 chars	1	0-152 chars	1
	161-304 chars	2	153-290 chars	2
	305-456 chars	3	291-435 chars	3
8-bit binary data	0-140 bytes	1	0-133 bytes	1
	41-266 bytes	2	134-254 bytes	2
	267-399 bytes	3	255-381 bytes	3
UCS-2 alphabet	0-70 chars	1	0-66 chars	1
	71-132 chars	2	67-126 chars	2
	133-198 chars	3	127-189 chars	3

Table 1 assumes for the GSM 7-bit alphabet that only characters that can be encoded with a single septet are used. If a character that encodes into two septets (using the escape code to the extension table) is used, it counts as two characters in this length calculation.

Note: the values in Table 1 include a concatenation header in all messages, when the message can not be sent in a single SMS protocol message.

Character Mapping Table

GSM 7-bit	UCS-2	Character name
0x00	0x0040	COMMERCIAL AT
0x01	0x00a3	POUND SIGN
0x02	0x0024	DOLLAR SIGN
0x03	0x00a5	YEN SIGN
0x04	0x00e8	LATIN SMALL LETTER E WITH GRAVE
0x05	0x00e9	LATIN SMALL LETTER E WITH ACUTE

GSM 7-bit	UCS-2	Character name
0x06	0x00f9	LATIN SMALL LETTER U WITH GRAVE
0x07	0x00ec	LATIN SMALL LETTER I WITH GRAVE
0x08	0x00f2	LATIN SMALL LETTER O WITH GRAVE
0x09	0x00c7	LATIN CAPITAL LETTER C WITH CEDILLA
0x0a	0x000a	ontrol: line feed
0x0b	0x00d8	LATIN CAPITAL LETTER O WITH STROKE
0x0c	0x00f8	LATIN SMALL LETTER O WITH STROKE
0x0d	0x000d	control: carriage return
0x0e	0x00c5	LATIN CAPITAL LETTER A WITH RING ABOVE
0x0f	0x00e5	LATIN SMALL LETTER A WITH RING ABOVE
0x10	0x0394	GREEK CAPITAL LETTER DELTA
0x11	0x005f	LOW LINE
0x12	0x03a6	GREEK CAPITAL LETTER PHI
0x13	0x0393	GREEK CAPITAL LETTER GAMMA
0x14	0x039b	GREEK CAPITAL LETTER LAMDA
0x15	0x03a9	GREEK CAPITAL LETTER OMEGA
0x16	0x03a0	GREEK CAPITAL LETTER PI
0x17	0x03a8	GREEK CAPITAL LETTER PSI
0x18	0x03a3	GREEK CAPITAL LETTER SIGMA
0x19	0x0398	GREEK CAPITAL LETTER THETA
0x1a	0x039e	GREEK CAPITAL LETTER XI
0x1b	xxx	escape to extension table
0x1c	0x00c6	LATIN CAPITAL LETTER AE
0x1d	0x00e6	LATIN SMALL LETTER AE
0x1e	0x00df	LATIN SMALL LETTER SHARP S
0x1f	0x00c9	LATIN CAPITAL LETTER E WITH ACUTE
0x20	0x0020	SPACE
0x21	0x0021	EXCLAMATION MARK
0x22	0x0022	QUOTATION MARK
0x23	0x0023	NUMBER SIGN
0x24	0x00a4	CURRENCY SIGN
0x25	0x0025	PERCENT SIGN
0x26	0x0026	AMPERSAND
0x27	0x0027	APOSTROPHE
0x28	0x0028	LEFT PARENTHESIS
0x29	0x0029	RIGHT PARENTHESIS
0x2a	0x002a	ASTERISK
0x2b	0x002b	PLUS SIGN
0x2c	0x002c	COMMA
0x2d	0x002d	HYPHEN-MINUS
0x2e	0x002e	FULL STOP
0x2f	0x002f	SOLIDUS
0x30	0x0030	DIGIT ZERO
0x31	0x0031	DIGIT ONE
0x32	0x0032	DIGIT TWO
0x33	0x0033	DIGIT THREE
0x34	0x0034	DIGIT FOUR
0x35	0x0035	DIGIT FIVE
0x36	0x0036	DIGIT SIX
0x37	0x0037	DIGIT SEVEN

GSM 7-bit	UCS-2	Character name
0x38	0x0038	DIGIT EIGHT
0x39	0x0039	DIGIT NINE
0x3a	0x003a	COLON
0x3b	0x003b	SEMICOLON
0x3c	0x003c	LESS-THAN SIGN
0x3d	0x003d	EQUALS SIGN
0x3e	0x003e	GREATER-THAN SIGN
0x3f	0x003f	QUESTION MARK
0x40	0x00a1	INVERTED EXCLAMATION MARK
0x41	0x0041	LATIN CAPITAL LETTER A
0x42	0x0042	LATIN CAPITAL LETTER B
0x43	0x0043	LATIN CAPITAL LETTER C
0x44	0x0044	LATIN CAPITAL LETTER D
0x45	0x0045	LATIN CAPITAL LETTER E
0x46	0x0046	LATIN CAPITAL LETTER F
0x47	0x0047	LATIN CAPITAL LETTER G
0x48	0x0048	LATIN CAPITAL LETTER H
0x49	0x0049	LATIN CAPITAL LETTER I
0x4a	0x004a	LATIN CAPITAL LETTER J
0x4b	0x004b	LATIN CAPITAL LETTER K
0x4c	0x004c	LATIN CAPITAL LETTER L
0x4d	0x004d	LATIN CAPITAL LETTER M
0x4e	0x004e	LATIN CAPITAL LETTER N
0x4f	0x004f	LATIN CAPITAL LETTER O
0x50	0x0050	LATIN CAPITAL LETTER P
0x51	0x0051	LATIN CAPITAL LETTER Q
0x52	0x0052	LATIN CAPITAL LETTER R
0x53	0x0053	LATIN CAPITAL LETTER S
0x54	0x0054	LATIN CAPITAL LETTER T
0x55	0x0055	LATIN CAPITAL LETTER U
0x56	0x0056	LATIN CAPITAL LETTER V
0x57	0x0057	LATIN CAPITAL LETTER W
0x58	0x0058	LATIN CAPITAL LETTER X
0x59	0x0059	LATIN CAPITAL LETTER Y
0x5a	0x005a	LATIN CAPITAL LETTER Z
0x5b	0x00c4	LATIN CAPITAL LETTER A WITH DIARESIS
0x5c	0x00d6	LATIN CAPITAL LETTER O WITH DIARESIS
0x5d	0x00d1	LATIN CAPITAL LETTER N WITH TILDE
0x5e	0x00dc	LATIN CAPITAL LETTER U WITH DIARESIS
0x5f	0x00a7	SECTION SIGN
0x60	0x00bf	INVERTED QUESTION MARK
0x61	0x0061	LATIN SMALL LETTER A
0x62	0x0062	LATIN SMALL LETTER B
0x63	0x0063	LATIN SMALL LETTER C
0x64	0x0064	LATIN SMALL LETTER D
0x65	0x0065	LATIN SMALL LETTER E
0x66	0x0066	LATIN SMALL LETTER F
0x67	0x0067	LATIN SMALL LETTER G
0x68	0x0068	LATIN SMALL LETTER H
0x69	0x0069	LATIN SMALL LETTER I

GSM 7-bit	UCS-2	Character name
0x6a	0x006a	LATIN SMALL LETTER J
0x6b	0x006b	LATIN SMALL LETTER K
0x6c	0x006c	LATIN SMALL LETTER L
0x6d	0x006d	LATIN SMALL LETTER M
0x6e	0x006e	LATIN SMALL LETTER N
0x6f	0x006f	LATIN SMALL LETTER O
0x70	0x0070	LATIN SMALL LETTER P
0x71	0x0071	LATIN SMALL LETTER Q
0x72	0x0072	LATIN SMALL LETTER R
0x73	0x0073	LATIN SMALL LETTER S
0x74	0x0074	LATIN SMALL LETTER T
0x75	0x0075	LATIN SMALL LETTER U
0x76	0x0076	LATIN SMALL LETTER V
0x77	0x0077	LATIN SMALL LETTER W
0x78	0x0078	LATIN SMALL LETTER X
0x79	0x0079	LATIN SMALL LETTER Y
0x7a	0x007a	LATIN SMALL LETTER Z
0x7b	0x00e4	LATIN SMALL LETTER A WITH DIARESIS
0x7c	0x00f6	LATIN SMALL LETTER O WITH DIARESIS
0x7d	0x00f1	LATIN SMALL LETTER N WITH TILDE
0x7e	0x00fc	LATIN SMALL LETTER U WITH DIARESIS
0x7f	0x00e0	LATIN SMALL LETTER A WITH GRAVE
0x1b 0x14	0x005e	CIRCUMFLEX ACCENT
0x1b 0x28	0x007b	LEFT CURLY BRACKET
0x1b 0x29	0x007d	RIGHT CURLY BRACKET
0x1b 0x2f	0x005c	REVERSE SOLIDUS
0x1b 0x3c	0x005b	LEFT SQUARE BRACKET
0x1b 0x3d	0x007e	TILDE
0x1b 0x3e	0x005d	RIGHT SQUARE BRACKET
0x1b 0x40	0x007c	VERTICAL LINE
0x1b 0x65	0x20ac	EURO SIGN

The GSM 7-bit characters that use the escape code for a two septet combination are represented in this table with the hexadecimal representations of the two septets separately. In the encoded messages, the septets are encoded together with no extra alignment to octet boundaries.

A.2.0 Message Addressing

The syntax of the URL connection strings that specify the address are described in Table 2.

Table 2: Connection Strings for Message Addresses

String	Definition
smsurl	::== "sms://" address_part
address_part	::== foreign_host_address | local_host_address
local_host_address	::== port_number_part
port_number_part	::== ":" digits

String	Definition
foreign_host_address	::== msisdn | msisdn port_number_part
msisdn	::== "+" digits | digits
digit	::== "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
digits	::== digit | digit digits

Examples of valid URL connection strings are:

```
sms://+358401234567
sms://+358401234567:6578
sms://:3381
```

When this adapter is used and the `Connector.open()` method is passed a URL with this syntax, it MUST return an instance implementing the `javax.wireless.messaging.MessageConnection` interface.

A.2.1 Specifying Recipient Addresses

In this URL connection string, the MSISDN part identifies the recipient phone number and the port number part of the application port number address as specified in the GSM 3.40 SMS specification [1] (sections 9.2.3.24.3 and 9.2.3.24.4). The same mechanism is used, for example, for the WAP WDP messages.

When the port number is present in the address, the TP-User-Data of the SMS MUST contain a User-Data-Header with the Application port addressing scheme information element.

When the recipient address does not contain a port number, the TP-User-Data MUST NOT contain the Application port addressing header. Java applications cannot receive this kind of message, but it will be handled as usual in the recipient device; for example, text messages will be displayed to the end user.

A.2.2 Client Mode and Server Mode Connections

Messages can be sent using this API via client or server type `MessageConnections`. When a message identifying a port number is sent from a server type `MessageConnection`, the originating port number in the message is set to the port number of the `MessageConnection`. This allows the recipient to send a response to the message that will be received by this `MessageConnection`.

However, when a client type `MessageConnection` is used for sending a message with a port number, the originating port number is set to an implementation-specific value and any possible messages received to this port number are not delivered to the `MessageConnection`.

Thus, only the server mode `MessageConnections` can be used for receiving messages. Any messages to which the other party is expected to respond should be sent using the appropriate server mode `MessageConnection`.

A.2.3 Handling Received Messages

When SMS messages are received by an application, they are removed from the SIM/ME memory where they may have been stored.

If the message information MUST be stored more persistently, then the application is responsible for saving it. For example, the application could could save the message information by using the RMS facility of the MIDP API or any other available mechanism.

The GSM SMS protocol does not guarantee to preserve the ordering when multiple messages are sent. When a large message is split into multiple GSM SMS sections as specified in A.1.2, ordering is handled correctly when they are automatically concatenated back into a single `Message` object. If the application sends multiple `Messages` to the same recipient, they might not be delivered in the correct order. The application must be written so that it is able to deal with this issue appropriately. However, even when the ordering may change

during the delivery in the network, the implementation MUST guarantee that the messages are delivered to the application in the same order as they were received by the implementation of the recipient terminal.

A.3.0 Short Message Service Center Address

Applications might need to obtain the Short Message Service Center (SMSC) address to decide which recipient number to use. For example, the application might need to do this because it is using service numbers for application servers which might not be consistent in all networks and SMSCs.

The SMSC address used for sending the messages MUST be made available using `System.getProperty` with the property name described in Table 3.

Table 3: Property Name and Description for SMSC Addresses

Property name	Description

`wireless.messaging.sms.smsc`	The address of the SMS expressed using the syntax expressed by the msisdn item of thefollowing BNF definition:
	`msisdn ::== "+" digits | digits`
	`digit ::== "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" |"8" | "9"`
	`digits ::== digit | digit digits`

A.4.0 Using Port Numbers

The receiving application in a device is identified with the port number included in the message. When opening the server mode `MessageConnection`, the application specifies the port number that it will use for receiving messages.

The first application to allocate a given port number will get it. If other applications try to allocate the same port number while it is being used by the first application, an IOException will be thrown when they attempt to open the `MessageConnection`. The same rule applies if a port number is being used by a system application in the device. In this case, the Java applications will not be able to use that port number.

As specified in the GSM 03.40 standard [1], the port numbers are split into ranges. The IANA (Internet Assigned Numbers Authority) controls one of the ranges. If an application author wants to ensure that an application can always use a specific port number value, then it can be registered with IANA. Otherwise, the author can pick a number at random from the freely usable range and hope that the same number is not used by another application that might be installed in the same device. This is exactly the same way that port numbers are currently used with TCP and UDP in the Internet.

A.5.0 Message Types

SMS messages can be sent using the `TextMessage` or the `BinaryMessage` message type of the API. The encodings used in the SMS protocol are defined in the GSM 03.38 standard (Part 4 SMS Data Coding Scheme) [2].

When the application uses the `TextMessage` type, the TP-Data-Coding-Scheme in the SMS MUST indicate the GSM default 7-bit alphabet or UCS-2. The TP-User-Data MUST be encoded appropriately using the chosen

alphabet. The 7-bit alphabet MUST be used for encoding if the String that is given by the application only contains characters that are present in the GSM 7-bit alphabet. If the String given by the application contains at least one character that is not present in the GSM 7-bit alphabet, the UCS-2 encoding MUST be used.

When the application uses the `BinaryMessage`, the TP-Data-Coding-Scheme in the SMS MUST indicate 8-bit data.

The application is responsible for ensuring that the message payload fits in an SMS message when encoded as defined in this specification. If the application tries to send a message with a payload that is too long, the `MessageConnection.send()` method will throw an `IllegalArgumentException` and the message will not be sent. This specification contains the information that applications need to determine the maximum payload for the message type they are trying to send.

All messages sent via this API MUST be sent as Class 1 messages GSM 3.40 SMS specification [1], Section 9. 2.3.9 "TP-Protocol-Identifier".

A.6.0 Restrictions on Port Numbers for SMS Messages

For security reasons, Java applications are not allowed to send SMS messages to the port numbers listed in Table 4. Implementations MUST throw a `SecurityException` in the `MessageConnection.send()` method if an application tries to send a message to any of these port numbers.

Table 4: Port Numbers Restricted to SMS Messages

Port number	Description
2805	WAP WTA secure connection-less session service
2923	WAP WTA secure session service
2948	WAP Push connectionless session service (client side)
2949	WAP Push secure connectionless session service (client side)
5502	Service Card reader
5503	Internet access configuration reader
5508	Dynamic Menu Control Protocol
5511	Message Access Protocol
5512	Simple Email Notification
9200	WAP connectionless session service
9201	WAP session service
9202	WAP secure connectionless session service
9203	WAP secure session service
9207	WAP vCal Secure
49996	SyncML OTA configuration
49999	WAP OTA configuration

APPENDIX B

GSM Cell Broadcast Adapter

This appendix describes an adapter that uses the messaging API with the GSM Cell Broadcast short message Service (CBS).

The Cell Broadcast service is a unidirectional data service where messages are broadcast by a base station and received by every mobile station listening to that base station. The Wireless Messaging API is used for receiving these messages.

B.1.0 GSM CBS message structure

The GSM CBS messages are defined in the GSM 03.41 standard [4].

The source/type of a CBS message is defined by its Message-Identifier field, which is used to choose topics to subscribe to. Applications can receive messages of a specific topic by opening a `MessageConnection` with a URL connection string in the format defined below. In the format, Message-Identifier is analogous to a port number.

Cell broadcast messages can be encoded using the same data coding schemes as GSM SMS messages (See Character Mapping Table in Appendix A, GSM SMS Adapter). The implementation of the API will convert messages encoded with the GSM 7-bit alphabet or UCS-2 into `TextMessage` objects and messages encoded in 8-bit binary to `BinaryMessage` objects.

Because the cell broadcast messages do not contain any timestamps, the `Message.getTimeStamp` method MUST always return null for received cell broadcast messages.

B.2.0 Addressing

The URL connection strings that specify the address use the following syntax:

String	Description
cbsurl	::== "cbs://" address_part
address_part	::== message_identifier_part
message_identifier_par	::== ":" digits
digit	::== "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
digits	::== digit | digit digits

Examples of valid URL connection strings are:

```
cbs://:3382
cbs://:3383
```

In this URL, the message identifier part specifies the message identifier of the cell broadcast messages that the application wants to receive.

When this adapter is used and the `Connector.open()` method is passed a URL with this syntax, it MUST return an instance implementing the `javax.wireless.messaging.MessageConnection` interface. These `MessageConnection` instances can be used only for receiving messages. Attempts to call the `send` method on these `MessageConnection` instances MUST result in an `IOException` being thrown.

APPENDIX C

CDMA IS-637 SMS Adapter

This appendix describes an adapter that uses the messaging API with the CDMA IS-637 SMS service.

C.1.0 CDMA IS-637 SMS Message Structure

CDMA SMS messages are defined in the CDMA IS-637 standard [6].

C.2.0 Addressing

The same `sms:` URL connection string is used as for GSM SMS (See Appendix A).

C.3.0 Port Numbers

The IS-637 SMS protocol does not include a port number or any other field for differentiating between recipient applications. For this purpose, the WAP WDP for IS-637 SMS defined in section 6.5 of the WAP Forum WDP specification[5] MUST be used.

Similarly, any rules for segmentation and reassembly follow the WAP WDP guidelines for adapting CDMA SMS messages for a common behavior with corresponding GSM SMS bearer capabilities.

Messages without a port number are sent as normal SMS messages targeted for presentation to the end user.

CDMA SMS messages MUST support a minimum of 3 concatenated messages to be consistent with the GSM SMS message adapter.

APPENDIX D

Deploying JSR 120 Interfaces on a MIDP 2.0 Platform

D.1.0 Introduction

This section provides implementation notes for platform developers deploying the JSR 120 interfaces on a MIDP 2.0 platform.

This section addresses features available in a MIDP 2.0 device that can be used to enhance WMA applications. In particular, this document describes how to:

- use the MIDP 2.0 security features to control access to WMA capabilities
- use the MIDP 2.0 Push mechanism with SMS and CBS messages
- write applications to remain portable between the MIDP 1.0 and MIDP 2.0 platforms

D.2.0 Security

To send and receive messages using this API, applications MUST be granted a permission to perform the requested operation. The mechanisms for granting a permission are implementation dependent.

D.2.1 Permissions for Opening Connections

The JSR 118 MIDP NG specification defines a mechanism for granting permissions to use privileged features. This mechanism is based on a policy mechanism enforced in the platform implementation. The following permissions are defined for the JSR 120 messaging functionality, when deployed with a JSR 118 MIDP 2.0 implementation.

To open a connection, a MIDlet suite requires an appropriate permission to access the `MessageConnection` implementation. If the permission is not granted, then `Connector.open` methods MUST throw a `SecurityException`. The following table indicates the permission that must be granted for each protocol.

Permission	Protocol
`javax.microedition.io.Connector.sms`	`sms`

Permission	Protocol
javax.microedition.io.Connector.cbs	cbs

D.2.2 Permissions for Send and Receive Operations

To send and receive messages, the MIDlet suite requires the appropriate permissions. If the permission is not granted, then the `MessageConnection.send` and the `MessageConnection.receive` methods MUST throw a `SecurityException`. The following table indicates the permission that must be granted for each requested operation.

Permission	Protocol
javax.wireless.messaging.sms.send	sms
javax.wireless.messaging.sms.receive	sms
javax.wireless.messaging.cbs.receive	cbs

The permissions for sending and receiving MAY depend on the type of messages and addresses being used. An implementation MAY restrict an application's ability to send some types of messages and/or sending messages to certain recipient addresses. These addresses can include device addresses and/or identifiers, such as port numbers, within a device.

An implementation MAY restrict certain types of messages or connection addresses, such that sending such messages will fail and throw a `SecurityException` even when the application has the permission to send messages in general.

The applications MUST NOT assume that successfully sending one message implies that they have the permission to send all kinds of messages to all addresses.

An application should handle `SecurityExceptions` when a connection handle is provided from `Connector.open(url)` and for any message `receive` or `send` operation that potentially engages with the network or the privileged message storage on the device.

D.3.0 WMA Push Capabilities

MIDP 2.0 includes a mechanism to register a MIDlet when a connection notification event is detected. Once the MIDlet has been launched it performs the same I/O operations it would normally use to open a connection and read and write data.

For WMA applications this capability allows the application to be launched if messages arrive either while the MIDlet is not running or while another MIDlet is running.

D.3.1 WMA Push Registration Entry

Push registrations are either defined in the application descriptor or made dynamically at runtime via `PushRegistry`. The entry for a WMA protocol will include the connection URL string which identifies the scheme and port number of the inbound message connection. The entry also contains a filter field that designates which senders are permitted to send messages that launch the registered MIDlet. An asterisk ("*") and question mark ("?") can be used in the filter field as a wild cards as specified in the MIDP 2.0 specification.

For the `sms:` protocol, the filter field is matched against the MSISDN part of the sender address, as defined by the `msisdn` element of the `sms:` URL syntax in section A.2.0 of the WMA API specification. The sender port number is not included in matching the filter. Wildcard characters can be used in the filter as specified in the MIDP 2.0 specification.

For the `CBS:` protocol, the filtering is not performed and only "*" MUST be used as the filter.

For example :

```
MIDlet-Push-1: sms://:12345, SmsExample, 123456789
MIDlet-Push-2: cbs://:54321, CbsExample, *
```

Unlike the initial push connections defined in JSR 118 for MIDP 2.0, the SMS protocol includes an explicit buffering mechanism where messages are held until processed by some application that reads and deletes messages when they are done with data. If a message is delivered to the device and does not pass the specified filter, the message will be deleted by the Application Management Software.

When the application is started in response to a `Push` message, the application SHOULD read and process all messages that are buffered for it. If an application fails to read and process the messages when started or if starting of the application is denied (for example, by the end user), the platform implementation MAY delete unread messages from the buffer, if it becomes necessary to do so. For example, the platform implementation may delete messages when the buffer becomes full.

Another difference between the WMA interface and other JSR 118 protocol handlers in MIDP 2.0, is that WMA includes a `MessageListener` which provides asynchronous callbacks when messages become available while the application is running.

D.4.0 Portable WMA Applications

If permitted by the device security policy, a WMA application written for a MIDP 1.0 platform will work without any modification on a MIDP 2.0 system. This behavior is defined by the JSR 118 specification of untrusted applications.

MIDP 2.0 also supports the concept of trusted applications. For these applications, the device can automatically handle trust decisions based on signed JAR files and a platform-specific policy mechanism that associates specific permissions with the signed application.

The security model also allows for the definition of user-granted permissions on a one-shot, session or blanket authorization. In many cases, the platform-dependent policy for permissions on MIDP 1.0 will be able to be mapped onto the MIDP 2.0 defined permissions.

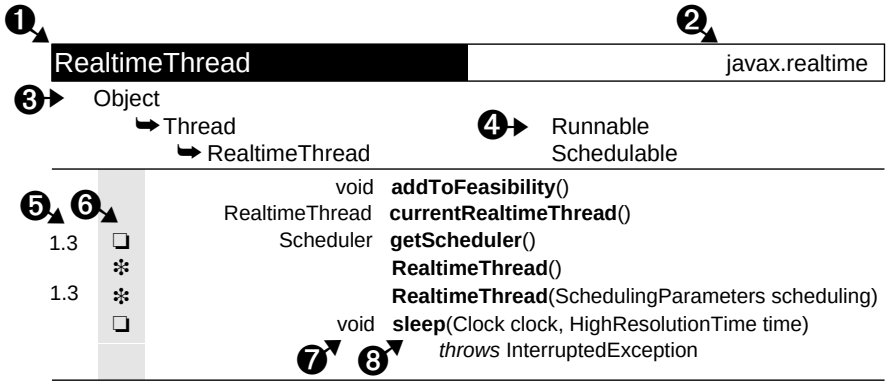
An application designed to work only on a MIDP 2.0 device can use the methods in the `PushRegistry` class to check if there are active connections (`listConnections`) or to add or remove registered connections at runtime (`registerConnection` or `unregisterConnection`).

An application designed to run portably on MIDP 1.0 or MIDP 2.0 platforms will only use the application descriptor and attributes in the manifest to describe requested permissions and push registration entries. See the JSR 118 MIDP 2.0 specification for details about the MIDlet-Permissions and MIDlet-Push-<n> attributes. On a MIDP 1.0 platforms these properties will be ignored. On a MIDP 2.0 platform, these properties will direct the application management software to perform the necessary checks and registrations when the application is installed and removed from the system.

ALMANAC LEGEND

The almanac presents classes and intefaces in alphabetic order, regardless of their package. Fields, methods and constructors are in alphabetic order in a single list.

This almanac is modeled after the style introduced by Patrick Chan in his excellent book *Java Developers Almanac*.



1. Name of the class, interface, nested class or nested interface. Interfaces are italic.
2. Name of the package containing the class or interface.
3. Inheritance hierarchy. In this example, `RealtimeThread` extends `Thread`, which extends `Object`.
4. Implemented interfaces. The interface is to the right of, and on the same line as, the class that implements it. In this example, `Thread` implements `Runnable`, and `RealtimeThread` implements `Schedulable`.
5. The first column above is for the value of the `@since` comment, which indicates the version in which the item was introduced.
6. The second column above is for the following icons. If the "protected" symbol does not appear, the member is public. (Private and package-private modifiers also have no symbols.) One symbol from each group can appear in this column.

Modifiers	**Access Modifiers**	**Constructors and Fields**
❍ abstract	♦protected	❇ constructor
● final		✍ field
❑ static		
■ static final		

7. Return type of a method or declared type of a field. Blank for constructors.
8. Name of the constructor, field or method. Nested classes are listed in 1, not here.

Almanac

BinaryMessage	**javax.wireless.messaging**
BinaryMessage	Message

byte[]	**getPayloadData()**
void	**setPayloadData(byte[] data)**

Connector	**javax.microedition.io**

Object
➥Connector

Connection	**open(String name) *throws* java.io.IOException**
Connection	**open(String name, int mode) *throws* java.io.IOException**
Connection	**open(String name, int mode, boolean timeouts) *throws* java.io.IOException**
java.io.DataInputStream	**openDataInputStream(String name) *throws* java.io.IOException**
java.io.DataOutputStream	**openDataOutputStream(String name) *throws* java.io.IOException**
java.io.InputStream	**openInputStream(String name) *throws* java.io.IOException**
java.io.OutputStream	**openOutputStream(String name) *throws* java.io.IOException**
int	**READ**
int	**READ_WRITE**
int	**WRITE**

Message	**javax.wireless.messaging**

Message

String	**getAddress()**
java.util.Date	**getTimestamp()**
void	**setAddress(String addr)**

MessageConnection	**javax.wireless.messaging**
MessageConnection	javax.microedition.io.Connection

String	**BINARY_MESSAGE**
Message	**newMessage(String type)**
Message	**newMessage(String type, String address)**
int	**numberOfSegments(Message msg)**
Message	**receive() *throws* java.io.IOException, java.io.InterruptedIOException**

	void	**send(Message msg) *throws* java.io.IOException, java.io.InterruptedIOException**
	void	**setMessageListener(MessageListener l) *throws* java.io.IOException**
✍■	String	**TEXT_MESSAGE**

MessageListener — javax.wireless.messaging

MessageListener

	void	**notifyIncomingMessage(MessageConnection conn)**

TextMessage — javax.wireless.messaging

TextMessage — Message

	String	**getPayloadText()**
	void	**setPayloadText(String data)**

Index

W