JavaMail™ API Design Specification

Version 1.2

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Chapter 1:

Introduction

In the few years since its first release, the Java™ programming language has matured to become a platform. The Java platform has added functionality, including distributed computing with RMI and the CORBA bridge, and a component architecture (JavaBeans™). Java applications have also matured, and many now need an addition to the Java platform: a mail and messaging framework. The JavaMail™ API described in this specification satisfies that need.

The JavaMail API provides a set of abstract classes defining objects that comprise a mail system. The API defines classes like Message, Store and Transport. The API can be extended and can be subclassed to provide new protocols and to add functionality when necessary.

In addition, the API provides concrete subclasses of the abstract classes. These subclasses, including MimeMessage and MimeBodyPart, implement widely used Internet mail protocols and conform to specifications RFC822 and RFC2045. They are ready to be used in application development.

Target Audience

The JavaMail API is designed to serve several audiences:

- Client, server, or middleware developers interested in building mail and messaging applications using the Java programming language.
- Application developers who need to "mail-enable" their applications.
- Service Providers who need to implement specific access and transfer protocols. For example; a telecommunications company can use the JavaMail API to implement a PAGER Transport protocol that sends mail messages to alphanumeric pagers.

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Chapter 2:

Goals and Design Principles

The JavaMail API is designed to make adding electronic mail capability to simple applications easy, while also supporting the creation of sophisticated user interfaces. It includes appropriate convenience classes which encapsulate common mail functions and protocols. It fits with other packages for the Java platform in order to facilitate its use with other Java APIs, and it uses familiar programming models.

The JavaMail API is therefore designed to satisfy the following development and runtime requirements:

- Simple, straightforward class design is easy for a developer to learn and implement.
- Use of familiar concepts and programming models support code development that interfaces well with other Java APIs.
  - Uses familiar exception-handling and JDK 1.1 event-handling programming models.
  - Uses features from the JavaBeans Activation Framework (JAF) to handle access to data based on data-type and to facilitate the addition of data types and commands on those data types. The JavaMail API provides convenience functions to simplify these coding tasks.
- Lightweight classes and interfaces make it easy to add basic mail-handling tasks to any application.
- Supports the development of robust mail-enabled applications, that can handle a variety of complex mail message formats, data types, and access and transport protocols.

The JavaMail API draws heavily from IMAP, MAPI, CMC, c-client and other messaging system APIs: many of the concepts present in these other systems are also present in the JavaMail API. It is simpler to use because it uses features of the Java programming language not available to these other APIs, and because it uses the Java programming language's object model to shelter applications from implementation complexity.

The JavaMail API design is driven by the needs of the applications it supports—but it is also important to consider the needs of API implementors. It is critically important to enable the implementation of messaging systems written using the Java programming language that interoperate with existing messaging systems—especially

Internet mail. It is also important to anticipate the development of new messaging systems. The JavaMail API conforms to current standards while not being so constrained by current standards that it stifles future innovation.

The JavaMail API supports many different messaging system implementations—different message stores, different message formats, and different message transports. The JavaMail API provides a set of base classes and interfaces that define the API for client applications. Many simple applications will only need to interact with the messaging system through these base classes and interfaces.

JavaMail subclasses can expose additional messaging system features. For instance, the MimeMessage subclass exposes and implements common characteristics of an Internet mail message, as defined by RFC822 and MIME standards. Developers can subclass JavaMail classes to provide the implementations of particular messaging systems, such as IMAP4, POP3, and SMTP.

The base JavaMail classes include many convenience APIs that simplify use of the API, but don't add any functionality. The implementation subclasses are not required to implement those convenience methods. The implementation subclasses must implement only the core classes and methods that provide functionality required for the implementation.

Alternately, a messaging system can choose to implement all of the JavaMail API directly, allowing it to take advantage of performance optimizations, perhaps through use of batched protocol requests. The IMAP4 protocol implementation takes advantage of this approach.

The JavaMail API uses the Java programming language to good effect to strike a balance between simplicity and sophistication. Simple tasks are easy, and sophisticated functionality is possible.

Chapter 3:

Architectural Overview

This section describes the JavaMail architecture, defines major classes and interfaces comprising that architecture, and lists major functions that the architecture implements.

JavaMail provides elements that are used to construct an interface to a messaging system, including system components and interfaces. While this specification does not define any specific implementation, JavaMail does include several classes that implement RFC822 and MIME Internet messaging standards. These classes are delivered as part of the JavaMail class package.

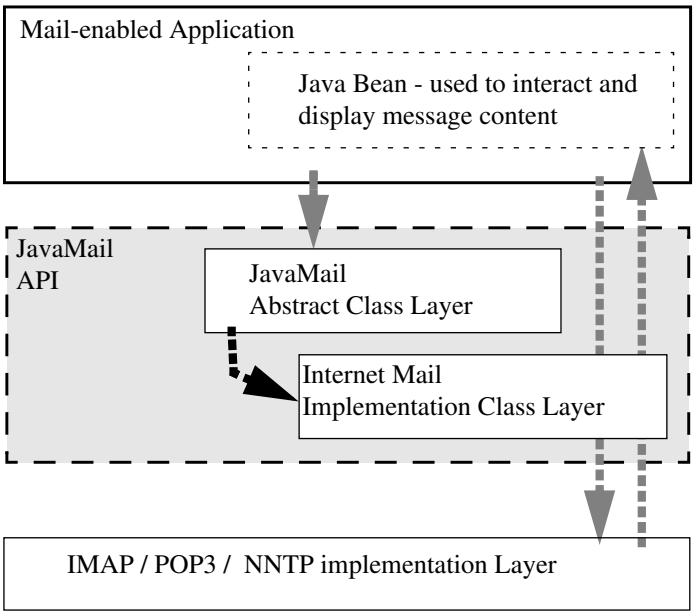
JavaMail Layered Architecture

The JavaMail architectural components are layered as shown below:

- The *Abstract Layer* declares classes, interfaces and abstract methods intended to support mail handling functions that all mail systems support. API elements comprising the Abstract Layer are intended to be subclassed and extended as necessary in order to support standard data types, and to interface with message access and message transport protocols as necessary.
- The internet *implementation layer* implements part of the abstract layer using internet standards - RFC822 and MIME.
- JavaMail uses the JavaBeans Activation Framework (JAF) in order to encapsulate message data, and to handle commands intended to interact with that data. Interaction with message data should take place via JAF-aware JavaBeans, which are not provided by the JavaMail API.

JavaMail clients use the JavaMail API and Service Providers implement the JavaMail API. The layered design architecture allows clients to use the same JavaMail API calls to send, receive and store a variety of messages using different data-types from different message stores and using different message transport protocols.

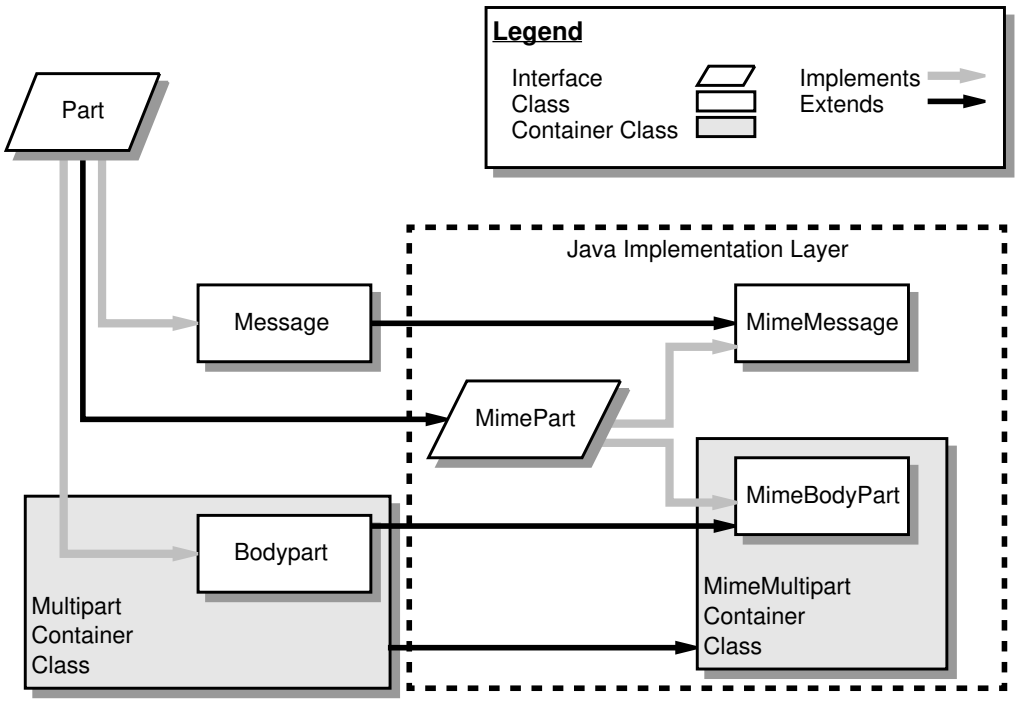
FIGURE 3-1



JavaMail Class Hierarchy

The figure below shows major classes and interfaces comprising the JavaMail API. See "Major JavaMail API Components" on page 10 for brief descriptions of all components shown on this diagram.

FIGURE 3-2



The JavaMail Framework

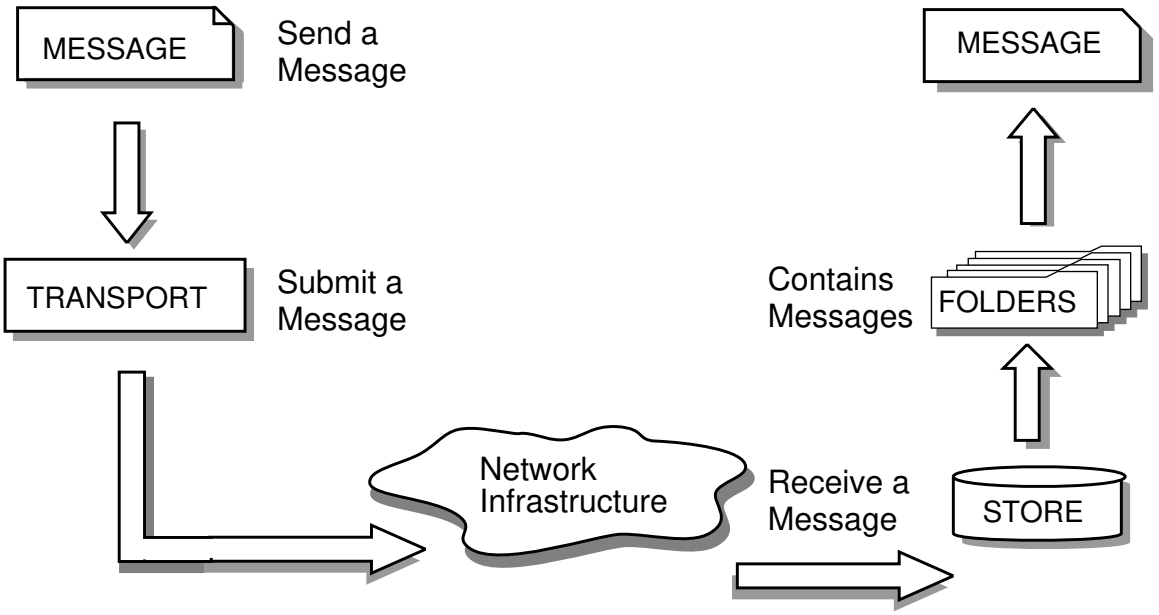
The JavaMail API is intended to perform the following functions, which comprise the standard mail handling process for a typical client application:

- Create a mail message consisting of a collection of header attributes and a block of data of some known data type as specified in the `Content-Type` header field. JavaMail uses the `Part` interface and the `Message` class to define a mail message. It uses the JAF-defined `DataHandler` object to contain data placed in the message.
- Create a `Session` object, which authenticates the user, and controls access to the message store and transport.
- Send the message to its recipient list.
- Retrieve a message from a message store.
- Execute a high-level command on a retrieved message. High-level commands like *view* and *print* are intended to be implemented via JAF-Aware JavaBeans.

Note – The JavaMail framework does not define mechanisms that support message delivery, security, disconnected operation, directory services or filter functionality. Security, disconnected operation and filtering support will be added in future releases.

This figure illustrates the JavaMail message-handling process.

FIGURE 3-3



Major JavaMail API Components

This section reviews major components comprising the JavaMail architecture.

The `Message` Class

The `Message` class is an abstract class that defines a set of attributes and a content for a mail message. Attributes of the `Message` class specify addressing information and define the structure of the content, including the content type. The content is represented as a `DataHandler` object that wraps around the actual data.

The `Message` class implements the `Part` interface. The `Part` interface defines attributes that are required to define and format data content carried by a `Message` object, and to interface successfully to a mail system. The `Message` class adds `From`, `To`, `Subject`, `Reply-To`, and other attributes necessary for message routing via a message transport system. When contained in a folder, a `Message` object has a set of flags associated with it. JavaMail provides `Message` subclasses that support specific messaging implementations.

The content of a message is a collection of bytes, or a reference to a collection of bytes, encapsulated within a `Message` object. JavaMail has no knowledge of the data type or format of the message content. A `Message` object interacts with its content through an intermediate layer—the JavaBeans Activation Framework (JAF). This separation allows a `Message` object to handle any arbitrary content and to transmit it using any appropriate transmission protocol by using calls to the same API methods. The message recipient usually knows the content data type and format and knows how to handle that content.

The JavaMail API also supports multipart `Message` objects, where each `Bodypart` defines its own set of attributes and content.

Message Storage and Retrieval

Messages are stored in `Folder` objects. A `Folder` object can contain subfolders as well as messages, thus providing a tree-like folder hierarchy. The `Folder` class declares methods that fetch, append, copy and delete messages. A `Folder` object can also send events to components registered as event listeners.

The `Store` class defines a database that holds a folder hierarchy together with its messages. The `Store` class also specifies the *access* protocol that accesses folders and retrieves messages stored in folders. The `Store` class also provides methods to establish a connection to the database, to fetch folders and to close a connection. Service providers implementing Message Access protocols (IMAP4, POP3 etc.) start off by subclassing the `Store` class. A user typically starts a session with the mail system by connecting to a particular `Store` implementation.

Message Composition and Transport

A client creates a new message by instantiating an appropriate `Message` subclass. It sets attributes like the recipient addresses and the subject, and inserts the content into the `Message` object. Finally, it sends the `Message` by invoking the `Transport.send` method.

The `Transport` class models the transport agent that routes a message to its destination addresses. This class provides methods that send a message to a list of recipients. Invoking the `Transport.send` method with a `Message` object identifies the appropriate transport based on its destination addresses.

The `Session` Class

The `Session` class defines global and per-user mail-related properties that define the interface between a mail-enabled client and the network. JavaMail system components use the `Session` object to set and get specific properties. The `Session` class also provides a default authenticated session object that desktop applications can share. The `Session` class is a final concrete class. It cannot be subclassed.

The `Session` class also acts as a factory for `Store` and `Transport` objects that implement specific access and transport protocols. By calling the appropriate factory method on a `Session` object, the client can obtain `Store` and `Transport` objects that support specific protocols.

The JavaMail Event Model

The JavaMail event model conforms to the JDK 1.1 event-model specification, as described in the JavaBeans Specification. The JavaMail API follows the design patterns defined in the JavaBeans Specification for naming events, event methods and event listener registration.

All events are subclassed from the `MailEvent` class. Clients listen for specific events by registering themselves as listeners for those events. Events notify listeners of state changes as a session progresses. During a session, a JavaMail component generates a specific event-type to notify objects registered as listeners for that event-type. The JavaMail `Store`, `Folder`, and `Transport` classes are event sources. This specification describes each specific event in the section that describes the class that generates that event.

Using the JavaMail API

This section defines the syntax and lists the order in which a client application calls some JavaMail methods in order to access and open a message located in a folder:

1. A JavaMail client typically begins a mail handling task by obtaining the default JavaMail Session object.

```
Session session = Session.getDefaultInstance(
                        props, authenticator);
```

2. The client uses the `Session` object's `getStore` method to connect to the default store. The `getStore` method returns a `Store` object subclass that supports the access protocol defined in the user properties object, which will typically contain per-user preferences.

```
Store store = session.getStore();
store.connect();
```

3. If the connection is successful, the client can list available folders in the Store, and then fetch and view specific Message objects.

```
// get the INBOX folder
Folder inbox = store.getFolder("INBOX");

// open the INBOX folder
inbox.open(Folder.READ_WRITE);

Message m = inbox.getMessage(1);       // get Message # 1
String subject = m.getSubject();       // get Subject
Object content = m.getContent();       // get content
...
...
```

4. Finally, the client closes all open folders, and then closes the store.

```
inbox.close();              // Close the INBOX
store.close();                   // Close the Store
```

See "Examples Using the JavaMail API" on page 63 for a more complete example.

Chapter 4:

The `Message` *Class*

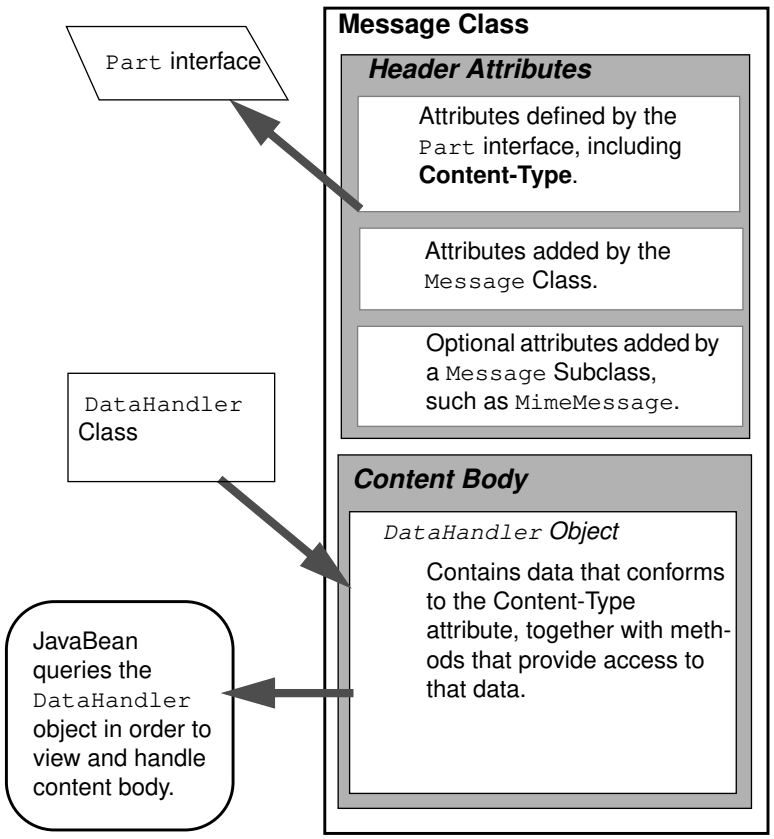
The `Message` class defines a set of attributes and a content for a mail message. Message attributes specify message addressing information and define the structure of the content, including the content type. The content is represented by a `DataHandler` object that wraps around the actual data. The `Message` class is an abstract class that implements the `Part` interface.

Subclasses of the `Message` classes can implement several standard message formats. For example, the JavaMail API provides the `MimeMessage` class, that extends the `Message` class to implement the RFC822 and MIME standards. Implementations can typically construct themselves from byte streams and generate byte streams for transmission.

A `Message` subclass instantiates an object that holds message content, together with attributes that specify addresses for the sender and recipients, structural information about the message, and the content type of the message body. Messages placed into a folder also have a set of flags that describe the state of the message within the folder.

The figure below illustrates the structure of the `Message` class.

FIGURE 4-1



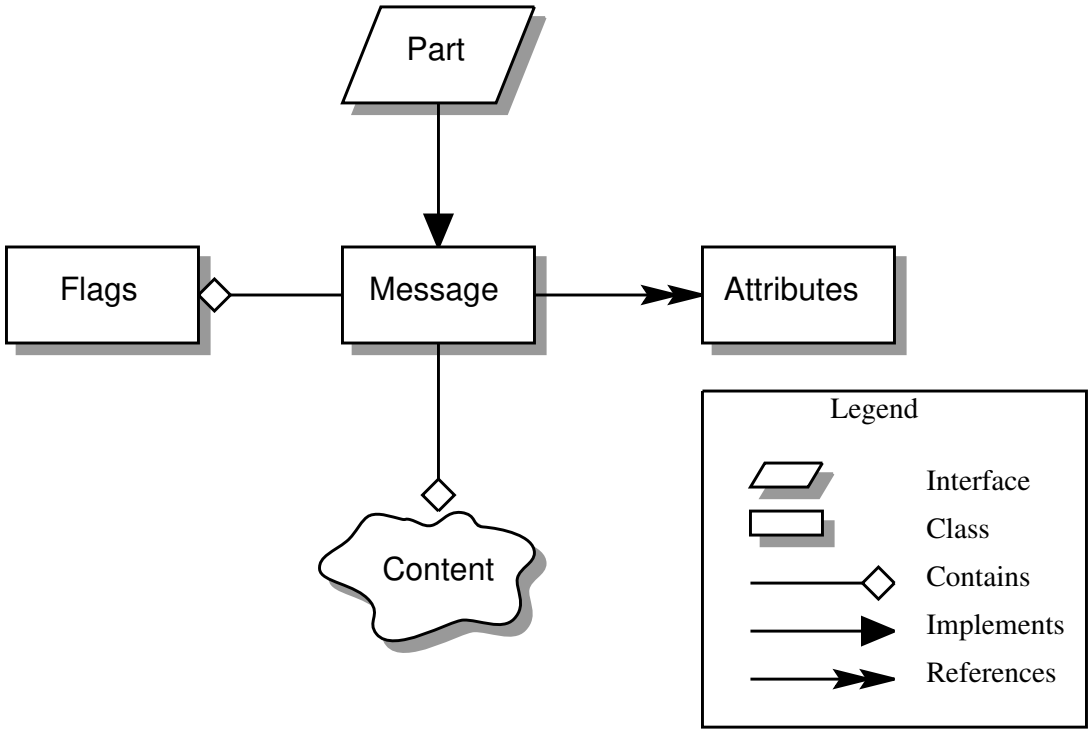
The `Message` object has no direct knowledge of the nature or semantics of its content. This separation of structure from content allows the message object to contain any arbitrary content.

`Message` objects are either retrieved from a `Folder` object or constructed by instantiating a new `Message` object of the appropriate subclass. Messages stored within a `Folder` object are sequentially numbered, starting at one. An assigned message number can change when the folder is expunged, since the expunge operation removes deleted messages from the folder and also renumbers the remaining messages.

A `Message` object can contain multiple parts, where each part contains its own set of attributes and content. The content of a multipart message is a `Multipart` object that contains `BodyPart` objects representing each individual part. The `Part` interface defines the structural and semantic similarity between the `Message` class and the `BodyPart` class.

The figure below illustrates a `Message` instance hierarchy, where the message contains attributes, a set of flags, and content. See "MimeMessage Object Hierarchy" on page 81 for an illustration of the `MimeMessage` object hierarchy.

FIGURE 4-2



The `Message` class provides methods to perform the following tasks:

- Get, set and create its attributes and content:

```
public String getSubject() throws MessagingException;

public void setSubject(String subject)
   throws MessagingException;

public String[] getHeader(String name)
   throws MessagingException;
```

```
public void setHeader(String name, String value)
   throws MessagingException;

public Object getContent()
   throws MessagingException;

public void setContent(Object content, String type)
   throws MessagingException
```

- Save changes to its containing folder.

```
public void saveChanges()
    throws MessagingException;
```

This method also ensures that the Message header fields are updated to be consistent with the changed message contents.

- Generate a bytestream for the `Message` object.

```
public void writeTo(OutputStream os)
   throws IOException, MessagingException;
```

This byte stream can be used to save the message or send it to a Transport object.

The `Part` Interface

The `Part` interface defines a set of standard headers common to most mail systems, specifies the data-type assigned to data comprising a content block, and defines set and get methods for each of these members. It is the basic data component in the JavaMail API and provides a common interface for both the `Message` and `BodyPart` classes. See the JavaMail API (Javadoc) documentation for details.

Note – A `Message` object can not be contained directly in a `Multipart` object, but must be embedded in a `BodyPart` first.

Message Attributes

The `Message` class adds its own set of standard attributes to those it inherits from the `Part` interface. These attributes include the sender and recipient addresses, the subject, flags, and sent and received dates. The `Message` class also supports non-standard attributes in the form of headers. See the JavaMail API (Javadoc) Documentation for the list of standard attributes defined in the `Message` class. Not all messaging systems will support arbitrary headers, and the availability and meaning of particular header names is specific to the messaging system implementation.

The `ContentType` *Attribute*

The `contentType` attribute specifies the data type of the content, following the MIME typing specification (RFC 2045). A MIME type is composed of a primary type that declares the general type of the content, and a subtype that specifies a specific format for the content. A MIME type also includes an optional set of type-specific parameters.

JavaMail API components can access content via these mechanisms:

As an input stream	The `Part` interface declares the `getInputStream` method that returns an input stream to the content. Note that `Part` implementations must decode any mail-specific transfer encoding before providing the input stream.
As a DataHandler object	The `Part` interface declares the `getDataHandler` method that returns a `javax.activation.DataHandler` object that wraps around the content. The `DataHandler` object allows clients to discover the operations available to perform on the content, and to instantiate the appropriate component to perform those operations. See "The JavaBeans Activation Framework" on page 41 for details describing the data typing framework
As an object in the Java programming language	The `Part` interface declares the `getContent` method that returns the content as an object in the Java programming language. The type of the returned object is dependent on the content's data type. If the content is of type multipart, the `getContent` method returns a `Multipart` object, or a `Multipart` subclass object. The `getContent` method returns an input stream for unknown content-types. Note that the `getContent` method uses the `DataHandler` internally to obtain the native form.

The `setDataHandler(DataHandler)` method specifies content for a new `Part` object, as a step toward the construction of a new message. The `Part` also provides some convenience methods to set up most common content types.

Part provides the `writeTo` method that writes its byte stream in mail-safe form suitable for transmission. This byte stream is typically an aggregation of the `Part` attributes and the byte stream for its content.

The `Address` *Class*

The `Address` class represents email addresses. The `Address` class is an abstract class. Subclasses provide implementation-specific semantics.

The `BodyPart` *Class*

The `BodyPart` class is an abstract class that implements the `Part` interface in order to define the attribute and content body definitions that `Part` declares. It does not declare attributes that set `From`, `To`, `Subject`, `ReplyTo`, or other address header fields, as a `Message` object does.

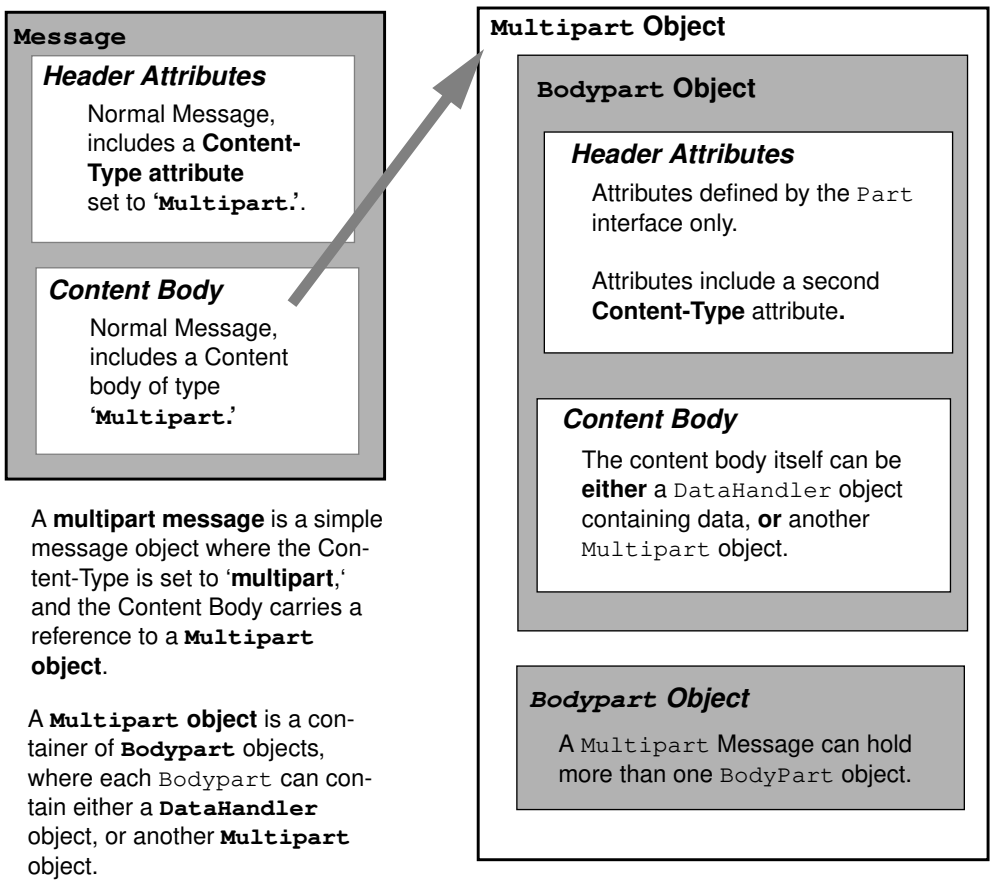
A `BodyPart` object is intended to be inserted into a `Multipart` container, later accessed via a multipart message.

The `Multipart` *Class*

The `Multipart` class implements multipart messages. A multipart message is a `Message` object where the content-type specifier has been set to *multipart*. The `Multipart` class is a container class that contains objects of type `Bodypart`. A `Bodypart` object is an instantiation of the `Part` interface—it contains either a new `Multipart` container object, or a `DataHandler` object.

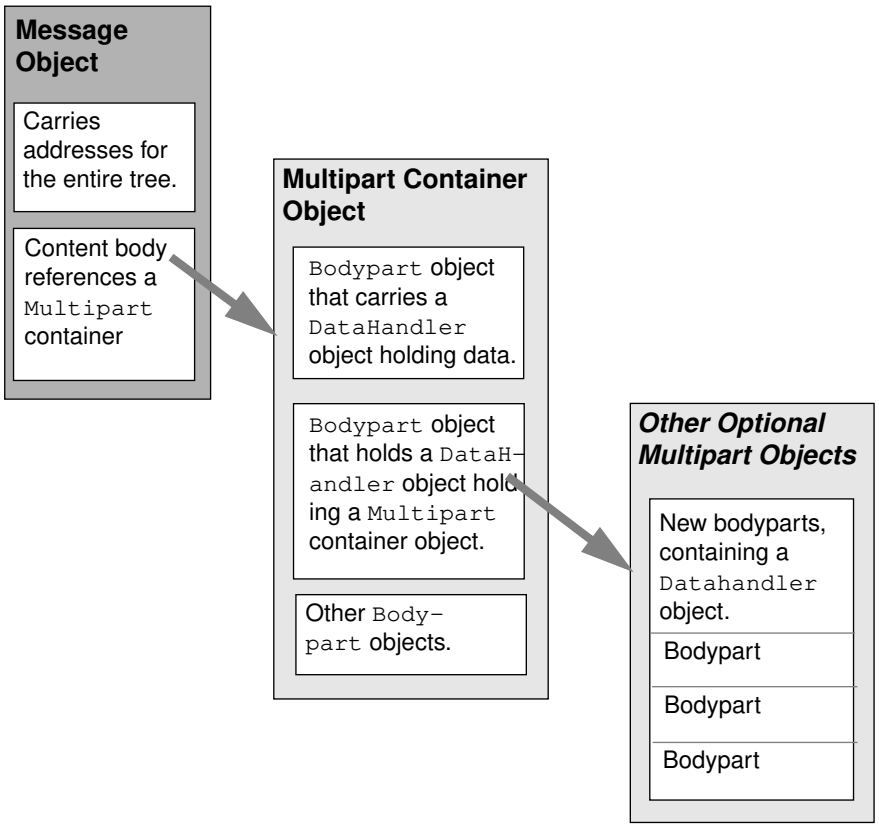
The figure below illustrates the structure and content of a multipart message:

FIGURE 4-3



Note that `Multipart` objects can be nested to any reasonable depth within a multipart message, in order to build an appropriate structure for data carried in `DataHandler` objects. Therefore, it is important to check the `ContentType` header for each `BodyPart` element stored within a `Multipart` container. The figure below illustrates a typical nested `Multipart` message.

FIGURE 4-4



Typically, the client calls the `getContentType` method to get the content type of a message. If `getContentType` returns a MIME-type whose primary type is multipart, then the client calls `getContent` to get the `Multipart` container object.

The `Multipart` object supports several methods that get, create, and remove individual BodyPart objects.

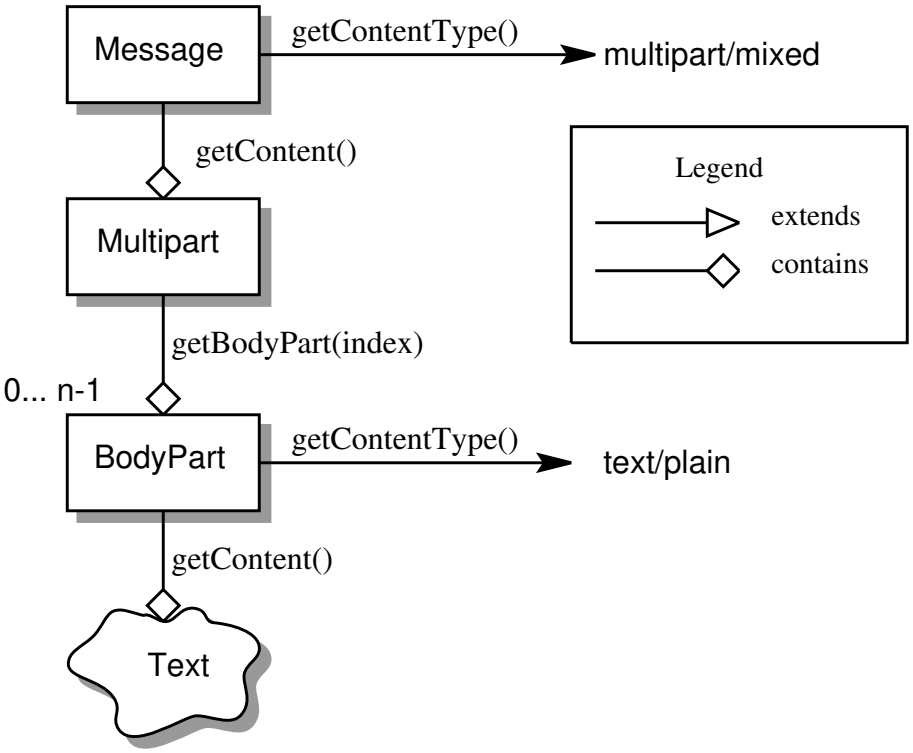
```
public int getCount() throws MessagingException;

public Body getBodyPart(int index)
    throws MessagingException;
```

```
public void addBodyPart(BodyPart part)
    throws MessagingException;

public void removeBodyPart(BodyPart body)
    throws MessagingException;

public void removeBodyPart(int index)
    throws MessagingException;
```

The `Multipart` class implements the `javax.beans.DataSource` interface. It can act as the `DataSource` object for `javax.beans.DataHandler` and `javax.beans.DataContentHandler` objects. This allows message-aware content handlers to handle multipart data sources more efficiently, since the data has already been parsed into individual parts.

This diagram illustrates the structure of a multipart message, and shows calls from the associated `Message` and `Multipart` objects, for a typical call sequence returning a `BodyPart` containing `text/plain` content.

FIGURE 4-5



In this figure, the `ContentType` attribute of a `Message` object indicates that it holds a multipart content. Use the `getContent` method to obtain the `Multipart` object.

This code sample below shows the retrieval of a `Multipart` object. See "Examples Using the JavaMail API" on page 63 for examples that traverse a multipart message and examples that create new multipart messages.

```
Multipart mp = (Multipart)message.getContent();

int count = mp.getCount();
BodyPart body_part;

for (int i = 0; i < count; i++)
   body_part = mp.getBodyPart(i);
```

The `Flags` *Class*

`Flags` objects carry flag settings that describe the state of a `Message` object within its containing folder. The `Message.getFlags` method returns a `Flags` object that holds all the flags currently set for that message.

The `setFlags(Flags f, boolean set)` method sets the specified flags for that message. The `add(Flags.Flag f)` method on a `Flags` object sets the specified flag; the `contains(Flags.Flag f)` method returns whether the specified flag is set.

ANSWERED	Clients set this flag to indicate that this message has been answered.
DRAFT	Indicates that this message is a draft.
FLAGGED	No defined semantics. Clients can use this flag to mark a message in some user-defined manner.
RECENT	This message is newly arrived in this folder. This flag is set when the message is first delivered into the folder and cleared when the containing folder is closed. Clients cannot set this flag.
SEEN	Marks a message that has been opened. A client sets this flag implicitly when the message contents are retrieved.
DELETED	Allows undoable message deletion. Setting this flag for a message marks it `deleted` but does not physically remove the message from its folder. The client calls the `expunge` method on a folder to remove all deleted messages in that folder.

Note that a folder is not guaranteed to support either standard system flags or arbitrary user flags. The `getPermanentFlags` method in a folder returns a `Flags` object that contains all the system flags supported by that `Folder` implementation. The presence of the special `USER` flag indicates that the client can set arbitrary user-definable flags on any message belonging to this folder.

Message Creation And Transmission

The `Message` class is abstract, so an appropriate subclass must be instantiated to create a new `Message` object. A client creates a message by instantiating an appropriate `Message` subclass.

For example, the `MimeMessage` subclass handles Internet email messages. Typically, the client application creates an email message by instantiating a `MimeMessage` object, and passing required attribute values to that object. In an email message, the client defines `Subject`, `From`, and `To` attributes. The client then passes message content into the `MimeMessage` object by using a suitably configured `DataHandler` object. See "Message Composition" on page 45 for details.

After the `Message` object is constructed, the client calls the `Transport.send` method to route it to its specified recipients. See "Transport Protocols and Mechanisms" on page 51 for a discussion of the transport process.

Chapter 5:

The Mail Session

A mail `Session` object manages the configuration options and user authentication information used to interact with messaging systems.

The JavaMail API supports simultaneous multiple sessions. Each session can access multiple message stores and transports. Any desktop application that needs to access the current primary message store can share the default session. Typically the mail-enabled application establishes the default session, which initializes the authentication information necessary to access the user's `Inbox` folder. Other desktop applications then use the default session when sending or accessing mail on behalf of the user. When sharing the session object, all applications share authentication information, properties, and the rest of the state of the object.

For example,

- To create a `Session` using a static factory method:
  ```
  Session session = Session.getInstance(props, authenticator);
  ```
- To create an unshared session, or to access the default session.
  ```
  Session defaultSession =
       Session.getDefaultInstance(props, authenticator);
  ```

The `Properties` object that initializes the `Session` contains default values and other configuration information. It is expected that clients using the APIs set the values for the listed properties, especially `mail.store.protocol`, `mail.transport.protocol`, `mail.host`, `mail.user`, and `mail.from`, since the defaults are unlikely to work in all cases. See "Environment Properties" on page 61 for a list of properties used by the JavaMail APIs and their defaults.

Some messaging system implementations can use additional properties. Typically the properties object contains user-defined customizations in addition to system-wide defaults. Mail-enabled application logic determines the appropriate set of properties. Lacking a specific requirement, the application can use the system properties object retrieved from the `System.getProperties` method.

The `Authenticator` object controls security aspects for the `Session` object. The messaging system uses it as a callback mechanism to interact with the user when a password is required to login to a messaging system. It indirectly controls access to the default session, as described below.

Clients using JavaMail can register `PasswordAuthentication` objects with the `Session` object for use later in the session or for use by other users of the same session. Because `PasswordAuthentication` objects contain passwords, access to

this information must be carefully controlled. Applications that create `Session` objects must restrict access to those objects appropriately. In addition, the `Session` class shares some responsibility for controlling access to the default session object.

The first call to the `getDefaultInstance` method creates a new `Session` object and associates it with the `Authenticator` object. Subsequent calls to the `getDefaultInstance` method compare the `Authenticator` object passed in with the `Authenticator` object saved in the default session. Access to the default session is allowed if both objects have been loaded by the same class loader. Typically, this is the case when both the default session creator and the program requesting default session access are in the same "security domain." Also, if both objects are `null`, access is allowed. Using `null` to gain access is discouraged, because this allows access to the default session from any security domain.

A mail-enabled client uses the `Session` object to retrieve a `Store` or `Transport` object in order to read or send mail. Typically, the client retrieves the default `Store` or `Transport` object based on properties loaded for that session:

```
Store store = session.getStore();
```

The client can override the session defaults and access a `Store` or `Transport` object that implements a particular protocol.

```
Store store = session.getStore("imap");
```

See "The Provider Registry" on page 26 for details.

Implementations of `Store` and `Transport` objects will be told the session to which they have been assigned. They can then make the `Session` object available to other objects contained within this `Store` or `Transport` objects using application-dependent logic.

The Provider Registry

The Provider Registry allows providers to register their protocol implementations to be used by JavaMail APIs. It provides a mechanism for discovering available protocol, for registering new protocols, and for specifying default implementations.

Resource Files

The providers for JavaMail APIs are configured using the following files:

- `javamail.providers` and `javamail.default.providers`
- `javamail.address.map` and `javamail.default.address.map`

Each `javamail.X` resource file is searched in the following order:

1. *java.home*`/lib/javamail.X`
2. `META-INF/javamail.X`
3. `META-INF/javamail.default.X`

The first method allows the user to include their own version of the resource file by placing it in the `lib` directory where the `java.home` property points. The second method allows an application that uses the JavaMail APIs to include their own resource files in their application's or jar file's `META-INF` directory. The `javamail.default.X` default files are part of the JavaMail `mail.jar` file.

File location depends upon how the `ClassLoader.getResource` method is implemented. Usually, the `getResource` method searches through `CLASSPATH` until it finds the requested file and then stops. JDK 1.1 has a limitation that the number of files of each type that will be found in the `CLASSPATH` is limited to one. However, this only affects method two, above; method one is loaded from a specific location (if allowed by the `SecurityManager`) and method three uses a different name to ensure that the default resource file is always loaded successfully.

The ordering of entries in the resource files matters. If multiple entries exist, the first entries take precedence over the latter entries as the initial defaults. For example, the first IMAP provider found will be set as the default IMAP implementation until explicitly changed by the application.

The user- or system-supplied resource files augment, they do not override, the default files included with the JavaMail APIs. This means that all entries in all files loaded will be available.

`javamail.providers` *and* `javamail.default.providers`

These resource files specify the stores and transports that are available on the system, allowing an application to "discover" what store and transport implementations are available. The protocol implementations are listed one per line. The file format defines four attributes that describe a protocol implementation. Each attribute is an "="-separated name-value pair with the name in lowercase. Each name-value pair is semi-colon (";") separated.

TABLE 5-1 Protocol Attributes

Name	Description
`protocol`	Name assigned to protocol. For example, 'smtp' for Transport.
`type`	Valid entries are "store" and "transport".
`class`	Class name that implements this protocol.
`vendor`	Optional string identifying the vendor.
`version`	Optional string identifying the version.

Here's an example of `META-INF/javamail.default.providers` file contents:

```
protocol=imap; type=store;
class=com.sun.mail.imap.IMAPStore;
vendor=SunMicrosystems,Inc;
protocol=smtp; type=transport;
class=com.sun.mail.smtp.SMTPTransport;
```

`javamail.address.map` *and* `javamail.default.address.map`

These resource files map transport address types to the transport protocol. The `javax.mail.Address.getType()` method returns the address type. The `javamail.address.map` file maps the transport type to the protocol. The file format is a series of name-value pairs. Each key name should correspond to an address type that is currently installed on the system; there should also be an entry for each `javax.mail.Address` implementation that is present if it is to be used. For example, `javax.mail.internet.InternetAddress.getType()` returns *rfc822*. Each referenced protocol should be installed on the system. For the case of *news,* below, the client should install a Transport provider supporting the *nntp* protocol.

Here are the typical contents of a `javamail.address.map` file.

```
rfc822=smtp
news=nntp
```

Provider

Provider is a class that describes a protocol implementation. The values come from the `javamail.providers` and `javamail.default.providers` resource files.

Protocol Selection and Defaults

The constructor for the Session object initializes the appropriate variables from the resource files. The order of the protocols in the resource files determines the initial defaults for protocol implementations. The methods, `getProviders()`, `{getProvider()` and `setProvider()` allow the client to discover the available (installed) protocol implementations, and to set the protocols to be used by default.

At runtime, an application may set the default implementation for a particular protocol. It can set the `mail.protocol.class` property when it creates the Session object. This property specifies the class to use for a particular protocol. The `getProvider()` method consults this property first.

The code can also call `setProviders()` passing in a Provider that was returned by the discovery methods. A Provider object cannot be explicitly created; it must be retrieved using the `getProviders()` method.

In either case, the provider specified must be one of the ones configured in the resource files. Note that the methods described here allow the client to **choose** from among preconfigured implementations, but doesn't allow it to configure a new implementation.

Example Scenarios

Scenario 1: The client application invokes the default protocols:

```
class Application1 {
    init() {
        // application properties include the JavaMail
        // required properties: mail.store.protocol,
        // mail.transport.protocol, mail.host, mail.user
        Properties props = loadApplicationProps();
        Session session  = Session.getInstance(props, null);

        // get the store implementation of the protocol
        // defined in mail.store.protocol; the implementation
        // returned will be defined by the order of entries in
        // javamail.providers & javamail.default.providers
        try {
            Store store = session.getStore();
            store.connect();
        } catch (MessagingException mex) {}
            ...
    }
}
```

Scenario 2: The client application presents available implementations to the user and then sets the user's choice as the default implementation:

```
class Application2 {
    init() {
        // application properties include the JavaMail
        // properties: mail.store.protocol,
        // mail.transport.protocol, mail.host, mail.user
        Properties props = loadApplicationProps();
        Session session = Session.getInstance(props, null);

        // find out which implementations are available
        Provider[] providers = session.getProviders();

        // ask the user which implementations to use
        // user's response may include a number of choices,
        // i.e. imap & nntp store providers & smtp transport
        Provider[] userChosenProviders =
        askUserWhichProvidersToUse(providers);

        // set the defaults based on users response
        for (int i = 0; i < userChosenProviders.length; i++)
            session.setProvider(userChosenProviders[i]);
```

```
        // get the store implementation of the protocol
        // defined in mail.store.protocol; the implementation
        // returned will be the one configured previously
        try {
            Store store = session.getStore();
            store.connect();
        } catch (MessagingException mex) {}
        ...
    }
}
```

Scenario 3: Application wants to specify an implementation for a given protocol:

```
class Application3 {
    init() {
        // application properties include the JavaMail
        // required properties: mail.store.protocol,
        // mail.transport.protocol, mail.host, mail.user
        Properties props = loadApplicationProps();

        // hard-code an implementation to use
        //  "com.acme.SMTPTRANSPORT"

        props.put("mail.smtp.class", "com.acme.SMTPTRANSPORT");
        Session session = Session.getInstance(props, null);

        // get the smtp transport implementation; the
        // implementation returned will be com.acme.SMTPTRANSPORT
        // if it was correctly configured in the resource files.
        // If com.acme.SMTPTRANSPORT can't be loaded, a
        // MessagingException is thrown.
        try {
            Transport transport = session.getTransport("smtp");
        } catch (MessagingException mex) {
            quit();
        }
    }
        ...
}
```

Managing Security

The `Session` class allows messaging system implementations to use the `Authenticator` object that was registered when the session was created. The `Authenticator` object is created by the application and allows interaction with the user to obtain a user name and password. The user name and password is returned in a `PasswordAuthentication` object. The messaging system implementation can ask the session to associate a user name and password with a particular message store using the `setPasswordAuthentication` method. This information is retrieved using the `getPasswordAuthentication` method. This avoids the need to ask the

user for a password when reconnecting to a `Store` that has disconnected, or when a second application sharing the same session needs to create its own connection to the same `Store`.

Messaging system implementations can register `PasswordAuthentication` objects with the `Session` object for use later in the session or for use by other users of the same session. Because `PasswordAuthentication` objects contain passwords, access to this information must be carefully controlled. Applications that create `Session` objects must restrict access to those objects appropriately. In addition, the `Session` class shares some responsibility for controlling access to the default `Session` object.

The first call to `getDefaultInstance` creates a new `Session` object and associates the `Authenticator` object with the `Session` object. Later calls to `getDefaultInstance` compare the `Authenticator` object passed in, to the `Authenticator` object saved in the default session. If both objects have been loaded by the same class loader, then `getDefaultInstance` will allow access to the default session. Typically, this is the case when both the creator of the default session and the code requesting access to the default session are in the same "security domain." Also, if both objects are null, access is allowed. This last case is discouraged because setting objects to `null` allows access to the default session from any security domain.

In the future, JDK 1.2 security Permissions could control access to the default session. Note that the `Authenticator` and `PasswordAuthentication` classes and their use in JavaMail is similar to the classes with the same names provided in the `java.net` package in JDK 1.2. As new authentication mechanisms are added to the system, new methods can be added to the `Authenticator` class to request the needed information. The default implementations of these new methods will fail, but new clients that understand these new authentication mechanisms can provide implementations of these methods. New classes other than `PasswordAuthentication` could be needed to contain the new authentication information, and new methods could be needed in the `Session` class to store such information. JavaMail design evolution will be patterned after the corresponding JDK classes.

Store and Folder URLs

To simplify message folder naming and to minimize the need to manage `Store` and `Transport` objects, folders can be named using URLNames. URLNames are similar to URLs except they only include the parsing of the URL string. The `Session` class provides methods to retrieve a `Folder` object given a URLName:

```
Folder f = session.getFolder(URLName);
```

or

```
Store s = session.getStore(URLName);
```

Chapter 6:

Message Storage And Retrieval

This section describes JavaMail message storage facilities supported by the `Store` and `Folder` classes.

Messages are contained in `Folders`. New messages are usually delivered to folders by a transport protocol or a delivery agent. Clients retrieve messages from folders using an access protocol.

The `Store` Class

The `Store` class defines a database that holds a `Folder` hierarchy and the messages within. The `Store` also defines the access protocol used to access folders and retrieve messages from folders. `Store` is an abstract class. Subclasses implement specific message databases and access protocols.

Clients gain access to a Message Store by obtaining a `Store` object that implements the database access protocol. Most message stores require the user to be authenticated before they allow access. The `connect` method performs that authentication.

For many message stores, a host name, user name, and password are sufficient to authenticate a user. The JavaMail API provides a `connect` method that takes this information as input parameters. `Store` also provides a default `connect` method. In either case, the client can obtain missing information from the `Session` object's properties, or by interacting with the user by accessing the `Session`'s `Authenticator` object.

The default implementation of the `connect` method in the `Store` class uses these techniques to retrieve all needed information and then calls the `protocolConnect` method. The messaging system must provide an appropriate implementation of this method. The messaging system can also choose to directly override the `connect` method.

By default, `Store` queries the following properties for the user name and host name:

- `mail.user` property, or `user.name` system property (if `mail.user` is not set)
- `mail.host`

These global defaults can be overridden on a per-protocol basis by the properties:

- `mail.protocol.user`
- `mail.protocol.host`

Note that passwords can not be specified using properties.

The Store presents a default namespace to clients. Store implementations can also present other namespaces. The getDefaultFolder method on Store returns the root folder for the default namespace.

Clients terminate a session by calling the close method on the Store object. Once a Store is closed (either explicitly using the close method; or externally, if the Mail server fails), all Messaging components belonging to that Store become invalid. Typically, clients will try to recover from an unexpected termination by calling connect to reconnect to the Store object, and then fetching new Folder objects and new Message objects.

Store *Events*

Store sends the following events to interested listeners:

ConnectionEvent	Generated when a connection is successfully made to the Store, or when an existing connection is terminated or disconnected.
StoreEvent	Communicates alerts and notification messages from the Store to the end user. The getMessageType method returns the event type, which can be one of: ALERT or NOTICE. The client must display ALERT events in some fashion that calls the user's attention to the message.
FolderEvent	Communicates changes to any folder contained within the Store. These changes include creation of a new Folder, deletion of an existing Folder, and renaming of an existing Folder.

The Folder *Class*

The Folder class represents a folder containing messages. Folders can contain subfolders as well as messages, thus providing a hierarchical structure. The getType method returns whether a Folder can hold subfolders, messages, or both. Folder is an abstract class. Subclasses implement protocol-specific Message Folders.

The getDefaultFolder method for the corresponding Store object returns the root folder of a user's default folder hierarchy. The list method for a Folder returns all the subfolders under that folder. The getFolder(String name) method for a Folder object returns the named subfolder. Note that this subfolder need not exist physically in the store. The exists method in a folder indicates whether this folder exists. A folder is created in the store by invoking its create method.

A closed Folder object allows certain operations, including deleting the folder, renaming the folder, listing subfolders, creating subfolders and monitoring for new messages. The open method opens a Folder object. All Folder methods except open, delete, and renameTo are valid on an open Folder object. Note that the open method is applicable only on Folder objects that can contain messages.

The messages within a Folder are sequentially numbered, from 1 through the total number of messages. This ordering is referred to as the "mailbox order" and is usually based on the arrival time of the messages in the folder. As each new message arrives into a folder, it is assigned a sequence number that is one higher than the previous number of messages in that folder. The getMessageNumber method on a Message object returns its sequence number.

The sequence number assigned to a Message object is valid within a session, but only as long as it retains its relative position within the Folder. Any change in message ordering can change the Message object's sequence number. Currently this occurs when the client calls expunge to remove deleted messages and renumber messages remaining in the folder.

A client can reference a message stored within a Folder either by its sequence number, or by the corresponding Message object itself. Since a sequence number can change within a session, it is preferable to use Message objects rather than sequence numbers as cached references to messages. Clients extending JavaMail are expected to provide light-weight Message objects that get filled 'on-demand', so that calling the getMessages method on a Folder object is an inexpensive operation, both in terms of CPU cycles and memory. For instance, an IMAP implementation could return Message objects that contain only the corresponding IMAP UIDs.

The FetchProfile *Method*

The Message objects returned by a Folder object are expected to be light-weight objects. Invoking get*xxx* methods on a Message cause the corresponding data items to be loaded into the object on demand. Certain Store implementations support batch fetching of data items for a range of Messages. Clients can use such optimizations, for example, when filling the header-list window for a range of messages. The FetchProfile method allows a client to list the items it will fetch in a batch for a certain message range.

The following code illustrates the use of FetchProfile when fetching Messages from a Folder. The client fills its header-list window with the Subject, From, and X-mailer headers for all messages in the folder.

```
Message[] msgs = folder.getMessages();
FetchProfile fp = new FetchProfile();
fp.add(FetchProfile.Item.ENVELOPE);
fp.add("X-mailer");
folder.fetch(msgs, fp);
for (int i = 0; i < folder.getMessageCount(); i++) {
    display(msgs[i].getFrom());
    display(msgs[i].getSubject());
    display(msgs[i].getHeader("X-mailer"));
}
```

Folder *Events*

Folders generate events to notify listeners of any change in either the folder or in its Messages list. The client can register listeners to a closed Folder, but generates a notification event only after that folder is opened.

Folder supports the following events:

ConnectionEvent	This event is generated when a Folder is opened or closed. When a Folder closes (either because the client has called close or from some external cause), all Messaging components belonging to that Folder become invalid. Typically, clients will attempt to recover by reopening that Folder, and then fetching Message objects.
FolderEvent	This event is generated when the client creates, deletes or renames this folder. Note that the Store object containing this folder can also generate this event.
MessageCountEvent	This event notifies listeners that the message count has changed. The following actions can cause this change: ■ *Addition* of new Messages into the Folder, either by a delivery agent or because of an append operation. The new Message objects are included in the event. ■ *Removal* of existing messages from this Folder. Removed messages are referred to as expunged messages. The isExpunged method returns true for removed Messages and the getMessageNumber method returns the original sequence number assigned to that message. All other Message methods throw a MessageRemovedException. See "The Folder Class" on page 34 for a discussion of removing deleted messages in shared folders. The expunged Message objects are included in the event. An expunged message is invalid and should be pruned from the client's view as early as possible. See "The Expunge Process" on page 37 for details on the expunge method.

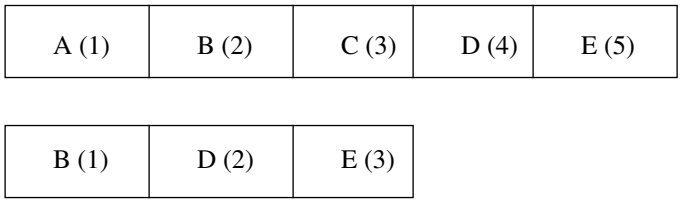
The Expunge Process

Deleting messages from a Folder is a two-phase operation. Setting the DELETED flag on messages marks them as deleted, but it does not remove them from the Folder. The deleted messages are removed only when the client invokes the expunge method on that Folder pbject. The Folder object then notifies listeners by firing an appropriate MessageEvent. The MessageEvent object contains the expunged Message objects. Note that the expunge method also returns the expunged Message objects. The Folder object also renumbers the messages falling after the expunged messages in the message list. Thus, when the expunge method returns, the sequence number of those Message objects will change. Note, however, that the expunged messages still retain their original sequence numbers.

Since expunging a folder can remove some messages from the folder and renumber others, it is important that the client synchronize itself with the expunged folder as early as possible. The next sections describe a set of recommendations for clients wanting to expunge a Folder:

- Expunge the folder; close it; and then reopen and refetch messages from that Folder. This ensures that the client was notified of the updated folder state. In fact, the client can just issue the close method with the expunge parameter set to true to force an expunge of the Folder during the close operation, thus even avoiding the explicit call to expunge.
- The previous solution might prove to be too simple or too drastic in some circumstances. This paragraph describes the scenario of a more complex client expunging a single access folder; for example, a folder that allows only one read-write connection at a time. The recommended steps for such a client after it issues the expunge command on the folder are:
  - Update its message count, either by decrementing it by the number of expunged messages, or by invoking the getMessageCount method on the Folder.
  - If the client uses sequence numbers to reference messages, it must account for the renumbering of Message objects subsequent to the expunged messages. Thus if a folder has 5 messages as shown below, (sequence numbers are within parenthesis), and if the client is notified that messages A and C are removed, it should account for the renumbering of the remaining messages as shown in the second figure.

FIGURE 6-1



- The client should prune expunged messages from its internal storage as early as possible.
- The expunge process becomes complex when dealing with a shared folder that can be edited. Consider the case where two clients are operating on the same folder. Each client possesses its own Folder object, but each Folder object actually represents the same physical folder.

If one client expunges the shared folder, any deleted messages are physically removed from the folder. The primary client can probably deal with this appropriately since it initiated this process and is ready to handle the consequences. However, secondary clients are not guaranteed to be in a state where they can handle an unexpected Message removed event— especially if the client is heavily multithreaded or if it uses sequence numbers.

To allow clients to handle such situations gracefully, the JavaMail API applies following restrictions to Folder implementations:

- A `Folder` can remove and renumber its Messages only when it is explicitly expunged using the `expunge` method. When the folder is implicitly expunged, it marks any expunged messages as expunged, but it still maintains access to those Message objects. This means that the following state is maintained when the Folder is implicitly expunged:
  - `getMessages` returns expunged Message objects together with valid message objects. However; an expunged message can throw the `MessageExpungedException` if direct access is attempted.
  - The messages in the `Folder` should not be renumbered.
  - The implicit `expunge` operation can not change the total `Folder` message count.

A `Folder` can notify listeners of “implicit” expunges by generating appropriate `MessageEvents`. However, the removed field in the event must be set to `false` to indicate that the message is still in the folder. When this `Folder` is explicitly expunged, then the `Folder` must remove all expunged messages, renumber it's internal Message cache, and generate MessageEvents for all the expunged messages, with each removed flag set to `true`.

The recommended set of actions for a client under the above situation is as follows:

- Multithreaded clients that expect to handle shared folders are advised not to use sequence numbers.
- If a client receives a MessageEvent indicating message removal, it should check the removed flag. If the flag is false, this indicates that another client has removed the message from this folder. This client might want to issue an `expunge` request on the folder object to synchronize it with the physical folder (but note the caveats in the previous section about using a shared folder). Alternatively, this client might want to close the `Folder` object (without expunging) and reopen it to synchronize with the physical folder (but note that all message objects would need to be refreshed in this case). The client may also mark the expunged messages in order to notify the end user.
- If the removed flag was set to `true`, the client should follow earlier recommendations on dealing with explicit expunges.

The Search Process

Search criteria are expressed as a tree of search-terms, forming a parse tree for the search expression. The `SearchTerm` class represents search terms. This is an abstract class with a single method:

```
public boolean match(Message msg);
```

Subclasses implement specific matching algorithms by implementing the `match` method. Thus new search terms and algorithms can be easily introduced into the search framework by writing the required code using the Java programming language.

The search package provides a set of standard search terms that implement specific match criteria on `Message` objects. For example, `SubjectTerm` pattern-matches the given `String` with the subject header of the given message.

```
public final class SubjectTerm extends StringTerm {
    public SubjectTerm(String pattern);
    public boolean match(Message m);
}
```

The search package also provides a set of standard logical operator terms that can be used to compose complex search terms. These include `AndTerm`, `OrTerm` and `NotTerm`.

```
final class AndTerm extends SearchTerm {
    public AndTerm(SearchTerm t1, SearchTerm t2);
    public boolean match(Message msg) {
        // The AND operator
        for (int i=0; i < terms.length; i++)
        if (!terms[i].match(msg))
            return false;
        return true;
    }
}
```

The `Folder` class supports searches on messages through these `search` method versions:

```
public Message[] search(SearchTerm term)
public Message[] search(SearchTerm term, Message[] msgs)
```

These methods return the `Message` objects matching the specified search term. The default implementation applies the search term on each `Message` object in the specified range. Other implementations may optimize this; for example, the IMAP `Folder` implementation maps the search term into an IMAP SEARCH command that the server executes.

Chapter 7:

The JavaBeans Activation Framework

JavaMail relies heavily on the JavaBeans Activation Framework (JAF) to determine the MIME data type, to determine the commands available on that data, and to provide a software component corresponding to a particular behavior. The JAF specification is part of the "Glasgow" JavaBeans specification. More details can be obtained from `http://java.sun.com/beans/glasgow/jaf.html`

This section explains how the JavaMail and JAF APIs work together to manage message content. It describes how clients using JavaMail can access and operate on the content of `Messages` and `BodyParts`. This discussion assumes you are familiar with the JAF specification posted at `http://java.sun.com`.

Accessing the Content

For a client using JavaMail, arbitrary data is introduced to the system in the form of mail messages. The `javax.mail.Part` interface allows the client to access the content. `Part` consists of a set of attributes and a "content". The `Part` interface is the common base interface for `Messages` and `BodyParts`. A typical mail message has one or more body parts, each of a particular MIME type.

Anything that deals with the content of a `Part` will use the `Part`'s `DataHandler`. The content is available through the `DataHandlers` either as an `InputStream` or as an object in the Java programming language. The `Part` also defines convenience methods that call through to the `DataHandler`. For example: the `Part.getContent` method is the same as calling `Part.getDataHandler().getContent()` and the `Part.getInputStream` method is the same as `Part.getDataHandler().getInputStream()`.

The content returned (either via an `InputStream` or an object in the Java programmin language) depends on the MIME type. For example: a `Part` that contains textual content returns the following:

- The `Part.getContentType` method returns `text/plain`
- The `Part.getInputStream` method returns an `InputStream` containing the bytes of the text
- The `Part.getContent` method returns a `java.lang.String` object

Content is returned either as an input stream, or as an object in the Java programming language.

- When an `InputStream` is returned, any mail-specific encodings are decoded before the stream is returned.
- When an object in the Java programming language is returned using the `getContent` method, the type of the returned object depends upon the content itself. In the JavaMail API, any `Part` with a main content type set to "`multipart/`" (any kind of multipart) should return a `javax.mail.Multipart` object from the `getContent` method. A `Part` with a content type of `message/rfc822` returns a `javax.mail.Message` object from the `getContent` method.

Example: Message Output

This example shows how you can traverse `Parts` and display the data contained in a message.

```
public void printParts(Part p) {
    Object o = p.getContent();
    if (o instanceof String) {
        System.out.println("This is a String");
        System.out.println((String)o);
    } else if (o instanceof Multipart) {
        System.out.println("This is a Multipart");
        Multipart mp = (Multipart)o;
        int count = mp.getCount();
        for (int i = 0; i < count; i++) {
            printParts(mp.getBodyPart(i));
        }
    } else if (o instanceof InputStream) {
         System.out.println("This is just an input stream");
         InputStream is = (InputStream)o;
         int c;
         while ((c = is.read()) != -1)
        System.out.write(c);
    }
}
```

Operating on the Content

The `DataHandler` allows clients to discover the operations available on the content of a `Message`, and to instantiate the appropriate JavaBeans to perform those operations. The most common operations on `Message` content are *view, edit* and *print*.

Example: Viewing a Message

Consider a Message "Viewer" Bean that presents a user interface that displays a mail message. This example shows how a viewer bean can be used to display the content of a message (that usually is `text/plain`, `text/html`, or `multipart/mixed`).

Note – Perform error checking to ensure that a valid Component was created.

```
// message passed in as parameter
void setMessage(Message msg) {
    DataHandler dh = msg.getDataHandler();
    CommandInfo cinfo = dh.getCommand("view");
    Component comp = (Component) dh.getBean(cinfo);
    this.setMainViewer(comp);
}
```

Example: Showing Attachments

In this example, the user has selected an attachment and wishes to display it in a separate dialog. The client locates the correct viewer object as follows.

```
// Retrieve the BodyPart from the current attachment
BodyPart bp = getSelectedAttachment();

DataHandler dh = bp.getDataHandler();
CommandInfo cinfo = dh.getCommand("view");
Component comp = (Component) dh.getBean(cinfo);

// Add viewer to dialog Panel
MyDialog myDialog = new MyDialog();
myDialog.add(comp);

// display dialog on screen
myDialog.show();
```

See "Setting Message Content" on page 47 for examples that construct a message for a send operation.

Adding Support for Content Types

Support for commands acting on message data is an implementation task left to the client. JavaMail and JAF APIs intend for this support to be provided by a JAF-Aware JavaBean. Almost all data will require edit and view support.

Currently, the JavaMail API does not provide viewer JavaBeans. The JAF does provide two very simple JAF-aware viewer beans: A Text Viewer and Image Viewer. These beans handle data where content-type has been set to `text/plain` or `image/gif`.

Developers writing a JavaMail client need to write additional viewers that support some of the basic content types-- specifically `message/rfc822`, `multipart/mixed`, and `text/plain`. These are the usual content-types encountered when displaying a `Message`, and they provide the look and feel of the application.

Content developers providing additional data types should refer to the JAF specification, that discusses how to create `DataContentHandlers` and Beans that operate on those contents.

Chapter 8:

Message Composition

This section describes the process used to instantiate a message object, add content to that message, and send it to its intended list of recipients.

The JavaMail API allows a client program to create a message of arbitrary complexity. Messages are instantiated from the `Message` subclass. The client program can manipulate any message as if it had been retrieved from a `Store`.

Building a Message Object

To create a message, a client program instantiates a `Message` object, sets appropriate attributes, and then inserts the content.

- The attributes specify the message address and other values necessary to send, route, receive, decode and store the message. Attributes also specify the message structure and data content type.
- Message content is carried in a `DataHandler` object, that carries either data or a `Multipart` object. A `DataHandler` carries the content body and provides methods the client uses to handle the content. A `Multipart` object is a container that contains one or more `Bodypart` objects, each of which can in turn contain `DataHandler` objects.

Message Creation

`javax.mail.Message` is an abstract class that implements the `Part` interface. Therefore, to create a message object, select a message subclass that implements the appropriate message type.

For example, to create a Mime message, a JavaMail client instantiates an empty `javax.mail.internet.MimeMessage` object passing the current `Session` object to it:

```
Message msg = new MimeMessage(session);
```

Setting Message Attributes

The `Message` class provides a set of methods that specify standard attributes common to all messages. The `MimeMessage` class provides additional methods that set MIME-specific attributes. The client program can also set non-standard attributes (custom headers) as name-value pairs.

The methods for setting standard attributes are listed below:

```
public class Message {
    public void setFrom(Address addr);
    public void setFrom();   // retrieves from system
    public void setRecipients(RecipientType type, Address[] addrs);
    public void setReplyTo(Address[] addrs);
    public void setSentDate(Date date);
    public void setSubject(String subject);
    ...
}
```

The `Part` interface specifies the following method, that sets custom headers:

```
public void setHeader(String name, String value)
```

The `setRecipients` method takes a `RecipientType` as its first parameter, which specifies which recipient field to use. Currently, `Message.RecipientType.TO`, `Message.RecipientType.CC`, and `Message.RecipientType.BCC` are defined. Additional `RecipientTypes` may be defined as necessary.

The `Message` class provides two versions of the of the `setFrom` method:

- `setFrom(Address addr)` specifies the sender explicitly from an `Address` object parameter.
- `setFrom` retrieves the sender's username from the local system.

The code sample below sets attributes for the MimeMessage just created. First, it instantiates `Address` objects to be used as `To` and `From` addresses. Then, it calls `set` methods, which equate those addresses to appropriate message attributes:

```
toAddrs[] = new InternetAddress[1];
toAddrs[0] = new InternetAddress("luke@rebellion.gov");
Address fromAddr =
      new InternetAddress("han.solo@smuggler.com");

msg.setFrom(fromAddr);
msg.setRecipients(Message.RecipientType.TO, toAddrs);
msg.setSubject("Takeoff time.");
msg.setSentDate(new Date());
```

Setting Message Content

The `Message` object carries content data within a `DataHandler` object. To add content to a `Message`, a client creates content, instantiates a `DataHandler` object, places content into that `DataHandler` object, and places that object into a `Message` object that has had its attributes defined.

The JavaMail API provides two techniques that set message content. The first technique uses the `setDataHandler` method. The second technique uses the `setContent` method.

Typically, clients add content to a `DataHandler` object by calling `setDataHandler(DataHandler)` on a `Message` object. The `DataHandler` is an object that encapsulates data. The data is passed to the `DataHandler`'s constructor as either a `DataSource` (a stream connected to the data) or as an object in the Java programming language. The `InputStream` object creates the `DataSource`. See "The JavaBeans Activation Framework" on page 41 for additional information.

```
public class DataHandler {
    DataHandler(DataSource dataSource);
    DataHandler(Object data, String mimeType);
}
```

The code sample below shows how to place text content into an InternetMessage. First, create the text as a string object. Then, pass the string into a `DataHandler` object, together with its MIME type. Finally, add the `DataHandler` object to the message object:

```
// create brief message text
String content = "Leave at 300.";

// instantiate the DataHandler object

DataHandler data = new DataHandler(content, "text/plain");

// Use setDataHandler() to insert data into the
// new Message object

 msg.setDataHandler(data);
```

Alternately, `setContent` implements a simpler technique that takes the data object and its MIME type. `setContent` creates the `DataHandler` object automatically:

```
// create the message text
String content = "Leave at 300.";

// call setContent to pass content and content type
// together into the message object

msg.setContent(content, "text/plain");
```

When the client calls `Transport.send()` to send this message, the recipient will receive the message below, using either technique:

```
Date: Wed, 23 Apr 1997 22:38:07 -0700 (PDT)
From: han.solo@smuggler.com
Subject: Takeoff time
To: luke@rebellion.gov

Leave at 300.
```

Building a MIME Multipart Message

Follow these steps to create a MIME Multipart Message:

1. Instantiate a new `MimeMultipart` object, or a subclass.
2. Create `MimeBodyParts` for the specific message parts. Use the `setContent` method or the `setDataHandler` method to create the content for each `Bodypart`, as described in the previous section.

Note – The default subtype for a `MimeMultipart` object is *mixed*. It can be set to other subtypes as required. `MimeMultipart` subclasses might already have their subtype set appropriately.

---

3. Insert the `Multipart` object into the `Message` object by calling `setContent(Multipart)` within a newly-constructed Message object.

   The example below creates a `Multipart` object and then adds two message parts to it. The first message part is a text string, "Spaceport Map," and the second contains a document of type "application/postscript." Finally, this multipart object is added to a `MimeMessage` object of the type described above.

```
// Instantiate a Multipart object
MimeMultipart mp = new MimeMultipart();

// create the first bodypart object
MimeBodyPart b1 = new MimeBodyPart();

// create textual content
// and add it to the bodypart object
b1.setContent("Spaceport Map","text/plain");
mp.addBodyPart(b1);

// Multipart messages usually have more than
// one body part.  Create a second body part
// object, add new text to it, and place it
// into the multipart message as well. This
// second object holds postscript data.

MimeBodyPart b2 = new MimeBodyPart(); b2.setContent(map,"application/
postscript");
mp.addBodyPart(b2);


// Create a new message object as described above,
// and set its attributes.  Add the multipart
// object to this message and call saveChanges()
// to write other message headers automatically.

Message msg = new MimeMessage(session);

// Set message attrubutes as in a singlepart
// message.

msg.setContent(mp);              // add Multipart
msg.saveChanges();               // save changes
```

After all message parts are created and inserted, call the `saveChanges` method to ensure that the client writes appropriate message headers. This is identical to the process followed with a single part message. Note that the JavaMail API calls the `saveChanges` method implicitly during the `send` process, so invoking it is unnecessary and expensive if the message is to be sent immediately.

Chapter 9:

Transport Protocols and Mechanisms

The `Transport` abstract class defines the message submission and transport protocol. Subclasses of the `Transport` class implement SMTP and other transport protocols.

Obtaining the Transport Object

The `Transport` object is seldom explicitly created. The `getTransport` method obtains a `Transport` object from the `Session` factory. The JavaMail API provides three versions of the `getTransport` method:

```
public class Session {
    public Transport getTransport(Address address);
    public Transport getTransport(String protocol);
    public Transport getTransport();
}
```

- `getTransport(Address address)` returns the implementation of the transport class based on the address type. A user-extensible map defines which transport type to use for a particular address. For example, if the address is an `InternetAddress`, and `InternetAddress` is mapped to a protocol that supports SMTP then `SMTPTransport` can be returned.
- The client can also call `getTransport("SMTP")` to request SMTP, or another transport implementation protocol.
- `getTransport()` returns the transport specified in the `mail.transport.protocol` property.

See "The Mail Session" on page 25 for details.

Transport Methods

The `Transport` class provides the `connect` and `protocolConnect` methods, which operate similarly to those on the `Store` class. See "The Store Class" on page 33 for details.

A `Transport` object generates a `ConnectionEvent` to notify its listeners of a successful or a failed connection. A `Transport` object can throw an `IOException` if the connection fails.

Transport implementations should ensure that the message specified is of a known type. If the type is known, then the `Transport` object sends the message to its specified destinations. If the type is not known, then the `Transport` object can attempt to reformat the `Message` object into a suitable version using gatewaying techniques, or it can throw a `MessagingException`, indicating failure. For example, the SMTP transport implementation recognizes `MimeMessages`. It invokes the `writeTo` method on a `MimeMessage` object to generate a RFC822 format byte stream that is sent to the SMTP host.

The message is sent using the `Transport.send` static method or the `sendMessage` instance method. The `Transport.send` method is a convenience method that instantiates the transports necessary to send the message, depending on the recipients' addresses, and then passes the message to each transport's `sendMessage` method. Alternatively, the client can get the transport that implements a particular protocol itself and send the message using the `sendMessage` method. This adds the benefit of being able to register as event listeners on the individual transports.

Note that the `Address[]` argument passed to the `send` and `sendMessage` methods do not need to match the addresses provided in the message headers. Although these arguments usually will match, the end-user determines where the messages are actually sent. This is useful for implementing the Bcc: header, and other similar functions.

Transport Events

Clients can register as listeners for events generated by transport implementations. (Note that the abstract `Transport` class doesn't fire any events, only particular protocol implementations generate events). There are two events generated: `ConnectionEvent` and `TransportEvent`.

ConnectionEvent

If the transport connects successfully, it will fire the `ConnectionEvent` with the type set to `OPENED`. If the connection times out or is closed, `ConnectionEvent` with type `CLOSED` is generated.

TransportEvent

The `sendMessage` method generates a `TransportEvent` to its listeners. That event contains information about the method's success or failure. There are three types of TransportEvent: `MESSAGE_DELIVERED`, `MESSAGE_NOT_DELIVERED`, `MESSAGE_PARTIALLY_DELIVERED`. The event contains three arrays of addresses: `validSent[]`, `validUnsent[]`, and `invalid[]` that list the valid and invalid addresses for this message and protocol.

Transport Event	Description
`MESSAGE_DELIVERED`	When the message has been successfully sent to all recipients by this transport. `validSent[]` contains all the addresses. `validUnsent[]` and `invalid[]` are null.
`MESSAGE_NOT_DELIVERED`	When `ValidSent[]` is null, the message was not successfully sent to any recipients. `validUnsent[]` may have addresses that are valid. `invalidSent[]` may contain invalid addresses.
`MESSAGE_PARTIALLY_DELIVERED`	Message was successfully sent to some recipients but not to all. `ValidSent[]` holds addresses of recipients to whom the message was sent. `validUnsent[]` holds valid addresses but the message wasn't sent to them. `invalid[]` holds invalid addresses.

Using The Transport Class

The code segment below sends a `MimeMessage` using a `Transport` class implementing the SMTP protocol. The client creates two `InternetAddress` objects that specify the recipients and retrieves a `Transport` object from the default `Session` that supports sending messages to Internet addresses. Then the `Session` object uses a `Transport` object to send the message.

```
// Get a session
Session session = Session.getInstance(props, null);

// Create an empty MimeMessage and its part
Message msg = new MimeMessage(session);
... add headers and message parts as before

// create two destination addresses
Address[] addrs = {new InternetAddress("mickey@disney.com"),
                   new InternetAddress("goofy@disney.com")};

// get a transport that can handle sending message to
// InternetAddresses. This will probably map to a transport
// that supports SMTP.
Transport trans = session.getTransport(addrs[0]);

// add ourselves as ConnectionEvent and TransportEvent listeners
trans.addConnectionListener(this);
trans.addTransportListener(this);

// connect method determines what host to use from the
// session properties
trans.connect();

// send the message to the addresses we specified above
trans.sendMessage(msg, addrs);
```

Chapter 10:

Internet Mail

The JavaMail specification does not define any implementation. However, the API does include a set of classes that implement Internet Mail standards. Although not part of the specification, these classes can be considered part of the JavaMail package. They show how to adapt an existing messaging architecture to the JavaMail framework.

These classes implement the Internet Mail Standards defined by the RFCs listed below:

- RFC822 (Standard for the Format of Internet Text Messages)
- RFC2045, RFC2046, RFC2047 (MIME)

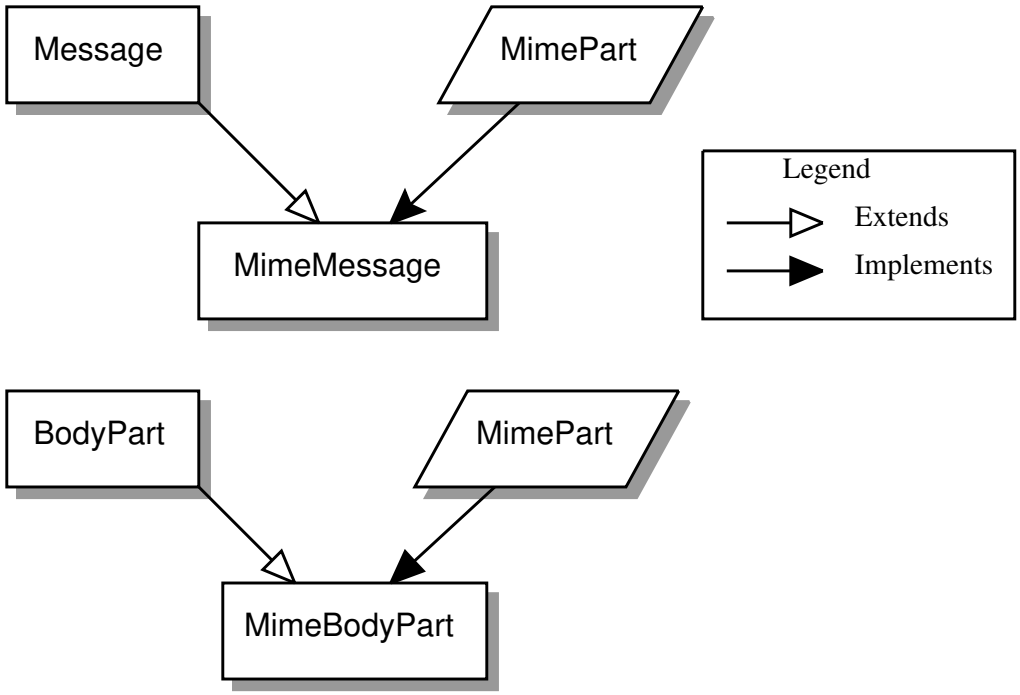
RFC822 describes the structure of messages exchanged across the Internet. Messages are viewed as having a header and contents. The header is composed of a set of standard and optional header fields. The header is separated from the content by a blank line. The RFC specifies the syntax for all header fields and the semantics of the standard header fields. It does not however, impose any structure on the message contents.

The MIME RFCs 2045, 2046 and 2047 define message content structure by defining structured body parts, a typing mechanism for identifying different media types, and a set of encoding schemes to encode data into mail-safe characters.

The Internet Mail package allows clients to create, use and send messages conforming to the standards listed above. It gives service providers a set of base classes and utilities they can use to implement Stores and Transports that use the Internet mail protocols. See "MimeMessage Object Hierarchy" on page 81 for a Mime class and interface hierarchy diagram.

The JavaMail MimePart interface models an *entity* as defined in RFC2045, Section 2.4. MimePart extends the JavaMail Part interface to add MIME-specific methods and semantics. The MimeMessage and MimeBodyPart classes implement the MimePart interface. The following figure shows the class hierarchy of these classes.

FIGURE 10-1



The `MimeMessage` *Class*

The `MimeMessage` class extends `Message` and implements `MimePart`. This class implements an email message that conforms to the RFC822 and MIME standards.

The `MimeMessage` class provides a default constructor that creates an empty `MimeMessage` object. The client can fill in the message later by invoking the `parse` method on an RFC822 input stream. Note that the `parse` method is protected, so that only this class and its subclasses can use this method. Service providers implementing 'light-weight' `Message` objects that are filled in on demand can generate the appropriate byte stream and invoke the `parse` method when a component is requested from a message. Service providers that can provide a separate byte stream for the message body (distinct from the message header) can override the `getContentStream` method.

The client can also use the default constructor to create new `MimeMessage` objects for sending. The client sets appropriate attributes and headers, inserts content into the message object, and finally calls the `send` method for that `MimeMessage` object.

This code sample creates a new MimeMessage object for sending. See "Message Composition" on page 45 and "Transport Protocols and Mechanisms" on page 51 for details.

```
MimeMessage m = new MimeMessage(session);
// Set FROM:
m.setFrom(new InternetAddress("jmk@Sun.COM"));
// Set TO:
InternetAddress a[] = new InternetAddress[1];
a[0] = new InternetAddress("javamail@Sun.COM");
m.setRecipients(Message.RecipientType.TO, a);
// Set content
m.setContent(data, "text/plain");
// Send message
m.send();
```

The MimeMessage class also provides a constructor that uses an input stream to instantiate itself. The constructor internally invokes the parse method to fill in the message. The InputStream object is left positioned at the end of the message body.

```
InputStream in = getMailSource(); // a stream of mail messages
MimeMessage m = null;
for (; ;) {
   try {
   m = new MimeMessage(session,in);
   } catch (MessagingException ex) {
   // reached end of message stream
   break;
   }
}
```

MimeMessage implements the writeTo method by writing an RFC822-formatted byte stream of its headers and body. This is accomplished in two steps: First, the MimeMessage object writes out its headers; then it delegates the rest to the DataHandler object representing the content.

The MimeBodyPart *Class*

The MimeBodyPart class extends BodyPart and implements the MimePart interface. This class represents a Part inside a Multipart. MimeBodyPart implements a *Body Part* as defined by RFC2045, Section 2.5.

The getBodyPart(int index) returns the MimeBodyPart object at the given index. MimeMultipart also allows the client to fetch MimeBodyPart objects based on their Content-IDs.

The addBodyPart method adds a new MimeBodyPart object to a MimeMultipart as a step towards constructing a new multipart MimeMessage.

The `MimeMultipart` *Class*

The `MimeMultipart` class extends `Multipart` and models a MIME multipart content within a message or a body part.

A `MimeMultipart` is obtained from a `MimePart` containing a `ContentType` attribute set to `multipart`, by invoking that part's `getContent` method.

The client creates a new `MimeMultipart` object by invoking its default constructor. To create a new multipart `MimeMessage`, create a `MimeMultipart` object (or its subclass); use set methods to fill in the appropriate `MimeBodyParts`; and finally, use `setContent(Multipart)` to insert it into the `MimeMessage`.

`MimeMultipart` also provides a constructor that takes an input stream positioned at the beginning of a MIME multipart stream. This class parses the input stream and creates the child body parts.

The `getSubType` method returns the multipart message MIME subtype. The subtype defines the relationship among the individual body parts of a multipart message. More semantically complex multipart subtypes are implemented as subclasses of `MimeMultipart`, providing additional methods that expose specific functionality.

Note that a multipart content object is treated like any other content. When parsing a MIME Multipart stream, the JavaMail implementation uses the JAF framework to locate a suitable DataContentHandler for the specific subtype and uses that handler to create the appropriate `Multipart` instance. Similarly, when generating the output stream for a `Multipart` object, the appropriate `DataContentHandler` is used to generate the stream.

The `MimeUtility` *Class*

`MimeUtility` is a utility class that provides MIME-related functions. All methods in this class are static methods. These methods currently perform the functions listed below:

Content Encoding and Decoding

Data sent over RFC 821/822-based mail systems are restricted to 7-bit US-ASCII bytes. Therefore, any non-US-ASCII content needs to be encoded into the 7-bit US-ASCII (mail-safe) format. MIME (RFC 2045) specifies the "base64" and "quoted-printable" encoding schemes to perform this encoding. The following methods support content encoding:

- The `getEncoding` method takes a `DataSource` object and returns the Content-Transfer-Encoding that should be applied to the data in that `DataSource` object to make it mail-safe.
- The `encode` method wraps an encoder around the given output stream based on the specified Content-Transfer-Encoding. The `decode` method decodes the given input stream, based on the specified Content-Transfer-Encoding.

Header Encoding and Decoding

RFC 822 restricts the data in message headers to 7bit US-ASCII characters. MIME (RFC 2047) specifies a mechanism to encode non 7bit US-ASCII characters so that they are suitable for inclusion in message headers. This section describes the methods that enable this functionality.

The header-related methods (getHeader, setHeader) in Part and Message operate on Strings. String objects contain (16 bit) Unicode characters.

Since RFC 822 prohibits non US-ASCII characters in headers, clients invoking the `setHeader()` methods must ensure that the header values are appropriately encoded if they contain non US-ASCII characters.

The encoding process (based on RFC 2047) consists of two steps:

1. Convert the Unicode String into an array of bytes in another charset. This step is required because Unicode is not yet a widely used charset. Therefore, a client must convert the Unicode characters into a charset that is more palatable to the recipient.
2. Apply a suitable encoding format that ensures that the bytes obtained in the previous step are mail-safe.

The `encodeText` method combines the two steps listed above to create an encoded header. Note that as RFC 2047 specifies, only "unstructured" headers and user-defined extension headers can be encoded. It is prudent coding practice to run such header values through the encoder to be safe. Also note that the `encodeText` method encodes header values only if they contain non US-ASCII characters.

The reverse of this process (decoding) needs to be performed when handling header values obtained from a MimeMessage or MimeBodyPart using the `getHeader` set of methods, since those headers might be encoded as per RFC 2047. The `decodeText` method takes a header value, applies RFC 2047 decoding standards, and returns the

decoded value as a Unicode String. Note that this method should be invoked only on "unstructured" or user-defined headers. Also note that `decodeText` attempts decoding only if the header value was encoded in RFC 2047 style. It is advised that you always run header values through the decoder to be safe.

The `ContentType` *Class*

The `ContentType` class is a utility class that parses and generates MIME content-type headers.

To parse a MIME content-Type value, create a `ContentType` object and invoke the `toString` method.

The `ContentType` class also provides methods that match Content-Type values.

The following code fragment illustrates the use of this class to extract a MIME parameter.

```
String type = part.getContentType();
ContentType cType = new ContentType(type);

if (cType.match("application/x-foobar"))
   iString color = cType.getParameter("color");
```

This code sample uses this class to construct a MIME Content-Type value:

```
ContentType cType = new ContentType();
cType.setPrimaryType("application");
cType.setSubType("x-foobar");
cType.setParameter("color", "red");

String contentType = cType.toString();
```

Appendix A:

Environment Properties

This section lists the environment properties that are used by the JavaMail APIs.

Note that Applets can not determine some defaults listed in this Appendix. When writing an applet, you must specify the properties you require.

Property	Description	Default Value
mail.store.protocol	Specifies the default Message Access Protocol. The `Session.getStore()` method returns a `Store` object that implements this protocol. The client can override this property and explicitly specify the protocol with the `Session.getStore(String protocol)` method.	The first appropriate protocol in the config files
mail.transport.protocol	Specifies the default Transport Protocol. The `Session.getTransport()` method returns a `Transport` object that implements this protocol. The client can override this property and explicitly specify the protocol by using `Session.getTransport(String protocol)` method.	The first appropriate protocol in the config files
mail.host	Specifies the default Mail server. The `Store` and `Transport` object's `connect` methods use this property, if the protocol-specific host property is absent, to locate the target host.	The local machine
mail.user	Specifies the username to provide when connecting to a Mail server. The `Store` and `Transport` object's `connect` methods use this property, if the protocol-specific username property is absent, to obtain the username.	`user.name`

Property	Description	Default Value
mail.*protocol*.host	Specifies the protocol-specific default Mail server. This overrides the `mail.host` property.	`mail.host`
mail.*protocol*.user	Specifies the protocol-specific default username for connecting to the Mail server. This overrides the `mail.user` property.	`mail.user`
mail.from	Specifies the return address of the current user. Used by the `InternetAddress.getLocalAddress` method to specify the current user's email address.	`username@host`
mail.debug	Specifies the initial debug mode. Setting this property to `true` will turn on debug mode, while setting it to `false` turns debug mode off. Note that the `Session.setDebug` method also controls the debug mode.	false

Appendix B:

Examples Using the JavaMail API

Following are some example programs that illustrate the use of the JavaMail APIs. These examples are also included in the JavaMail implementation.

Example: Showing a Message

```
import java.util.*;
import java.io.*;
import javax.mail.*;
import javax.mail.internet.*;
import javax.activation.*;

/*
 * Demo app that exercises the Message interfaces.
 * Show information about and contents of messages.
 *
 * msgshow protocol host user password mailbox msgnum
 */

public class msgshow {

    static String protocol;
    static String host = null;
    static String user = null;
    static String password = null;
    static String mbox = "INBOX";
    static String url = null;
    static int port = -1;
    static boolean verbose = false;
    static boolean debug = false;
    static boolean showStructure = false;

    public static void main(String argv[]) {
        int msgnum = -1;
        int optind;

        for (optind = 0; optind < argv.length; optind++) {
            if (argv[optind].equals("-T")) {
                protocol = argv[++optind];
            } else if (argv[optind].equals("-H")) {
                host = argv[++optind];
            } else if (argv[optind].equals("-U")) {
                user = argv[++optind];
```

```
            } else if (argv[optind].equals("-P")) {
                password = argv[++optind];
            } else if (argv[optind].equals("-v")) {
                verbose = true;
            } else if (argv[optind].equals("-D")) {
                debug = true;
            } else if (argv[optind].equals("-f")) {
                mbox = argv[++optind];
            } else if (argv[optind].equals("-L")) {
                url = argv[++optind];
            } else if (argv[optind].equals("-p")) {
                port = Integer.parseInt(argv[++optind]);
            } else if (argv[optind].equals("-s")) {
                showStructure = true;
            } else if (argv[optind].equals("--")) {
                optind++;
                break;
            } else if (argv[optind].startsWith("-")) {
                System.out.println(
"Usage: msgshow [-L url] [-T protocol] [-H host] [-p port] [-U user]");
                System.out.println(
"   [-P password] [-f mailbox] [msgnum] [-v] [-D] [-s]");
                System.exit(1);
            } else {
                break;
            }
        }

        try {
            if (optind < argv.length)
              msgnum = Integer.parseInt(argv[optind]);

            // Get a Properties object
            Properties props = System.getProperties();

            // Get a Session object
            Session session = Session.getDefaultInstance(props, null);
            session.setDebug(debug);

            // Get a Store object
            Store store = null;
            if (url != null) {
                URLName urln = new URLName(url);
                store = session.getStore(urln);
                store.connect();
            } else {
                if (protocol != null)
                    store = session.getStore(protocol);
                else
                    store = session.getStore();

                // Connect
                if (host != null || user != null || password != null)
```

```
            store.connect(host, port, user, password);
        else
            store.connect();
    }


    // Open the Folder
    Folder folder = store.getDefaultFolder();
    if (folder == null) {
        System.out.println("No default folder");
        System.exit(1);
    }

    folder = folder.getFolder(mbox);
    if (folder == null) {
        System.out.println("Invalid folder");
        System.exit(1);
    }

    // try to open read/write and if that fails try read-only
    try {
        folder.open(Folder.READ_WRITE);
    } catch (MessagingException ex) {
        folder.open(Folder.READ_ONLY);
    }
    int totalMessages = folder.getMessageCount();

    if (totalMessages == 0) {
        System.out.println("Empty folder");
        folder.close(false);
        store.close();
        System.exit(1);
    }

    if (verbose) {
        int newMessages = folder.getNewMessageCount();
        System.out.println("Total messages = " + totalMessages);
        System.out.println("New messages = " + newMessages);
        System.out.println("------------------------------");
    }

    if (msgnum == -1) {
        // Attributes & Flags for all messages ..
        Message[] msgs = folder.getMessages();

        // Use a suitable FetchProfile
        FetchProfile fp = new FetchProfile();
        fp.add(FetchProfile.Item.ENVELOPE);
        fp.add(FetchProfile.Item.FLAGS);
        fp.add("X-Mailer");
        folder.fetch(msgs, fp);

        for (int i = 0; i < msgs.length; i++) {
```

```
                System.out.println("--------------------------");
                System.out.println("MESSAGE #" + (i + 1) + ":");
                dumpEnvelope(msgs[i]);
            }
        } else {
            System.out.println("Getting message number: " + msgnum);
            Message m = null;

            try {
                m = folder.getMessage(msgnum);
                dumpPart(m);
            } catch (IndexOutOfBoundsException iex) {
                System.out.println("Message number out of range");
            }
        }

        folder.close(false);
        store.close();
    } catch (Exception ex) {
        ex.printStackTrace();
    }
    System.exit(1);
}

public static void dumpPart(Part p) throws Exception {
    if (p instanceof Message)
        dumpEnvelope((Message)p);

    /** Dump input stream ..

    InputStream is = p.getInputStream();
    // If "is" is not already buffered, wrap a BufferedInputStream
    // around it.
    if (!(is instanceof BufferedInputStream))
        is = new BufferedInputStream(is);
    int c;
    while ((c = is.read()) != -1)
        System.out.write(c);

    **/

    pr("CONTENT-TYPE: " + p.getContentType());

    /*
     * Using isMimeType to determine the content type avoids
     * fetching the actual content data until we need it.
     */
    if (p.isMimeType("text/plain")) {
        pr("This is plain text");
        pr("---------------------------");
        if (!showStructure)
            System.out.println((String)p.getContent());
    } else if (p.isMimeType("multipart/*")) {
```

```
            pr("This is a Multipart");
            pr("--------------------------");
            Multipart mp = (Multipart)p.getContent();
            level++;
            int count = mp.getCount();
            for (int i = 0; i < count; i++)
                dumpPart(mp.getBodyPart(i));
            level--;
        } else if (p.isMimeType("message/rfc822")) {
            pr("This is a Nested Message");
            pr("--------------------------");
            level++;
            dumpPart((Part)p.getContent());
            level--;
        } else if (!showStructure) {
            /*
            * If we actually want to see the data, and it's not a
            * MIME type we know, fetch it and check its Java type.
            */
            Object o = p.getContent();
            if (o instanceof String) {
                pr("This is a string");
                pr("--------------------------");
                System.out.println((String)o);
            } else if (o instanceof InputStream) {
                pr("This is just an input stream");
                pr("--------------------------");
                InputStream is = (InputStream)o;
                int c;
                while ((c = is.read()) != -1)
                    System.out.write(c);
            } else {
                pr("This is an unknown type");
                pr("--------------------------");
                pr(o.toString());
                }
        } else {
            pr("This is an unknown type");
            pr("--------------------------");
        }
    }

    public static void dumpEnvelope(Message m) throws Exception {
        pr("This is the message envelope");
        pr("--------------------------");
        Address[] a;
        // FROM
        if ((a = m.getFrom()) != null) {
            for (int j = 0; j < a.length; j++)
                pr("FROM: " + a[j].toString());
        }

        //TO
```

```
if ((a = m.getRecipients(Message.RecipientType.TO)) != null) {
    for (int j = 0; j < a.length; j++)
        pr("TO: " + a[j].toString());
}

// SUBJECT
pr("SUBJECT: " + m.getSubject());

// DATE
Date d = m.getSentDate();
pr("SendDate: " +
    (d != null ? d.toString() : "UNKNOWN"));

//FLAGS
Flags flags = m.getFlags();
StringBuffer sb = new StringBuffer();
Flags.Flag[] sf = flags.getSystemFlags(); // get the system flags

boolean first = true;
for (int i = 0; i < sf.length; i++) {
    String s;
    Flags.Flag f = sf[i];
    if (f == Flags.Flag.ANSWERED)
        s = "\\Answered";
    else if (f == Flags.Flag.DELETED)
        s = "\\Deleted";
    else if (f == Flags.Flag.DRAFT)
        s = "\\Draft";
    else if (f == Flags.Flag.FLAGGED)
        s = "\\Flagged";
    else if (f == Flags.Flag.RECENT)
        s = "\\Recent";
    else if (f == Flags.Flag.SEEN)
        s = "\\Seen";
    else
        continue;       // skip it
    if (first)
        first = false;
    else
        sb.append(' ');
    sb.append(s);
}

String[] uf = flags.getUserFlags(); // get user-flag strings
for (int i = 0; i < uf.length; i++) {
    if (first)
        first = false;
    else
        sb.append(' ');
    sb.append(uf[i]);
}
pr("FLAGS: " + sb.toString());
```

```
        // X-MAILER
        String[] hdrs = m.getHeader("X-Mailer");
        if (hdrs != null)
            pr("X-Mailer: " + hdrs[0]);
        else
            pr("X-Mailer NOT available");
    }

    static String indentStr = "                                                ";
    static int level = 0;

    /**
     * Print a, possibly indented, string.
     */
    public static void pr(String s) {
        if (showStructure)
            System.out.print(indentStr.substring(0, level * 2));
    System.out.println(s);
    }
}
```

Example: Listing Folders

```
import java.util.Properties;
import javax.mail.*;

/**
 * Demo app that exercises the Message interfaces.
 * List information about folders.
 */

public class folderlist {
    static String protocol = null;
    static String host = null;
    static String user = null;
    static String password = null;
    static String url = null;
    static String root = null;
    static String pattern = "%";
    static boolean recursive = false;
    static boolean verbose = false;
    static boolean debug = false;

    public static void main(String argv[]) throws Exception {
        int optind;
        for (optind = 0; optind < argv.length; optind++) {
            if (argv[optind].equals("-T")) {
                protocol = argv[++optind];
            } else if (argv[optind].equals("-H")) {
                host = argv[++optind];
```

```
            } else if (argv[optind].equals("-U")) {
                user = argv[++optind];
            } else if (argv[optind].equals("-P")) {
                password = argv[++optind];
            } else if (argv[optind].equals("-L")) {
                url = argv[++optind];
            } else if (argv[optind].equals("-R")) {
                root = argv[++optind];
            } else if (argv[optind].equals("-r")) {
                recursive = true;
            } else if (argv[optind].equals("-v")) {
                verbose = true;
            } else if (argv[optind].equals("-D")) {
                debug = true;
            } else if (argv[optind].equals("--")) {
                optind++;
                break;
            } else if (argv[optind].startsWith("-")) {
                System.out.println(
"Usage: folderlist [-T protocol] [-H host] [-U user] [-P password] [-L
url]");
                System.out.println(
"   [-R root] [-r] [pattern]");
                System.exit(1);
            } else {
                break;
            }
        }
        if (optind < argv.length)
            pattern = argv[optind];

        // Get a Properties object
        Properties props = System.getProperties();


        // Get a Session object
        Session session = Session.getDefaultInstance(props, null);
        session.setDebug(debug);

        // Get a Store object
        Store store = null;
        Folder rf = null;
        if (url != null) {
            URLName urln = new URLName(url);
            store = session.getStore(urln);
            store.connect();
        } else {
            if (protocol != null)
                store = session.getStore(protocol);
            else
                store = session.getStore();

            // Connect
```

```
            if (host != null || user != null || password != null)
                store.connect(host, user, password);
            else
                store.connect();
        }

        // List namespace
        if (root != null)
            rf = store.getFolder(root);
        else
            rf = store.getDefaultFolder();

        dumpFolder(rf, false, "");
        if ((rf.getType() & Folder.HOLDS_FOLDERS) != 0) {
            Folder[] f = rf.list(pattern);
            for (int i = 0; i < f.length; i++)
                dumpFolder(f[i], recursive, "    ");
        }

        store.close();
    }

    static void dumpFolder(Folder folder, boolean recurse, String tab)
                                        throws Exception {
        System.out.println(tab + "Name:      " + folder.getName());
        System.out.println(tab + "Full Name: " + folder.getFullName());
        System.out.println(tab + "URL:       " + folder.getURLName());

        if (verbose) {
            if (!folder.isSubscribed())
                System.out.println(tab + "Not Subscribed");

            if ((folder.getType() & Folder.HOLDS_MESSAGES) != 0) {
                if (folder.hasNewMessages())
                    System.out.println(tab + "Has New Messages");
                System.out.println(tab + "Total Messages:  " +
                                            folder.getMessageCount());
                System.out.println(tab + "New Messages:    " +
                                            folder.getNewMessageCount());
                System.out.println(tab + "Unread Messages: " +
                                            folder.getUnreadMessageCount());
            }
            if ((folder.getType() & Folder.HOLDS_FOLDERS) != 0)
                System.out.println(tab + "Is Directory");
        }

        System.out.println();

        if ((folder.getType() & Folder.HOLDS_FOLDERS) != 0) {
            if (recurse) {
                Folder[] f = folder.list();
                for (int i=0; i < f.length; i++)
                    dumpFolder(f[i], recurse, tab + "    ");
```

```
            }
        }
    }
}
```

Example: Search a Folder for a Message

```
import java.util.*;
import java.io.*;
import javax.mail.*;
import javax.mail.internet.*;
import javax.mail.search.*;
import javax.activation.*;
/*
 * Search the given folder for messages matching the given
 * criteria.
 */

public class search {

    static String protocol = "imap";
    static String host = null;
    static String user = null;
    static String password = null;
    static String mbox = "INBOX";
    static String url = null;
    static boolean debug = false;

    public static void main(String argv[]) {
        int optind;

        String subject = null;
        String from = null;
        boolean or = false;
        boolean today = false;

        for (optind = 0; optind < argv.length; optind++) {
            if (argv[optind].equals("-T")) {
                protocol = argv[++optind];
            } else if (argv[optind].equals("-H")) {
                host = argv[++optind];
            } else if (argv[optind].equals("-U")) {
                user = argv[++optind];
            } else if (argv[optind].equals("-P")) {
                password = argv[++optind];
            } else if (argv[optind].equals("-or")) {
                or = true;
            } else if (argv[optind].equals("-D")) {
                debug = true;
            } else if (argv[optind].equals("-f")) {
```

```
            mbox = argv[++optind];
        } else if (argv[optind].equals("-L")) {
            url = argv[++optind];
        } else if (argv[optind].equals("-subject")) {
            subject = argv[++optind];
        } else if (argv[optind].equals("-from")) {
            from = argv[++optind];
        } else if (argv[optind].equals("-today")) {
            today = true;
        } else if (argv[optind].equals("--")) {
            optind++;
            break;
        } else if (argv[optind].startsWith("-")) {
            System.out.println(
             "Usage: search [-D] [-L url] [-T protocol] [-H host] " +
             "[-U user] [-P password] [-f mailbox] " +
             "[-subject subject] [-from from] [-or] [-today]");
            System.exit(1);
        } else {
            break;
        }
    }

    try {

        if ((subject == null) && (from == null) && !today) {
            System.out.println("Specify either -subject, -from or
             -today");
            System.exit(1);
        }

        // Get a Properties object
        Properties props = System.getProperties();

        // Get a Session object
        Session session = Session.getDefaultInstance(props, null);
        session.setDebug(debug);

        // Get a Store object
        Store store = null;
        if (url != null) {
            URLName urln = new URLName(url);
            store = session.getStore(urln);
            store.connect();
        } else {
            if (protocol != null)
                store = session.getStore(protocol);
            else
                store = session.getStore();

            // Connect
            if (host != null || user != null || password != null)
                store.connect(host, user, password);
```

```
    else
        store.connect();
}


// Open the Folder
Folder folder = store.getDefaultFolder();
if (folder == null) {
    System.out.println("No default folder");
    System.exit(1);
}

folder = folder.getFolder(mbox);
if (folder == null) {
    System.out.println("Invalid folder");
    System.exit(1);
}

folder.open(Folder.READ_ONLY);
SearchTerm term = null;

if (subject != null)
    term = new SubjectTerm(subject);
if (from != null) {
    FromStringTerm fromTerm = new FromStringTerm(from);
    if (term != null) {
        if (or)
            term = new OrTerm(term, fromTerm);
        else
            term = new AndTerm(term, fromTerm);
    }
    else
        term = fromTerm;
}
if (today) {
    ReceivedDateTerm dateTerm =
     new ReceivedDateTerm(ComparisonTerm.EQ, new Date());
    if (term != null) {
        if (or)
            term = new OrTerm(term, dateTerm);
        else
            term = new AndTerm(term, dateTerm);
    }
    else
        term = dateTerm;
}

Message[] msgs = folder.search(term);
System.out.println("FOUND " + msgs.length + " MESSAGES");
if (msgs.length == 0) // no match
    System.exit(1);

// Use a suitable FetchProfile
```

```
            FetchProfile fp = new FetchProfile();
            fp.add(FetchProfile.Item.ENVELOPE);
            folder.fetch(msgs, fp);

            for (int i = 0; i < msgs.length; i++) {
                System.out.println("--------------------------");
                System.out.println("MESSAGE #" + (i + 1) + ":");
                dumpPart(msgs[i]);
            }

            folder.close(false);
            store.close();
        } catch (Exception ex) {
            ex.printStackTrace();
        }

        System.exit(1);
    }

    public static void dumpPart(Part p) throws Exception {
        if (p instanceof Message) {
            Message m = (Message)p;
            Address[] a;
            // FROM
            if ((a = m.getFrom()) != null) {
                for (int j = 0; j < a.length; j++)
                    System.out.println("FROM: " + a[j].toString());
            }

            // TO
            if ((a = m.getRecipients(Message.RecipientType.TO)) != null) {
                for (int j = 0; j < a.length; j++)
                    System.out.println("TO: " + a[j].toString());
            }

            // SUBJECT
            System.out.println("SUBJECT: " + m.getSubject());

            // DATE
            Date d = m.getSentDate();
            System.out.println("SendDate: " +
                (d != null ? d.toLocaleString() : "UNKNOWN"));

            // FLAGS:
            Flags flags = m.getFlags();
            StringBuffer sb = new StringBuffer();
            Flags.Flag[] sf = flags.getSystemFlags(); // get the system flags

            boolean first = true;
            for (int i = 0; i < sf.length; i++) {
                String s;
                Flags.Flag f = sf[i];
                if (f == Flags.Flag.ANSWERED)
```

```
            s = "\\Answered";
        else if (f == Flags.Flag.DELETED)
            s = "\\Deleted";
        else if (f == Flags.Flag.DRAFT)
            s = "\\Draft";
        else if (f == Flags.Flag.FLAGGED)
            s = "\\Flagged";
        else if (f == Flags.Flag.RECENT)
            s = "\\Recent";
        else if (f == Flags.Flag.SEEN)
            s = "\\Seen";
        else
            continue;// skip it
        if (first)
            first = false;
        else
            sb.append(' ');
        sb.append(s);
    }

    String[] uf = flags.getUserFlags(); // get the user flag strings
    for (int i = 0; i < uf.length; i++) {
        if (first)
            first = false;
        else
            sb.append(' ');
        sb.append(uf[i]);
    }
    System.out.println("FLAGS = " + sb.toString());
}

System.out.println("CONTENT-TYPE: " + p.getContentType());

/* Dump input stream
InputStream is = ((MimeMessage)m).getInputStream();
int c;
while ((c = is.read()) != -1)
    System.out.write(c);
*/

Object o = p.getContent();
if (o instanceof String) {
    System.out.println("This is a String");
    System.out.println((String)o);
} else if (o instanceof Multipart) {
    System.out.println("This is a Multipart");
    Multipart mp = (Multipart)o;
    int count = mp.getCount();
    for (int i = 0; i < count; i++)
        dumpPart(mp.getBodyPart(i));
} else if (o instanceof InputStream) {
    System.out.println("This is just an input stream");
    InputStream is = (InputStream)o;
```

```
            int c;
            while ((c = is.read()) != -1)
                System.out.write(c);
        }
    }
}
```

Example: Monitoring a Mailbox

```
import java.util.*;
import java.io.*;
import javax.mail.*;
import javax.mail.event.*;
import javax.activation.*;

/* Monitors given mailbox for new mail */

public class monitor {

    public static void main(String argv[])
    {
        if (argv.length != 5) {
            System.out.println("Usage: monitor <host> <user> <password>
                <mbox> <freq>");
            System.exit(1);
        }
        System.out.println("\nTesting monitor\n");

        try {
            Properties props = System.getProperties();

            // Get a Session object
            Session session = Session.getDefaultInstance(props, null);
            // session.setDebug(true);

            // Get a Store object
            Store store = session.getStore("imap");

            // Connect
            store.connect(argv[0], argv[1], argv[2]);

            // Open a Folder
            Folder folder = store.getFolder(argv[3]);
            if (folder == null || !folder.exists()) {
                System.out.println("Invalid folder");
                System.exit(1);
            }

            folder.open(Folder.READ_WRITE);
```

```
            // Add messageCountListener to listen for new messages
            folder.addMessageCountListener(new MessageCountAdapter() {
               public void messagesAdded(MessageCountEvent ev) {
                  Message[] msgs = ev.getMessages();
                  System.out.println("Got " + msgs.length +
                     " new messages");

                  // Just dump out the new messages
                  for (int i = 0; i < msgs.length; i++) {
                     try {
                        DataHandler dh = msgs[i].getDataHandler();
                        InputStream is = dh.getInputStream();
                        int c;
                        while ((c = is.read()) != -1)
                           System.out.write(c);
                     } catch (IOException ioex) {
                        ioex.printStackTrace();
                     } catch (MessagingException mex) {
                        mex.printStackTrace();
                     }
                  }
               }
            });

            // Check mail once in "freq" MILLIseconds
            int freq = Integer.parseInt(argv[4]);

            for (; ;) {
               Thread.sleep(freq); // sleep for freq milliseconds

               // This is to force the IMAP server to send us
               // EXISTS notifications.
               folder.getMessageCount();
            }

         } catch (Exception ex) {
            ex.printStackTrace();
         }
      }
   }
```

Example: Sending a Message

```
import java.util.*;
import java.io.*;
import javax.mail.*;
import javax.mail.internet.*;
import javax.activation.*;
/**
 * msgmultisendsample creates a simple multipart/mixed message and sends
```

```
 * it. Both body parts are text/plain.
 *
 * usage:java msgmultisendsample to from smtp true|false
 * where to and from are the destination and
 * origin email addresses, respectively, and smtp
 * is the hostname of the machine that has smtp server
 * running.  The last parameter either turns on or turns off
 * debugging during sending.
 */

public class msgmultisendsample {
   static String msgText1 = "This is a message body.\nHere's line two.";
   static String msgText2 = "This is the text in the message attachment.";

   public static void main(String[] args) {
      if (args.length != 4) {
         System.out.println("usage: java msgmultisend <to> <from> <smtp>
            true|false");
         return;
      }

      String to = args[0];
      String from = args[1];
      String host = args[2];
      boolean debug = Boolean.valueOf(args[3]).booleanValue();

      // create some properties and get the default Session
      Properties props = new Properties();
      props.put("mail.smtp.host", host);

      Session session = Session.getDefaultInstance(props, null);
      session.setDebug(debug);

      try {
         // create a message
         MimeMessage msg = new MimeMessage(session);
         msg.setFrom(new InternetAddress(from));
         InternetAddress[] address = {new InternetAddress(to)};
         msg.setRecipients(Message.RecipientType.TO, address);
         msg.setSubject("JavaMail APIs Multipart Test");
         msg.setSentDate(new Date());

         // create and fill the first message part
         MimeBodyPart mbp1 = new MimeBodyPart();
         mbp1.setText(msgText1);

         // create and fill the second message part
         MimeBodyPart mbp2 = new MimeBodyPart();
         // Use setText(text, charset), to show it off !
         mbp2.setText(msgText2, "us-ascii");

         // create the Multipart and its parts to it
         Multipart mp = new MimeMultipart();
```

```
            mp.addBodyPart(mbp1);
            mp.addBodyPart(mbp2);

            // add the Multipart to the message
            msg.setContent(mp);

            // send the message
            Transport.send(msg);
        } catch (MessagingException mex) {
            mex.printStackTrace();
            Exception ex = null;
            if ((ex = mex.getNextException()) != null) {
                ex.printStackTrace();
            }
        }
    }
}
```

Appendix C:

Message Security

Overview

This is not a full specification of how Message Security will be integrated into the JavaMail system. This is a description of implementation strategy. The purpose of this section is to declare that it is possible to integrate message security, not to define how it will be integrated. The final design for Message Security will change based on feedback and finalization of the S/MIME IETF specification.

This section discusses encrypting/decrypting messages, and signing/verifying signatures. It will not discuss how Security Restrictions on untrusted or signed applets will work, nor will it discuss a general authentication model for Stores (For example; a GSS API in the Java platform.)

Displaying an Encrypted/Signed Message

Displaying an encrypted or signed message is the same as displaying any other message. The client uses the `DataHandler` for that encrypted message together with the "view" command. This returns a bean that displays the data. There will be both a multipart/signed and multipart/encrypted viewer bean (can be the same bean). The beans will need to be aware of the MultiPartSigned/MultiPartEncrypted classes.

MultiPartEncrypted/Signed Classes

The JavaMail API will probably add two new content classes: `MultiPartEncrypted` and `MultiPartSigned`. They subclass the `MultiPart` class and handle the MIME types multipart/encrypted and multipart/signed. There are many possible "protocols" that specify how a message has been encrypted and/or signed. The MPE/MPS classes will find all the installed protocols. The `ContentType`'s protocol parameter determines which protocol class to use. There needs to be a standard registration of protocol objects or a way to search for valid packages and instantiate a particular class. The `MultiPart` classes will hand off the control information, other parameters, and the data to be manipulated (either the signed or encrypted block) through some defined `Protocol` interface.

Reading the Contents

There will be times when an applet/application needs to retrieve the content of the message without displaying it. The code sample below shows one possible technique with a message containing encrypted content:

```
Message msg = // message gotten from some folder.
if (msg.isMimeType("multipart/encrypted")) {
    Object o = msg.getContent();
    if (o instanceof MultiPartEncrypted) {
        MultiPartEncrypted mpe = (MultiPartEncrypted) o;
        mpe.decrypt();
            // use the default keys/certs from the user.
            // We should alsobe able to determine
            // whether or not to interact with the user

    // should then be able to use the multipart methods to
    // get any contained blocks }
    }
}
```

The `getContent` method returns a `MultiPartEncrypted` object. There will be methods on this class to decrypt the content. The decryption could either determine which keys needed to be used, use the defaults (maybe the current user's keys) or explicitly pass which keys/certificates to use.

Verifying Signatures

Applications/applets will need to verify the validity of a signature. The code sample below shows how this might be done:

```
Message msg = // message gotten from some folder
if (msg.isMimeType("multipart/signed")) {
    Object o = msg.getContent();
    if (o instanceof MultiPartSigned) {
        MultiPartSigned mps = (MultiPartSigned) o;
        boolean validsig = mps.verifySignature();

    // could already get the other blocks
    // even if it wasn't a valid signature
    }
}
```

If the signature is invalid, the application can still access the data. There will be methods in `MultiPartSigned` that allow the setting of which keys or certificates to use when verifying the signature.

Creating a Message

There are two methods for creating an Encrypted/Signed message. Users will probably see an editor bean for the content types multipart/signed and multipart/encrypted. These beans would handle the UI components to allow the user to select how they want to encrypt/sign the message. The beans could be integrated into an application's Message Composition window.

Encrypted/Signed

The non-GUI method of creating the messages involves using the MultiPartEncrypted/Signed classes. The classes can be created and used as the content for a message. The following code shows how might work:

```
MultiPartEncrypted mpe = new MultiPartEncrypted();
// Can setup parameters for how you want to encrypt the
// message; otherwise, it will use the user's preferences.
// Set the content you wish to encrypt (to encrypt multiple
// contents a multipart/mixed block should be used)
String ourContent = "Please encrypt me!";
mpe.setContent(ourContent);

MimeMessage m = new MimeMessage(session);
m.setContent(mpe);
```

The message will be encrypted when the message is sent. There will be other methods that allow the setting of which encryption scheme shall be used, and the keys involved.

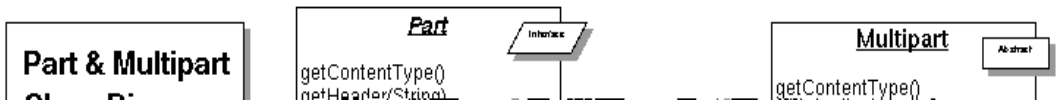
Creating a Multipart Signed message is very similar to creating a Multipart Encrypted message, except that a Multipart Signed object is created instead.

Appendix D:

Part and Multipart Class Diagram

This appendix illustrates relationships between `Part` interfaces and `Message` classes.

FIGURE D-1

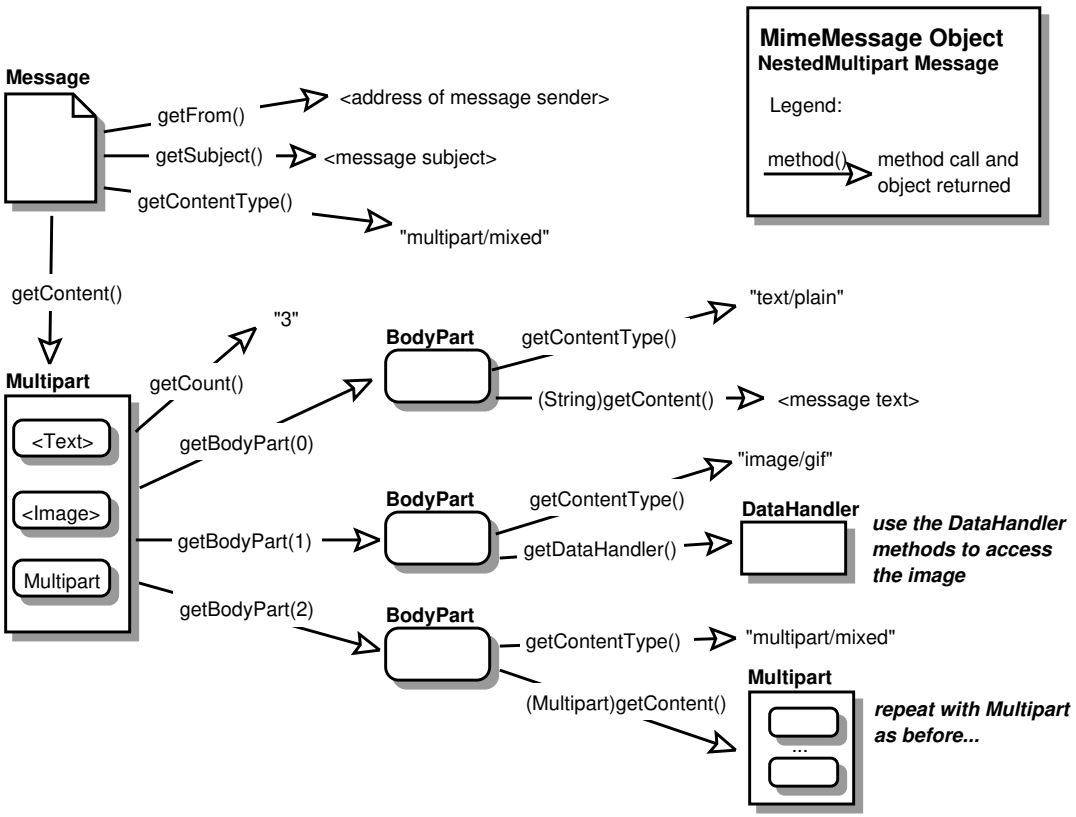


Appendix E:

MimeMessage Object Hierarchy

This appendix illustrates the object hierarchy.

FIGURE E-1



Appendix F:

Features Added in JavaMail 1.1

This appendix summarizes the features added to JavaMail 1.1. For more information about each item, refer to the appropriate Javadoc documentation.

The `MessageContext` *Class and* `MessageAware` *Interface*

In some cases it is desirable for the object representing the content of a `BodyPart` object to know something about the context in which it is operating. For example, the content-object might need to know what other data is contained in the same `Multipart` object, who sent the message containing the data, and so forth. This allows for more interesting content types that know more about the message containing them and the mail system in general.

Some uses of the `multipart/related` object might require these capabilities. For instance, the handler for a `text/html` body part contained in a `multipart/related` object might need to know about the containing object in order to find the related image data needed to display the HTML document. (Note that JavaMail provides no direct support for multipart/related messages.)

To deal with these issues, the `MessageContext` class and `MessageAware` interface have been added in JavaMail 1.1.

The `MessageContext` class provides the basic information about the context in which a content object is operating. Given a `MessageContext object`, it is possible to navigate through a message's body structure. The `MessageAware` interface is an optional interface, implemented by `DataSources` that have the capability of providing a suitable `MessageContext` object. The `MimePartDataSource` implements the `MessageAware` interface, making this capability available to all MIME messages.

The `getMessageID` *method*

The `getMessageID` method has been added to the `MimeMessage` class. This method returns the value of RFC822 Message-ID field.

Additions to the `InternetAddress` *Class*

The `encodedPersonal` protected field has been added to the `javax.mail.internet.InternetAddress` class.

The `toString(Address[], int)` method has also been added to this class

Additions to the `MimeUtility` *Class*

Two static methods have been added to the `javax.mail.internet.MimeUtility` class:

- `String mimeCharset(String charset)`
- `String getDefaultJavaCharset()`

The `mimeCharset` method returns the MIME name of the given JDK™ charset.

The `getDefaultJavaCharset` method returns the default JDK charset for the platform's locale.

New `SearchTerms`

The current address related search terms: `AddressTerm`, `FromTerm` and `RecipientTerm`, are limited in that they operate on `Address` objects, not `Strings`. These terms use the `equals` methd to compare the addresses, which is not useful for the common case of substring comparisons.

Hence three new `SearchTerms` have been introduced:

- `AddressStringTerm`
- `FromStringTerm`
- `RecipientStringTerm`

These terms operate on `Address Strings`, rather than `Address` objects.

These new terms correspond to the capabilities provided by the IMAP protocol. The older terms were not supported by IMAP and thus resulted in client-side searches.

Additions to the Folder Class

Two methods have been added to the javax.mail.Folder class:

- int getMode()
- URLName getURLName()

The getMode method returns the mode in which the Folder object was opened.

The getURLName method returns the URLName value of the folder.

New Service Class

To emphasize the commonality in behavior between the Store and Transport classes, and to simplify maintenance of these classes, a new superclass, javax.mail.Service, has been introduced for the Store and Transport classes.

Appendix G:

Features Added in JavaMail 1.2

This appendix summarizes the features that were added in JavaMail 1.2. Refer to the appropriate Javadoc documentation for additional information about each item,.

Additions to the `MimeMessage` *Class*

The following have been added to the `MimeMessage` class:

- To simplify the creation of `MimeMessage` subclasses:
  - The `modified` field and the `parse(InputStream is)` method that were previously private are now protected.
  - The `createInternetHeaders(InputStream is)` method has also been added to this class.
- When forwarding or saving a message retrieved from a Store, it is sometimes desirable to be able to modify the message first. Since most Stores do not allow their `Message` objects to be modified, the message must first be copied. To simplify copying a `MimeMessage`, we introduce a copy constructor, `MimeMessage(MimeMessage source)`, that allows a new `MimeMessage` to be created and initialized with a copy of another `MimeMessage`.
- The following convenience methods were added to `MimeMessage`.
  - `setRecipients(Message.RecipientType type, String addresses)`
  - `addRecipients(Message.RecipientType type, String addresses)`

  Note that these methods take a `String` for setting/adding a recipient (instead of `javax.mail.Address` objects).
- One of the most common errors encountered when constructing new messages is forgetting to call the `saveChanges()` method before writing out the message or calling the `Transport.sendMessage()` method. To solve this problem, a `saved` flag was added to `MimeMessage` and the `writeTo()` method was changed accordingly.

Additions to the MimeMultipart Class

To simplify the creation of MimeMultipart subclasses, the following have been added to the MimeMultipart class:

- The parse(InputStream is) method that was previously private is now protected.
- The createInternetHeaders(InputStream is) and createMimeBodyPart(InternetHeaders headers, byte[] content) methods have been added to this class as protected methods.

The getRawInputStream method

In some cases, it is desirable to get the data for a body part before JavaMail attempts to decode it. This is particularly important if the Content-Transfer-Encoding header is incorrect. (For example, some mail software is known to use "7-bit" instead of the MIME-defined "7-bit".) Access to this data is currently provided through the protected getContentStream method. Since simply making this method public has the potential to cause a source incompatibility for any subclasses that declare this method as protected, we instead add a new public method, getRawInputStream(), that calls this protected method to the MimeMessage and MimeBodyPart classes.

Additions to the InternetAddress Class

The following were added to the InternetAddress class:

- To simplify copying of InternetAddress objects, the InternetAddress class now implements the Cloneable interface and will provide a public clone() method.
- AddressStringTerm.match does not return the correct results in some situations because it wants to do the match against the formatted address string in Unicode, not the ASCII version that might include charset encoding information. To do this, it attempts to format the address itself, but its logic does not handle all the rules about formatting an address (such as, when to quote the personal name) so it does this formatting differently than InternetAddress.toString does. When the address contains only ASCII characters, the formatting should be identical. This problem has been remedied by adding a new method, toUnicodeString(), to the InternetAddress class, which returns a properly formatted address (RFC 822 syntax) of Unicode characters.

- The `InternetAddress` class now implements the `Serializable` interface to support saving `javax.mail.search` terms (described in "Additions for serializable javax.mail.search terms").

The `MailDateFormat` *Class*

The `MailDateFormat` class is now part of the `javax.mail.internet` package. It was previously contained in the `com.sun.mail.util` package. This is a utility class used in formatting and parsing dates in MIME headers. The methods it provides are:

- ```
  StringBuffer format(Date date,
                      StringBuffer dateStrBuf,
                          FieldPosition fieldPosition)
  ```
- ```
  Date parse(String text, ParsePosition pos)
  ```

Additions to `Exceptions` *and* `Events`

The following exceptions and events have been added in JavaMail 1.2:

- Previously, if a client attempted to open a read-only folder in read-write mode, a `MessagingException` was thrown. This exception type does not indicate that the anomaly was caused by the lack of write-permissions. A new `ReadOnlyFolderException` was added to indicate that the problem was caused by a read-only folder.
- When authentication with a server fails, the server often supplies some information in its protocol message that indicates the reason for the failure. To allow a service provider to return this information to the user, we now allow the `Service.protocolConnect()` method to throw an `AuthenticationFailedException` in this case. The exception may contain a string message that includes the additional information from the server.
- The `FolderNotFoundException` constructors were not consistent with other exceptions defined in the API. Two new constructors were added to eliminate these inconsistencies:
  - `FolderNotFoundException(Folder folder)`
  - `FolderNotFoundException(Folder folder, String s)`
- If an error occurs when sending a message, the `TransportEvent` class saved the message that caused the error, but provided no `getMessage` method for the listener to retrieve the `Message` object. The `getMessage()` method was added to `TransportEvent` class.

Additions to the Session Class

Two static convenience methods were added to the Session class for retrieving the default Session or a new Session object, which do not require an Authenticator parameter (assumed to be null):

- `Session Session.getDefaultInstance(Properties props)`
- `Session Session.getInstance(Properties props)`

Additions to the MimeUtility Class

The following were added to the MimeUtility class to provide additional support for encoding:

- The UUEncode encoder requires the filename to be inserted into the encoded stream. The public access point to the encoder is through the MimeUtility.encode() method, which does not have any parameter that can provide the filename. Hence the uuencoded stream always has "encode.buf" as filename. A new method, that allows the setting of the filename has been added:

  ```
  encode(OutputStream os, String encoding, String filename)
  ```

- The getEncoding() method which was previously added to improve the performance of JavaMail was changed from package private to public.

Additions for serializable javax.mail.search terms

The javax.mail.search package allows you to programmatically construct a search term. As a convenience, these terms can now be saved in persistent storage and restored in a later session. The simplest way to store these expressions is to use serialization.

Many of the search terms reference other objects that must also be serializable. The most problematic such objects are of the class Message.RecipientType. This class uses the java "type-safe enum" idiom, which involves a number of static final instances of the class. Applications are allowed to test for equivalence with these "constants" by using the "==" equality operator. Thus, it's critical that only a single instance of each constant exist in the Java virtual machine. To ensure that this constraint is met when deserializing an object of this class, we must take advantage of the J2SE 1.2 readReplace() method. Since this method is not available on JDK 1.1, objects of this class, and thus search terms that reference them, can not be correctly deserialized on JDK 1.1. This is a limitation of this new capability.

To provide this support, the following classes and all their subclasses now implement the `Serializable` interface:

- `javax.mail.search.SearchTerm`
- `javax.mail.Address`
- `javax.mail.Flags`
- `javax.mail.Message.RecipientType`

In addition, to allow comparison between search terms, the `equals` and `hashCode` methods on `SearchTerm` (and all subclasses) now implement "value" equivalence rather than identity equivalence.

Additions to the `Store` Class

The following methods have been added to `javax.mail.Store` to provide namespace information:

- `Folder[] getPersonalNamespaces()`

  A personal namespace is a set of names that is considered within the personal scope of the authenticated user. Typically, only the authenticated user has access to mail folders in their personal namespace. If an INBOX exists for a user, it must appear within the user's personal namespace. In the typical case, there should be only one personal namespace for each user in each Store.

- `Folder[] getUserNamespaces(String user)`

  The namespaces returned represent the personal namespaces for the user. To access mail folders in the other user's namespace, the currently authenticated user must be explicitly granted access rights. For example, it is common for a manager to grant to their secretary access rights to their mail folders.

- `Folder[] getSharedNamespaces()`

  A shared namespace is a namespace that consists of mail folders that are intended to be shared amongst users and do not exist within a user's personal namespace.

New `ContentDisposition` Class

The `ContentDisposition` class contained in `javax.mail.internet` package has been changed from package private to public.

New performance improvements

To allow us to improve the performance of the `MimeMessage` and `MimeMultipart` classes when parsing data from an `InputStream`, we introduce a new `SharedInputStream` interface that allows the data in the `InputStream` to be shared instead of copied, and we use this new interface in key parts of the implementation. The methods defined by the `SharedInputStream` interface are:

- `long getPosition()`
- `InputStream newStream(long start, long end)`

A new protected `InputStream` (which implements the `SharedInputStream` interface) data member, `contentStream`, has been added to the `MimeMessage` and `MimeBodyPart` classes.

Additions to the `ParameterList` class

The `ParameterList.toString()` method returns its results "unfolded". It would be useful to have the results "folded" in certain situations. A new method, `ParameterList.toString(int used)`, will be added which will return "folded" results. Folding is defined by RFC 822 as the process of splitting a header field into multiple lines. "The general rule is that wherever there may be linear-white-space (NOT simply LWSP-chars), a CRLF immediately followed by AT LEAST one LWSP-char may instead be inserted." Unfolding is the process of returning to a single line representation. "Unfolding is accomplished by regarding CRLF immediately followed by a LWSP-char as equivalent to the LWSP-char."