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An Introduction to MIME

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1. Introduction

Internet e-mail allows users to exchange messages around the world, and is still the most widely used service on the Internet. In terms of actually Internet traffic, though E-mail only accounts for a small percentage of the total, around 6% in December 1994. Part of the reason for this is that in the past e-mail messages have been limited to text only.

The basic e-mail standards were established in 1982 and allow for mail messages that contain only 7 bit ASCII characters, no lines longer than 1000 characters and are of a limited length. This was known as SMTP, or Simple Mail Transport Protocol. Since 1982 computer technology has moved on, and multimedia systems are becoming the norm. However, it is often difficult to transfer information between these systems and their applications as there are many different formats for encoding data. Although several proprietary multimedia mail systems were developed, they suffer from the same problems as other multimedia systems and were not compatible with each other, and could only send multimedia messages to users of the same system. To solve these problems a new Internet mail standard was approved in 1992. The new standard is called MIME, Multipurpose Internet Mail Extensions. This standard provides sufficient new features to address a number of problems with SMTP, including the ability to send non-textual data, such as images and sound, and non-ASCII text, necessary for many non-English languages. MIME allows messages to be sent which may contain:

- Multiple objects within a single message
- Text with unlimited line length or overall length
- Character sets other than 7-bit ASCII
- Multi-font messages
- Binary or application-specific files
- Images, audio, video and multi-media messages

This document will provide an overview of the MIME standard, and look at the way MIME messages are handled by some common MIME compliant mail handlers.

2. MIME Overview

When the MIME specification was developed, it was decided that it would build on the existing Internet standards, so that nothing in the new document should cause existing mail systems to break. The old standard consists of two parts, a header containing a series of fields, and a body, which may contain only US ASCII text.

Header fields	From: Sue Cunningham <sue.cunningham@mcc.ac.uk> To: joe.bloggs@mcc.ac.uk Subject: Hello
Text body	Hello

Table 1 A simple e-mail message

This basic structure was maintained in the new standard, with several new header fields being created:

- A MIME-Version header field. This allows the mail reading program to recognise that it has received a MIME message and deal with it accordingly. The header is written as:

  ```
  MIME-Version: 1.0
  ```

- A Content-Type header field. This tells the mailer what type of data is included in the message. The header is written as:

  ```
  Content-Type: type / subtype [; parameter]
  ```

  where the type is one of the seven types defined below. The type gives the general type of the data, while the subtype specifies a specific format for that type of data. This method ensures that a MIME compliant mail reader, even if it does not recognise the exact subtype will recognise the basic type of data involved. For example:

  ```
  Content-type: image/gif
  ```

  The parameter field is an optional field giving additional information if required. For example, a standard text message would have a Content-Type header of:

  ```
  Content-type: text/plain; charset=us-ascii
  ```

  Seven mail content types were defined, which it was hoped would cover most cases. However, MIME was designed to be extensible, and new subtypes may easily be defined. In order to avoid naming problems, implementers must register the new subtypes with the Internet Assigned Numbers Authoring (IANA). ‘Private’ or test subtypes can be used freely, but must start with the letters “X-”.

- A Content-Transfer-Encoding header field. This specifies any encoding that has been used to allow the message to pass through any mail transport mechanisms which have data limitations. For example, binary data cannot be transmitted over some transport protocols, and must first be converted into 7-bit short-line form (i.e. less than 1000 characters per line). Several encodings are specified, and are detailed below.

2.1. Content-Types

The seven content-types defined are:

- application - a catch all category for binary data which does fit into any of the other categories.

- audio - audio data. The subtype is the audio format name. `audio/basic` refers to single channel 8000HZ u-law audio data, allowing telephone quality e-mail audio.

- image - still image data. The subtype is the image format name. `image/gif` and `image/jpeg` were defined originally, as they are both standard formats in common use.

- message - this indicates an encapsulated message, and could be used for example when forwarding messages. Two subtypes were originally defined:
  `message/partial` indicates a partial message, where a large message has been broken up into smaller fragments.
  `message/external-body` indicates that the actual data is not contained in the message, only a reference to it, for example giving an FTP (file transport protocol) location.

- multipart - this indicates a message with several body parts, each with its own data type. There is a mandatory parameter for this type, the boundary. This specifies the string that is used to separate the different parts. The final boundary has two hyphens added to the end of the line. Any string can be used as a boundary, but it must not appear inside any of the encapsulated parts. The example message below shows how the boundary string is used.

- text - the default type. The default sub-type is `text/plain`.
  `text/richtext` indicates a format defined in the MIME standard that is a small subset of SGML (Standard Generalised Markup Language). This allows formatted text to be sent.

- video - for transmitting video or moving image data, which may include sound. Subtypes correspond to the video format name, for example: `video/Mpeg`

2.2. Content-Transfer-Encoding

The two basic encodings defined in the specification are:

- `base64` Well suited for representing binary files, and is similar to uuencoding. Uuencoding was not chosen because there is no standard, and many flavours of the encoding exist. In addition some mail gateways will not handle some of the characters used in the uuencode format. The base64 format was designed to be acceptable to all known gateways.

- `quoted-printable` Most suitable for data consisting mainly of ASCII characters. ASCII characters are left un-coded, other characters encoded as an equals sign (=) followed by two hexadecimal digits. If the message contains mostly ASCII characters it will be able to be read even if the mail reader is not MIME aware.

Other codings have also been defined. A list of encoding and content-types (as of June 1996) is given in Appendix A.

`To: mdpyssc@fs2.scg.man.ac.uk`	Standard e-mail headers
`From: sue.cunningham@mcc.ac.uk`	
`Subject: test mime message`	
`Date: Thurs, 27 Nov 1994 16:09:24`	
`MIME-Version: 1.0`	
`Content-Type:multipart/mixed;`	Type of objects in message
`boundary="divider-between-parts"`	Boundary token separating types
	Blank line signifies start of message
`--divider-between-parts`	
`Content-Type: text/plain`	First type in the message
`Content-Transfer-Encoding: 7bit`	Object encoding in this case none
`The message goes here`	Standard text message
`--divider-between-parts`	End of first type
`Content-Type:image/gif`	Start of second type, a gif image
`Content-Transfer-Encoding: base64`	ASCII encoding for binary data
`Content-Description: put the title here`	Text description of file
`R01GODdhXgBnAPcAAAAAAAAVQAAqgA......`	Encoded gif file
`--divider-between-parts--`	End of gif and message

Table 2 Multipart MIME message

The table above shows the structure of a MIME message. This will usually be hidden from the user in a MIME compliant browser.

2.3. Other Uses

Although MIME was originally designed for sending multimedia electronic mail, because it specifies what the type of media and the encoding are in a standard way, it has found a use in a number of other situations, particularly on the World Wide Web (WWW). When a Web browser requests a file from a server, the server looks at the file extension and attaches a suitable MIME header. The browser can then use these headers to determine how it should deal with the files, for example by calling an external application such as an MPEG viewer.

3. Specific Packages

There are many MIME compliant mail packages now available, providing various degrees of MIME support. The MIME FAQ (see References) provides a list of such packages. This section will look at a few of the more common ones.

3.1. MH (version 6.8 and later)

For full details of the MIME implementation in MH, see the MHN tutorial available from:
http://www.cs.ucsb.edu/Facilities/Software/mh.html

MH is not a single program, but a collection of tools, and its multimedia related functions are implemented in the **mhn** program. When composing a message using MH, MIME attachments can be sent by including the line:
`#content-type/subtype filename`
at the end of the message body, for example
`#image/gif /images/testimage.gif`
At the **What now?** prompt typing `edit mhn -list` a new draft will be created and the message and its attachments are now ready to be sent.

To view MIME messages the `-show` option is used, and to store them the `-store` option. Most of the configuration to view MIME files using mhn will be done by the system administrator, but its behaviour can be customised by editing the **.mh_profile** file. This file contains three main types of command which begin with:

`mhn-compose-`	for operations to apply when composing messages
`mhn-show-`	for operations to apply when displaying messages
`mhn-store-`	for operations to apply when storing messages

For example:
`mhn-show-video/mpeg: mpeg_play '%F'`
instructs mhn to display a message of type video/mpeg using the mpeg_play program. The `'%F'` escape code indicates that the message should be stored in a temporary file, and the name of the file passed to the mhn-show program.

Full details of the these commands can be found in the mhn tutorial and manual pages.

3.2. Pegasus Mail

Pegasus Mail is a free mailtool developed by David Harris, but the manuals are sold separately (extensive online help is provided). It is available in DOS and Windows versions for the PC, and for the Macintosh, and provides much of the functionality of expensive commercial products. It has good MIME support, and handles attachments well. It can send MIME messages either as enclosures or as attachments, and can recognise both types of incoming message. In addition to basic MIME encoding it also supports uuencoding and BinHex (widely used in the Macintosh world).

3.2.1. Pegasus for Windows

Sending MIME messages

The Pegasus mail editor has a row of icons down the left hand side, one of which is attachments. Clicking on this will bring up the attachments dialogue box.

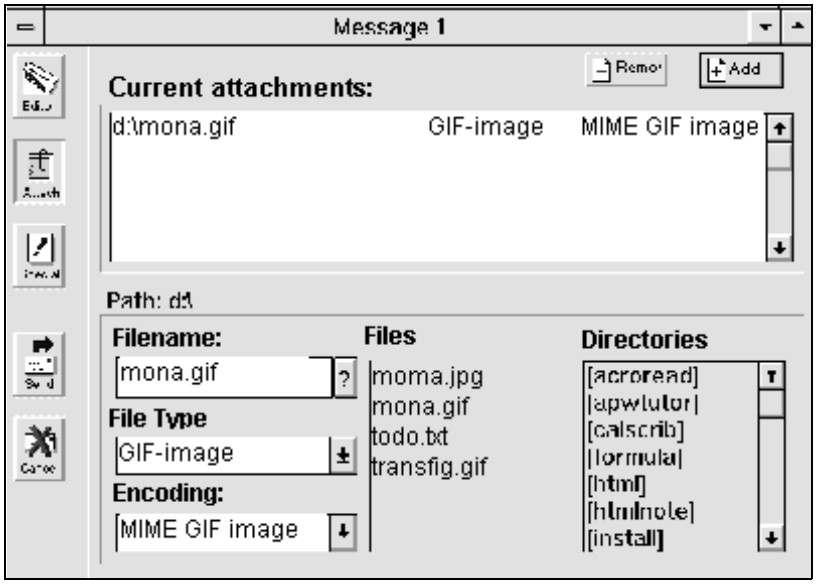

Figure 1 Pegasus for Windows Attachments dialogue box

The files to be sent can then be selected from the file list or typed in directly to the Filename field, the correct File Type and encoding type selected, and the files added to the list of attachments. For MIME messages the appropriate MIME type must be selected in the encoding field, and MIME encodings must be enabled. MIME encoding is enabled by selecting the Special icon on the left hand side of the message screen and checking **'Use MIME encodings for Internet and local mail'**. If this field is not selected a warning message will appear if you try to send a MIME file. The File Type is for information only, Pegasus does perform any format conversions or check that the file type matches the file. Pegasus allows you to attach up to 64 files to a message in this way. The default behaviour of Pegasus is to send each attachment separately, but they can be encapsulated by selecting **Preferences, Advanced Settings** from the main **File** menu, and

checking **Send enclosures instead of attachments**.

Viewing MIME messages

In order to view MIME messages that contain non-textual data external viewers must first be configured. Select **Preferences, Attachment Viewers** from the main **File** menu, and click on the **Add** button. The **Define an attachment viewer** dialogue box will appear. This allows you to define viewers that will be called based on an attachments file extension or the "attachment type" information. Selecting the "attachment type" box will bring up a pull down list of types, e.g. GIF-image, MPEG-movie. Select the type, then click on the **Browse** button, which will bring up a filelist box. Select the appropriate application to view the filetype and click on OK.

When a MIME message containing non-textual data is received and opened Pegasus will display the following dialogue box.

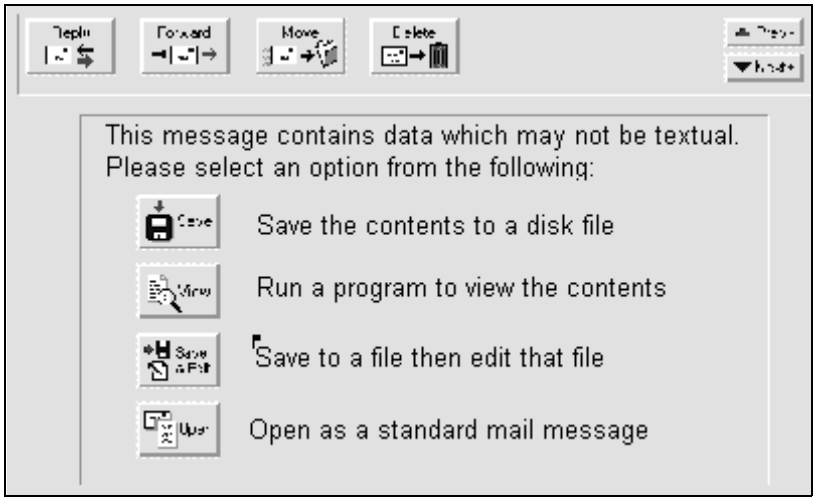

Figure 2 MIME message dialogue box

If the correct attachment viewers have been configured, clicking on **'Run a program to view the contents'** will launch that program. **'Save to a file then edit that file'** will first allow you to choose a filename and save the contents then display the file in the attachment viewer as above. **'Open as a standard mail message'** will display the file as if it were text, i.e. not decoded. This is how a non MIME compliant mail handler would display the file.

3.2.2. Pegasus for DOS

Sending MIME messages

MIME messages are sent in similar way to the windows version. From the message screen, press F7 to select the attachments dialogue box, then enter the Filename, File Type and Encoding, and press Ctrl-Enter to accept. Before sending the message, select **Other Options (F9),** and make sure MIME encoding is on. If this option is not checked the message will not be sent as a MIME message, and no warning will be displayed.

Viewing MIME messages

Customising Pegasus Mail's MIME support is done via a **PM-MIME.RSC** resource file created using the Pegasus Mail 3.x resource compiler, **ResCom**. A sample source file, **PM-MIME.R** is provided, and this should be edited to configure your own attachment viewers. ResCom is then run giving `pm-mime.r` as the only parameter, and the resource file **pm-mime.rsc** is created. If this is put in your own mail directory it will affect only your version of Pegasus. On a network installation, the network manager can create a resource file which will be used by the entire site.

PM-MIME.R contains the following lines which must be edited (comments are preceded by a # sign and do not affect the compilation of the file, actual code is shown in bold):

```
 {
## The following number is the number of defined viewers that follow. In this case only
##  the first four will be used regardless of the number of lines following.
 4,
## The viewer definition consists of :
## integer - 0 if PMail must prompt before running it, non-zero otherwise
## The primary content-type, e.g. text, image, application
## The secondary content-type, e.g gif, jpeg, Mpeg
## The command line for the attachment viewer. This must be less than 100 characters
## long and all \ must be replaced with \\
 0, "IMAGE", "GIF",       "c:\\viewers\\gif.bat ~c",
 0, "IMAGE", "JPEG",    "c:\\viewers\\jpeg.bat ~c",
 0, "VIDEO",  "MPEG",   "C:\\VIEWERS\\VMPEG\\mpeg.bat ~c",
 0, "APPLICATION", "POSTSCRIPT",   "C:\\GS\\GS386.EXE ~c"
 };
```

Table 3 PM-MIME.R

3.3. Eudora

Eudora is a popular mail handler with versions available for Microsoft Windows and the Macintosh. Eudora Light is a free version which includes much of the functionality of the commercial version, Eudora Pro, but does not support uuencoding/decoding. Both versions are MIME compliant, but Eudora Lite can only be configured to save MIME attachments to appropriate files, Eudora Pro will also open the attachments within the appropriate application..

3.3.1. Eudora Lite - PC Version

Mappings to the MIME types must be configured by editing the **[Mappings]** section of the eudora.ini file. Each entry in this section contains the following information

```
[in,out,both]=PC extension, Mac code, Mac type, MIME type, MIME subtype
```

Mappings beginning `'in'` refer only to received messages, `'out'` only to those being sent, and `'both'` to incoming and outgoing messages. For example,

```
both=gif,,,image,gif
```

specifies that an incoming MIME message with content-type image/gif will be saved to a file with the extension ".gif", and any gif files sent as message attachments will be encoded as content-type image/gif.

To ensure that messages are sent as MIME, from the **Special, Settings** menu select **Attachments.** The following dialogue box will appear. Select MIME as the encoding type. Selecting `'put text attachments in body of message'` will put any plain text files into the main message as if they had been typed in. The attachment directory option allows you to specify the directory into which incoming file attachments will be saved.

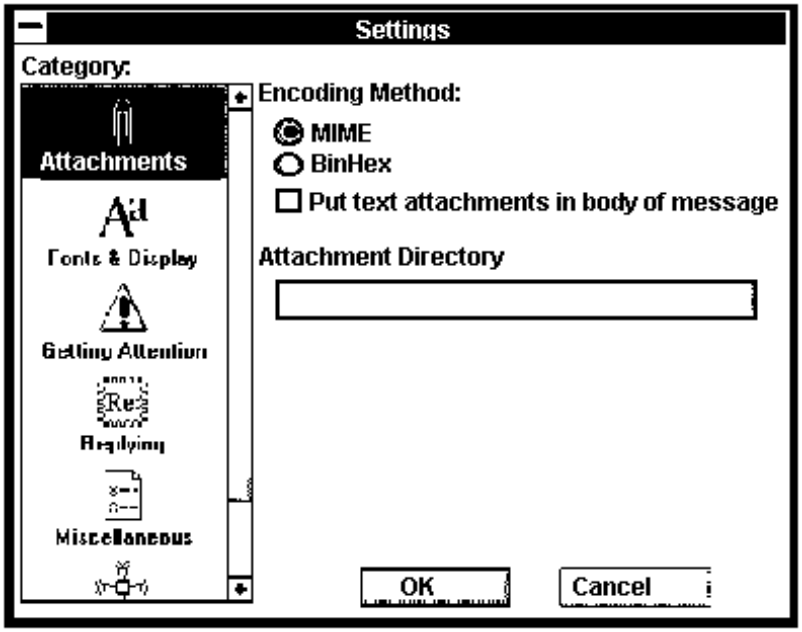

Figure 3 Eudora Attachments dialogue

3.3.2. Eudora Lite - Macintosh Version

The MIME mappings are configured by editing the EuIM (incoming) and EuOM (outgoing) resources. Like the PC .ini file these contain lists of maps.

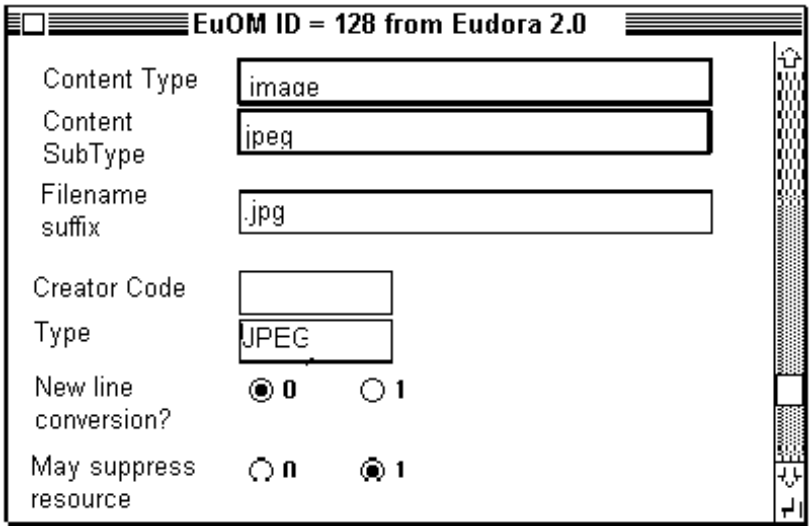

Figure 4 Editing the EuOM Resource

The Content-type and subtype refer to the MIME encodings. The suffix is added to the filename as an extra decoding aid for the receiving system. The `'May Suppress Resource'` should be set to 1 unless you are sure the receiving computer is another Macintosh. This will ensure only the data fork with the attached MIME information is sent, rather than including the resource fork as well. EuIM resources are configured similarly to EuOM resources.
The Attachment settings is configured similarly to the PC version, and should generally be set to **Apple Double** to ensure messages are MIME encoded and can be read by any other system.

3.4. Viewing MIME messages without a MIME compliant mail handler

It is possible to view MIME messages without a MIME compliant mail handler using one of the several tools available.

3.4.1. Munpack

Munpack will decode MIME messages, writing out the various parts to files which can then be viewed using other applications. To use munpack, the MIME message must first be saved to a file, complete with all its headers. Munpack is then run over the saved file. Versions of munpack are available for Unix, Ms-DOS, Macintosh and Amiga platforms from *ftp://ftp.andrew.cmu.edu/pub/mpack/*

3.4.2. Metamail

Metamail is available for Unix, Dos and Amiga platforms. Metamail allows the relatively easy configuration of mail readers to call external viewers, and includes viewers for a number of MIME types including:

- Plain US ASCII (i.e., English) text, of course.
- Plain text in the ISO-8859-8 (Hebrew/English) character set.
- Richtext (multifont formatted text, termcap-oriented viewer)
- Image formats (X11(Unix) systems only)
- Audio (SPARCstations)

Support for other media types and character sets can be added using the provided types as templates. The Metamail program comes with a small patch for many common mail handlers including: Berkeley mail, Elm, Xmail, Mailtool, Emacs Rmail, Emacs VM, Andrew.
Metamail can be downloaded from:
ftp://thumper.bellcore.com/pub/nsb/

MIME glossary

This glossary comes from the MIME FAQ (Frequently Asked Questions) available from: *http://sunsite.doc.ic.ac.uk/usenet/news-FAQS/*

body	the part of a message after the header (the "meat")
content	a portion of a MIME message
CTE	content transfer encoding (e.g. base64, quoted-printable, etc.)
ESMTP	Extended SMTP - RFC 1651
external part	a "pointer" to a part available via FTP or other means
GIF	graphical interchange format for images
header	the To, From, Subject, etc. at the start of a message
HTML	hypertext markup language; used in WWW documents
JPEG	an image compression standard for still images
mail transport	the "post office", e.g. sendmail, smail, MMDF, etc.
MIME	Multipurpose Internet Mail Extensions - RFC 1521
MPEG	an image compression standard for moving pictures
MTA	Mail Transport Agent, see "mail transport
MUA	Mail User Agent, see "user agent"
multi-media	nebulous marketroid term meaning audio and visual stuff
part	a piece of a MIME message containing some data type
PBM	an image format
PEM	Privacy Enhanced Mail
PGP	Pretty Good Privacy
PostScript	a popular page description language
RFC	request for comments; proposed or standard Internet protocols
SMTP	Simple Mail Transfer Protocol - RFC 821
text/enriched	simple text markup language for MIME - RFC 1563
text/simplemail	another (even simpler?) text markup language
URL	WWW uniform resource locator; access-method://host/path
user agent	the end user's mail program, e.g. MH, ELM, /bin/mail, etc.
WWW	the worldwide web (see section 4.4)

Appendix A - Media Types

This is a partial list of currently registered content-types and sub-types and encoding-types. The complete current list can be found at:
ftp://ftp.isi.edu/in-notes/iana/assignments/media-types/media-types

Content - Type	Subtype	RFC Number
text	plain	1521
	richtext	1521
	enriched	1896
	tab-separated-values	
	html	1866
	sgml	1874
multipart	mixed	1521
	alternative	1521
	digest	1521
	parallel	1521
	appledouble	
	header-set	
	form-data	1867
	related	1872
	report	1892
	voice-message	1911
message	rfc822	1521
	partial	1521
	external-body	1521
	news	1036
	http	1945
application	octet-stream	1521
	postscript	1521
	oda	1521
	mac-binhex40	
	news-message-id	1036
	news-transmission	
	pdf	
	zip	
	remote-printing	1486

image	jpeg	1521
	gif	1521
	ief	1314
	tiff	
	cgm	
audio	basic	1521
	32kapcm	1911
video	mpeg	1521
	quicktime	

Content Transfer Encodings

(see RFC 1521)
7 Bit
8 Bit
Base64
Binary
Quoted-Printable

References and Resources

RFC (Request for Comments) are available from:
http://sunsite.doc.ic.ac.uk/packages/rfc/

Borenstien, N., and N. Freed, "MIME (Multipurpose Internet Mail Extensions) Part One: Mechanisms for Specifying and Describing the Format of Internet Message Bodies", RFC 1521, Bellcore, Innosoft, September 1993.

Crocker, D. “Standard for the format of ARPA Internet text messages”, RFC 822, Network Information Centre, August 1982.

Evaluation of E-mail clients under the MS-Windows environment
http://www.hk-r.se/SUNET-MIME/

USENET comp.mail.mime FAQ - *http://sunsite.doc.ic.ac.uk/usenet/news-FAQS/*

Pegasus Mail:	*http://www.pegasus.usa.com/*
Eudora:	*http://www.eudora.com/*
MH:	*http://www.cs.ucsb.edu/Facilities/Software/mh.html*
EXMH:	*http://parcftp.xerox.com/pub/exmh/html/index.htm*
Metamail	*ftp://thumper.bellcore.com/pub/nsb/*
Munpack	*ftp://ftp.andrew.cmu.edu/pub/mpack/*

Test MIME address
mimeback@bunyip.com is a listserver which will send standard MIME messages in response to comands submitted in the subject line of messages sent to it. Initially send a message with HELP as the subject (no message body).