

FUNCTIONAL REQUIREMENTS FOR MULTIMEDIA ELECTRONIC MAIL

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Today the need of sending content types other than plain English text with Electronic mail is well understood. Fortunately the standard exists and implementations started coming up. As the main content types and their encoding methods are precisely defined, inter-operability problems between implementations are unlikely to occur.

This document lists technical and functional requirements any mail product claiming to be 'multimedia' should fulfill.

A summary of the Multipurpose Internet Mail Extensions (**MIME**) standard and some of its implementations follow. Given that things evolve fast in this area, this can only be a status report as far as the products is concerned .

1. REQUIREMENTS

Electronic mail¹ is now required to include text in character sets other than US-ASCII and other content types (also called body types or body parts) such as image, audio², video, binary data or a combination of them. Such body parts are often called attachments or enclosures and products that can handle them are commonly called 'multimedia' mail systems.

A list of vital and desirable criteria is given below for use by CERN user groups evaluating such mail products.³ It is important to note that this list applies to the near future only and some of the criteria now classified as desirable will become vital in two years from now at most. An indication whether each requirement is

¹ Electronic mail is called 'mail' further in the text.

² **NB!**The 'audio' content type is NOT related to voice mail (depositing and receiving messages using the telephone). A description of all MIME content types is included in chapter 4.

³ Parts of [1] are embedded in this chapter.

satisfied by the mail systems currently supported at CERN (the ones described in the mail user guide[2]) is also included.

1.1 Vital requirements

- **MIME conformance.** RFC 1341 (MIME) is our strategic direction. If candidate products are not conformant to MIME [3] today, they should commit to become conformant by a given date in order to avoid islands of incompatible mail systems. For those which provide MIME support already today a 'MIME-Version' header line should be present as well as standard definitions of content types, subtypes and their encoding.
 - VMS Mail: No
 - Unix Mail: No but there are products based on it.
 - MAIL on VM/CMS: No
 - QuickMail on a Mac: No but it has multimedia functionality and a QuickMail to MIME translator is announced.
 - MS-Mail on a PC: No but it has multimedia functionality and Microsoft expressed interest for a migration to MIME. Today some document types can be exchanged between QuickMail and MS-Mail using a CERN-made program (written by P. Hagen).
- **Flexibility.** Products should allow viewing plain text included in "richer" content types. A mechanism similar to the MIME defined Content-Type : multipart/alternative (see chapter 2 and 4) allows plain text to co-exist with formatted text in a message so that the recipient mail system to use the best representation it understands.
 - VMS Mail: No
 - Unix Mail: No
 - MAIL on VM/CMS: No
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes
- **Native packages.** Users generally wish their mail environment to be fully integrated with their normal computing environment. For this reason mail packages must be chosen for each platform, fully integrated with the native operating system, file system, configurable to use the user's standard editor and printer and, where relevant, the windowing system.
 - VMS Mail: Yes
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes
- **Universal connectivity.** All mail users at CERN should be able to exchange mail inside CERN, throughout HEPnet and the Internet, and where Internet gateways exist also with outside (commercial) mail systems.
 - VMS Mail: Yes via the CERN central gateway (dxmint)

- Unix Mail: Yes via the CERN central gateway (dxmint)
 - MAIL on VM/CMS: Yes via the CERN central gateway (dxmint)
 - QuickMail on a Mac: Yes via the CERN central gateway (dxmint)
 - MS-Mail on a PC: Yes via the CERN central gateway (dxmint)
- **Uniform addressing.** All mail addresses should follow the Internet format RFC 822 [11] (typically *user@sequence-of-dot-separated-subdomains.country*).
 - VMS Mail: Yes via the CERN central gateway (dxmint)
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: partially from QuickMail to the outside world. Yes on the other direction.
 - MS-Mail on a PC: partially from MS-Mail to the outside world. Yes on the other direction.
- **Reply functionality.** The "reply" function should work in all cases. The header fields should be only US-ASCII for the moment. RFC 1342 [4] allows the representation of other character sets in RFC 822 message headers. However, this possibility is not yet implemented in mail readers supporting MIME.
 - VMS Mail: Yes
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes
- **Forward.** Users should be able to forward messages to other users on multi-media or not systems.
 - VMS Mail: Yes
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes
- **Auto-forward.** It must be possible to set any user's mail account to automatically forward all incoming mail to another RFC822-style address.
 - VMS Mail: Yes
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: No
 - MS-Mail on a PC: No
- **Follow Internet standards.** All products must include a standard mechanism for re-encoding 8-bit character or binary data into 7-bit US-ASCII as required by the SMTP (RFC 821) [12] standard for text mail. In fact MIME conformant messages can cross any old fashion SMTP gateway and arrive 'intact' at the other end (see chapter 2 and 4 on Content-Transfer-Encoding).

Nevertheless recent Internet drafts [7],[8] ,[9] define mechanisms for extending the SMTP service. Thus, SMTP contents (composed by the header and the body) may include body parts other than US ASCII text. A specific command (EHLO) during the SMTP session and an IANA registered (Internet Assigned Numbers Authority) keyword value are used by the SMTP server and client to inform each other about the SMTP extensions they support.

- VMS Mail: Yes if file uuencoded first, then included in a mail message
 - Unix Mail: Yes if file uuencoded first, then included in a mail message
 - MAIL on VM/CMS: Yes if file uuencoded first, then included in a mail message
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes
- **Management and registration.** Products should only need a minimum of routine interventions. A special hardware platform for management must not be required. Extensive logging facilities must be included (from/to, date and time, size of each message) as well as some basic control functions. No special user registration should be required beyond what is anyhow needed to access a server.
 - VMS Mail: Yes except there are no logs
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes after the QuickMail gateway manager registers the user on the appropriate mail centre.
 - MS-Mail on a PC: Yes after the post office manager registers the mailbox name.

1.2 Desirable requirements

- **Extensibility.** Products should be able to later include additional content types by simple change of configuration parameters.
 - VMS Mail: No
 - Unix Mail: No but there are products which are extensible
 - MAIL on VM/CMS: No
 - QuickMail on a Mac: Yes but internal to the QuickMail community only
 - MS-Mail on a PC: Yes but internal to the MS-Mail community only
- **Communication with/through X.400 systems.** X.400 today offers less than MIME in terms of functionality. The developing Internet standards[5] , [6], [10] are in the process of defining mechanisms to allow "tunneling" of MIME content types through MHS relays and vice versa. X.400 headers should be extended to carry the richer MIME semantics.
 - VMS Mail: Yes via the CERN central gateway (dxmint)
 - Unix Mail: Yes via the CERN central gateway (dxmint)
 - MAIL on VM/CMS: Yes via the CERN central gateway (dxmint)
 - QuickMail on a Mac: Yes via the CERN central gateway (dxmint)
 - MS-Mail on a PC: Yes via the CERN central gateway (dxmint)

- **Reply-all functionality.** The "reply all" or "group reply" function (whereby all addressees receive a copy of the reply) should be supported. Many current mail gateways generate headers which do not allow this.
 - VMS Mail: No
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes

- **Acknowledgement** of message reception should be possible on request.
 - VMS Mail: No
 - Unix Mail: No
 - MAIL on VM/CMS: Yes internally
 - QuickMail on a Mac: Yes internally
 - MS-Mail on a PC: Yes internally

- **Distribution lists.** Users should be able to create, manage and use distribution lists, preferably with some indication on the capabilities of the recipients' mail readers.
 - VMS Mail: Yes but creates false headers if message sent to SMTP destinations
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes

- **Remote access.** It should be possible to access waiting mail remotely, e.g. by *telnet* from another Internet site or by login from home.
 - VMS Mail: Yes
 - Unix Mail: Yes
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes, in principle but needs dedicated host for access
 - MS-Mail on a PC: Yes, in principle but needs dedicated host for access

- **Message folders' access and management.**
 - Message **(un)delete** functionality must be provided as in all traditional mail systems.
 - Allow the creation and use of **Nicknames/Aliases** files as User Directories.
 - If a graphical user interface is available then **customizing menus and buttons** should be possible.
 - The standard sender's **signature** (personal information) text should be definable by the user and automatically appended to the messages.
 - **Sorting** and **Filtering** messages in a given folder by date, subject, size or possibly other user defined criteria is desirable.

- **Searching** by pattern across folders is desirable to easily retrieve stored messages.
 - VMS Mail: Yes. Even better if running DEC Windows.
 - Unix Mail: Yes. Even better if using Elm as a user interface (or other).
 - MAIL on VM/CMS: Yes
 - QuickMail on a Mac: Yes
 - MS-Mail on a PC: Yes
- **Directories.** Integration in the central CERN computer user registration scheme, extraction of data for the CERN directory (EMDIR), and remote access to EMDIR should be possible.
 - VMS Mail: Yes, outside MAIL
 - Unix Mail: Yes, outside MAIL
 - MAIL on VM/CMS: Yes, outside MAIL
 - QuickMail on a Mac: Yes, QuickMail user community only.
 - MS-Mail on a PC: Yes, outside MAIL
- **Reliability and security.** Products should of course be reliable and fault-tolerant, in particular able to recover from messages with faulty headers or invalid formats. Specific anti-looping precautions must be implemented. Mail storage should be on a reliable, backed-up medium and in particular desktop storage of mail should be avoided in favour of properly managed servers. These servers should be routinely protected against unauthorised access. The introduction of Privacy Enhanced Mail should be considered as soon as the appropriate Internet standards are widely used.
 - VMS Mail: Yes for reliability, privacy and back-up. Some loop check via the gateway.
 - Unix Mail: Yes for reliability, privacy and back-up. Some loop check via the gateway.
 - MAIL on VM/CMS: Yes for reliability, privacy and back-up. Some loop check via the gateway.
 - QuickMail on a Mac: Yes for reliability, privacy and back-up. Some loop check via the gateway.
 - MS-Mail on a PC: Enhanced privacy. Password is needed to access the mail. Some loop check via the gateway.

2. MIME DESCRIPTION AND EXAMPLES

The standard defines a mechanism to include in a mail message data other than english text, i.e. text in other character sets, formatted text, binary data, image, audio and video fragments in a mail message. The different types of data that can (co)exist in the mail are called in the standard 'Content-Types'. Seven Content-Types (and their subtypes) are defined in the MIME document. However, the standard is extensible to include new Content-Types or subtypes with universal validity using the IANA registration procedures.

For example a MIME conformant message including only plain english text should carry a `MIME-Version : 1.0` header field and a `Content-Type : text/plain;charset = ISO 8859-1` line at the beginning of the body.

A message containing plain greek text followed by the greek text formatted in TeX ending with a picture and an audio part displayed and heard simultaneously should look like:

MIME-Version : 1.0

Standard header lines (From, To, Cc, Subject)

Content-Type : multipart/mixed;

boundary = here-we-change-type-of-content

here-we-change-type-of-content

Content-Type : text/plain;charset = ISO-8859-7

The plain text goes here.

here-we-change-type-of-content

Content-Type : text/richtext;charset = ISO-8859-7

The formatted text goes here.

here-we-change-type-of-content

Content-Type : multipart/parallel;

boundary = another-boundary

another-boundary

Content-Type : image/gif

Content-Transfer-Encoding: Base64

here are the image data encoded in base64

another-boundary

Content-Type : audio/basic

Content-Transfer-Encoding: base64

here is the audio part if you have a speaker

another-boundary

here-we-change-type-of-content

MIME conformant messages can transit through traditional 7-bit SMTP relays without loss of functionality as a special encoding is introduced for those data types which are naturally 8-bit.

MIME allows for multiple content types to co-exist in a message (`Content-Type : multipart`)⁴ and be displayed simultaneously, e.g. text and image and audio (`Content-Type : multipart/parallel`) or alternatively, i.e. only one of the types present

⁴ See syntax details in chapter 4.

in the message depending on the sophistication of the recipient's mail system (Content-Type : multipart/alternative).

3. MIME SUPPORTING PRODUCTS

This list is not exhaustive. The products are examples and not recommendations. The purpose is to show that although MIME was published in June 1992 implementations immediately appeared very well integrated to popular user agents.

All these products offer additional (MIME) functionality to the Message Transfer Agents (MTAs in X.400 terminology). Some include User Agents (UAs) to notify the users about the MTA extensions e.g. Pine, Z-Mail or integrate existing popular UAs, e.g. Metamail. Others make use of the extended functionality for other applications, e.g. ServiceMail Toolkit, PMDF 4.1.

Products rumoured to be under development at the moment this report is written are not listed. The following (except those marked as *announced*) are known to be in operation in various sites without interoperability problems with older SMTP systems.

- **Metamail**

It is Developed by one of the MIME authors (N. Borenstein) in Bellcore labs. Available in free distribution it runs on any Unix platform and integrates several popular User Agents.

- **Pine**

Started as an Elm extension (their user interfaces in fact resemble). Also available free of charge it runs on a variety of Unix platforms.

- **ServiceMail Toolkit**

Developed by Enterprise Integration Technologies Corporation for free distribution. It is an automatic mail processing package, i.e. mail is used to invoke application programs. It runs on Unix and includes parts of metamail code.

- **Z-Mail 2.1**

It is a commercial product by Siren Software Corporation. It has a very nice Graphical User Interface, with menus and buttons that can be easily customized and a clear display of message content types, subtypes and their encoding (they are called attachments in Z-Mail's jargon). It runs on virtually any Unix system. It was the UNIX World Magazine "Product of the Year" winner for 1991.

- **PMDF 4.1**

Marketed by Innosoft International Inc. at a low price (use to be free of charge). Developed basically by the other MIME author Ned Freed. It runs on VMS and is used as a multi-protocol (mainly SMTP-DECnet) mail gateway.

- **ISODE to MIME gateway**

ISO Development Environment is available free of charge. Originally developed for Sun hardware it now runs on some other Unix platforms too. It is a full OSI stack implementation offering 3 applications: a X.500 Directory Service (QUIPU), a X.400 MTA (PP), and a File Transfer Access and Man-

agement (FTAM) slot. Now the ISODE consortium *announced* that the next release planned for December 1992 will include a MIME gateway.

- **QuickMail-MIME translator**
QuickMail developers *announced* a program, which will convert QuickMail 'enclosures' in MIME defined Content-Types and subtypes with standard parameters and encoding.
- **cc:Mail**
The company *announced* that cc:Mail will be providing MIME support in an upcoming release of their SMTP gateway. The version with MIME support is expected to ship in Q2 of '93.

4. RFC 1341 (MIME) SUMMARY

The standard provides mechanisms to include multiple content types in a message. It keeps the header fields in US ASCII text only. Any message conforming to MIME carries the following header:

MIME-Version: 1.0

The body types are described by the value of the Content-Type header field. Seven content types are defined by the document. Others can be specified in the future and get registered in IANA for universal use or be used for experimental reasons between 2 cooperating agents, in which case their name should start with "X-".

In order for MIME messages to be transferred through SMTP gateways a mechanism is defined to encode 8-bit character or binary data into a 7-bit short line format as RFC 821 defines [12]. This is expressed by the field:

Content-Transfer-Encoding

with possible values: "BASE64" / "QUOTED-PRINTABLE" / "8BIT" / "7BIT" / "BINARY" / x-token (non-standard encoding).

A list of MIME defined content types follows. A detailed description of types, subtypes and encoding methods is included in[3]:

- **Content-type: text**
Textual information in a number of character sets as defined in ISO 8859-1 up to ISO 8859-9 and formatted text.
 - Subtypes defined by MIME: plain, richtext
 - Important Parameters: charset
 - Encoding notes: quoted-printable generally preferred if an encoding is needed and the character set is mostly an ASCII superset.
- **Content-type: multipart**
A combination of several body parts, possibly of different types into a single message.
 - Subtypes defined by MIME: mixed, alternative, digest, parallel.
 - Important Parameters: boundary

- Encoding notes: No content-transfer-encoding is permitted.
- Content-type: **message**
A fully formatted RFC 822 mail message, possibly containing several content types.
 - Subtypes defined by MIME: rfc822, partial, external-body
 - Important Parameters: id, number, total
 - Encoding notes: No content-transfer-encoding is permitted.
- Content-type: **application**
Application data or binary data (mail used for file transfer).
 - Subtypes defined by MIME: octet-stream, postscript, oda
 - Important Parameters: profile
 - Encoding notes: base64 generally preferred for octet-stream or other unreadable subtypes.
- Content-type: **image**
Still image (picture) data. A display device is needed to view this content type.
 - Subtypes defined by MIME: jpeg, gif
 - Important Parameters: none
 - Encoding notes: base64 generally preferred
- Content-type: **audio**
Audio or voice data. Also requires a specific (audio) device.
 - Subtypes defined by MIME: basic
 - Important Parameters: none
 - Encoding notes: base64 generally preferred
- Content-type: **video**
Moving pictures possibly with audio part.
 - Subtypes defined by MIME: mpeg
 - Important parameters: none
 - Encoding notes: base64 generally preferred

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