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Internationalized Email Headers
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Abstract

Internet mail was originally limited to 7-bit ASCII. MIME added support for the use of 8-bit character sets in body parts, and also defined an encoded-word construct so other character sets could be used in certain header field values. But full internationalization of electronic mail requires additional enhancements to allow the use of Unicode, including characters outside the ASCII repertoire, in mail addresses as well as direct use of Unicode in header fields like From:, To:, and Subject:, without requiring the use of complex encoded-word constructs. This document specifies an enhancement to the Internet Message Format and to MIME that allows use of Unicode in mail addresses and most header field content.

This specification replaces [RFC 5335](#). This specification also updates [Section 6.4 of RFC 2045](#) to eliminate the restriction prohibiting the use of non-identity content-transfer-encodings on subtypes of "message/".

Status of This Memo

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1. Introduction

Internet mail distinguishes a message from its transport and further divides a message between a header and a body [[RFC5322](#)]. Internet mail header field values contain a variety of strings that are intended to be user-visible. The range of supported characters for these strings was originally limited to 7-bit [[ASCII](#)]. MIME [[RFC2045](#)] [[RFC2046](#)] [[RFC2047](#)] provides the ability to use additional character sets, but this support is limited to body part data and to special encoded-word constructs that were only allowed in a limited number of places in header field values.

Globalization of the Internet requires support of the much larger set of characters provided by Unicode [[RFC5198](#)] in both mail addresses and most header field values. Additionally, complex encoding schemes like encoded-words introduce inefficiencies as well as significant opportunities for processing errors. And finally, native support for the UTF-8 charset is now available on most systems. Hence it is strongly desirable for Internet mail to support UTF-8 [[RFC3629](#)] directly.

This document specifies an enhancement to the Internet Message Format [[RFC5322](#)] and to MIME that permits the direct use of UTF-8, rather than only ASCII, in header field values, including mail addresses. A new media type, message/global, is defined for messages that use this extended format. This specification also lifts the MIME restriction on having non-identity content-transfer-encodings on any subtype of the message top-level type so that message/global parts can be safely transmitted across existing mail infrastructure.

This specification is based on a model of native, end-to-end support for UTF-8, which depends on having an "8-bit clean" environment assured by the transport system. Support for carriage across legacy, 7-bit infrastructure and for processing by 7-bit receivers requires additional mechanisms that are not provided by these specifications.

This specification is a revision of and replacement for [[RFC5335](#)]. Section 6 of [[I-D.ietf-eai-frmrk-4952bis](#)] describes the change in approach between this specification and the previous version.

2. Terminology Used In This Specification

A plain ASCII string is fully compatible with [[RFC5321](#)] and [[RFC5322](#)]. In this document, non-ASCII strings are UTF-8 strings if they are in header field values which contain at least one <UTF8-non-ascii> (see [Section 3.1](#)).

Unless otherwise noted, all terms used here are defined in [[RFC5321](#)],

[[RFC5322](#)], [[I-D.ietf-eai-frmwrk-4952bis](#)], or [[I-D.ietf-eai-rfc5336bis](#)].

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

The term "8-bit" means octets are present in the data with values above 0x7F.

3. Changes to Message Header Fields

To permit Unicode characters in field values, the header definition in [[RFC5322](#)] is extended to support the new format. The following sections specify the necessary changes to [RFC 5322](#)'s ABNF.

The syntax rules not mentioned below remain defined as in [[RFC5322](#)].

Note that this protocol does not change [RFC 5322](#) rules for defining header field names. The bodies of header fields are allowed to contain Unicode characters, but the header field names themselves must contain only ASCII characters.

Also note that messages in this format require the use of the UTF8SMTPbis extension [[I-D.ietf-eai-rfc5336bis](#)] to be transferred via SMTP.

3.1. UTF-8 Syntax and Normalization

UTF-8 characters can be defined in terms of octets using the following ABNF [[RFC5234](#)], taken from [[RFC3629](#)]:

UTF8-non-ascii	=	UTF8-2 / UTF8-3 / UTF8-4
UTF8-2	=	<Defined in Section 4 of RFC3629 >
UTF8-3	=	<Defined in Section 4 of RFC3629 >
UTF8-4	=	<Defined in Section 4 of RFC3629 >

See [[RFC5198](#)] for a discussion of Unicode normalization; normalization form NFC [[UNF](#)] SHOULD be used. Actually, if one is going to do internationalization properly, one of the most often-cited goals is to permit people to spell their names correctly. Since many mailbox local parts reflect personal names, that principle applies to mailboxes as well. The NFKC normalization form [[UNF](#)]

SHOULD NOT be used because it may lose information that is needed to correctly spell some names in some unusual circumstances.

3.2. Syntax Extensions to [RFC 5322](#)

The following rules extend the ABNF syntax defined in [[RFC5322](#)] and [[RFC5234](#)] in order to allow UTF-8 content.

VCHAR =/ UTF8-non-ascii

ctext =/ UTF8-non-ascii

atext =/ UTF8-non-ascii

qtext =/ UTF8-non-ascii

text =/ UTF8-non-ascii
 ; note that this upgrades the body to UTF-8

dtext =/ UTF8-non-ascii

The preceding changes mean that the following constructs now allow UTF-8:

1. Unstructured text, used in header fields like Subject: or Content-description:.
2. Any construct that uses atoms, including but not limited to the local parts of addresses and message-ids. This includes addresses in the "for" clauses of Received: header fields.
3. Quoted strings.
4. Domains.

Note that header field names are not on this list; these are still restricted to ASCII.

3.3. Use of 8-bit UTF-8 in Message-Ids

Implementers of message-id generation algorithms MAY prefer to restrain their output to ASCII since that has some advantages, such as when constructing In-reply-to: and References: header fields in mailing-list threads where some senders use EAI and others not.

[3.4.](#) Effects on Line Length Limits

[Section 2.1.1 of \[RFC5322\]](#) limits lines to 998 characters and recommends that the lines be restricted to only 78 characters. This specification changes the former limit to 998 octets. (Note that in ASCII octets and characters are effectively the same but this is not true in UTF-8.) The 78 character limit remains defined in terms of characters, not octets, since it is intended to address display width issues, not line length issues.

[3.5.](#) Changes to MIME Message Type Encoding Restrictions

This specification updates [Section 6.4 of \[RFC2045\]](#). [\[RFC2045\]](#) prohibits applying a content-transfer-encoding to any subtypes of "message/". This specification relaxes that rule -- it allows newly defined MIME types to permit content-transfer-encoding, and it allows content-transfer-encoding for message/global (see [Section 3.7](#)).

Background: Normally, transfer of message/global will be done in 8-bit-clean channels, and body parts will have "identity" encodings, that is, no decoding is necessary.

But in the case where a message containing a message/global is downgraded from 8-bit to 7-bit as described in [\[RFC6152\]](#), an encoding might have to be applied to the message; if the message travels multiple times between a 7-bit environment and an environment implementing these extensions, multiple levels of encoding may occur. This is expected to be rarely seen in practice, and the potential complexity of other ways of dealing with the issue is thought to be larger than the complexity of allowing nested encodings where necessary.

[3.6.](#) Use of MIME Encoded-Words

The MIME encoded-words facility [\[RFC2047\]](#) provides the ability to place non-ASCII text, but only in a subset of the places allowed by this extension. Additionally, encoded-words are substantially more complex since they allow the use of arbitrary charsets. Accordingly, encoded-words SHOULD NOT be used when generating header fields for messages employing this extension. Agents MAY, when incorporating material from another message, convert encoded-word use to direct use of UTF-8.

Note that care must be taken when decoding encoded-words because the results after replacing an encoded-word with its decoded equivalent in UTF-8 may be syntactically invalid. Processors that elect to decode encoded-words MUST NOT generate syntactically invalid fields.

3.7. The Message/global Media Type

Internationalized messages in this format MUST only be transmitted as authorized by [[I-D.ietf-eai-rfc5336bis](#)] or within a non-SMTP environment that supports these messages. A message is a "message/global message" if:

- o it contains 8-bit UTF-8 header values as specified in this document, or
- o it contains 8-bit UTF-8 values in the header fields of body parts.

The content of a message/global part is otherwise identical to that of a message/rfc822 part.

If an object of this type is sent to a 7-bit-only system, it MUST have an appropriate content-transfer-encoding applied. (Note that a system compliant with MIME that doesn't recognize message/global is supposed to treat it as "application/octet-stream" as described in [Section 5.2.4 of \[RFC2046\]](#).)

Type name: message

Subtype name: global

Required parameters: none

Optional parameters: none

Encoding considerations: Any content-transfer-encoding is permitted. The 8-bit or binary content-transfer-encodings are recommended where permitted.

Security considerations: See [Section 4](#).

Interoperability considerations: This media type provides functionality similar to the message/rfc822 content type for email messages with internationalized email headers. When there is a need to embed or return such content in another message, there is generally an option to use this media type and leave the content unchanged or down-convert the content to message/rfc822. Both of these choices will interoperate with the installed base, but with different properties. Systems unaware of internationalized headers will typically treat a message/global body part as an unknown attachment, while they will understand the structure of a message/rfc822. However, systems that understand message/global will provide functionality superior to the result of a down-conversion to message/rfc822. The most interoperable choice

depends on the deployed software.

Published specification: RFC XXXX

Applications that use this media type: SMTP servers and email clients that support multipart/report generation or parsing. Email clients that forward messages with internationalized headers as attachments.

Additional information:

Magic number(s): none

File extension(s): The extension ".u8msg" is suggested.

Macintosh file type code(s): A uniform type identifier (UTI) of "public.utf8-email-message" is suggested. This conforms to "public.message" and "public.composite-content", but does not necessarily conform to "public.utf8-plain-text".

Person & email address to contact for further information: See the Author's Address section of this document.

Intended usage: COMMON

Restrictions on usage: This is a structured media type that embeds other MIME media types. An 8-bit or binary content-transfer-encoding SHOULD be used unless this media type is sent over a 7-bit-only transport.

Author: See the Author's Address section of this document.

Change controller: IETF Standards Process

4. Security Considerations

Because UTF-8 often requires several octets to encode a single character, internationalization may cause header field values in general and mail addresses in particular to become longer. As specified in [\[RFC5322\]](#), each line of characters MUST be no more than 998 octets, excluding the CRLF. On the other hand, MDA (Mail Delivery Agent) processes that parse, store, or handle email addresses or local parts must take extra care not to overflow buffers, truncate addresses, or exceed storage allotments. Also, they must take care, when comparing, to use the entire lengths of the addresses.

There are lots of ways to use UTF-8 to represent something equivalent

or similar to a particular displayed character or group of characters; see the security considerations in [\[RFC3629\]](#) for details on the problems this can cause. The normalization process described in [Section 3.1](#) is recommended to minimize these issues.

The security impact of UTF-8 headers on email signature systems such as Domain Keys Identified Mail (DKIM), S/MIME, and OpenPGP is discussed in [\[I-D.ietf-eai-frmrk-4952bis\]](#), Section 14.

If a user has a non-ASCII mailbox address and an ASCII mailbox address, a digital certificate that identifies that user might have both addresses in the identity. Having multiple email addresses as identities in a single certificate is already supported in PKIX (Public Key Infrastructure for X.509 Certificates) [\[RFC5280\]](#) and OpenPGP [\[RFC3156\]](#), but there may be user interface issues associated with the introduction of UTF-8 into addresses in this context.

[5.](#) IANA Considerations

IANA is requested to update the registration of the message/global MIME type using the registration form contained in [Section 3.7](#).

[6.](#) Acknowledgements

This document incorporates many ideas first described in Internet-Draft form by Paul Hoffman, although many details have changed from that earlier work.

The author especially thanks Jeff Yeh for his efforts and contributions on editing previous versions.

Most of the content of this document was provided by John C Klensin and Dave Crocker. Significant comments and suggestions were received from Martin Duerst, Julien Elie, Arnt Gulbrandsen, Kristin Hubner, Kari Hurtt, Yangwoo Ko, Charles H. Lindsey, Alexey Melnikov, Chris Newman, Pete Resnick, Yoshiro Yoneya, and additional members of the JET team (Joint Engineering Team) and were incorporated into the document. The editors wish to sincerely thank them all for their contributions.

[7.](#) Edit history

[RFC Editor: Please remove this section before publishing.]

[7.1.](#) [draft-ietf-eai-rfc5335bis-00](#)

1. Applied Errata suggested by Alfred Hoenes.
2. Adjust [[RFC2821](#)] and [[RFC2822](#)] to [[RFC5321](#)] and [[RFC5322](#)].
3. Abrogate <alt-address> in ABNF of <angle-addr>.
4. Revoke [[RFC5504](#)] from this document.
5. Upgrade some references from I-Ds to RFC.

[7.2. draft-ietf-eai-rfc5335bis-01](#)

1. Author name revised.

[7.3. draft-ietf-eai-rfc5335bis-02](#)

1. ABNF revised.

[7.4. draft-ietf-eai-rfc5335bis-03](#)

1. Fix typos
2. ABNF revised
3. Improve sentence

[7.5. draft-ietf-eai-rfc5335bis-04](#)

1. improve sentences and ABNF revised based on AD and Co-chairs

[7.6. draft-ietf-eai-rfc5335bis-05](#)

1. ABNF revised based on AD comments

[7.7. draft-ietf-eai-rfc5335bis-06](#)

1. ABNF revised
2. improve [Section 5](#)

[7.8. draft-ietf-eai-rfc5335bis-07](#)

1. Minor ABNF revised in [Section 3.2](#)
2. improve [Section 5](#)

[7.9. draft-ietf-eai-rfc5335bis-09](#)

Version -08 was posted in error and withdrawn. Version 09 is identical to version 07 except for a date change, addition of this note, and some vertical spacing compression on this page.

[7.10. draft-ietf-eai-rfc5335bis-10](#)

1. Add appendix and overview of changes
2. Replace polls result in Abstract and [Section 1](#)
3. Minor Sentence modification

[7.11. draft-ietf-eai-rfc5335bis-11](#)

1. Major rewrite of entire document to incorporate Dave Crocker's simplified ABNF.
2. The document has intentionally been refocused on implementors wishing to adapt their software to support EAI, so much of the explanatory and historical text has been removed. (Some of it may be reintroduced later as an appendix.

[7.12. draft-ietf-eai-rfc5335bis-12](#)

1. Added a section on the handling of MIME encoded-words.
2. Updated the security considerations to refer to the more complete discussion in [RFC 3629](#).
3. Added a section on the effects on line length limits.
4. Removed the syntax restriction on the use of 8-bit UTF-8 in message-ids.
5. Added text recommending that 8-bit UTF-8 be avoided in message-ids.

[7.13. draft-ietf-eai-rfc5335bis-13](#)

1. Updated and alphabetized the contributor list.
2. Corrected various typos, reworded some sections to make them clearer.
3. Replaced the reference to [RFC 5598](#) with a reference to [RFC 5322](#).

4. Removed the Updates: [RFC 5322](#). [RFC 5322](#) is extended by this document, not updated.
5. Added some text to the Introduction referring to the framework document for information about changes between this specification and [RFC 5335](#).
6. Added text to the Abstract to say that this document replaces [RFC 5335](#) and that [RFC 2045](#) is updated.

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