

**SMTP extension for internationalized email address
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Abstract

Internationalized email address includes two parts, the local part and the domain part. The ways email addresses are used by protocols are different from the ways domain names are used. The most critical difference is that emails are delivered through a chain of peering clients and servers while domain names are resolved by name servers by looking up their own tables. In addition to this, email transport protocols SMTP and ESMTP provide a negotiation mechanism through which clients can make decisions for further processing. This

document specifies the use of SMTP extension for internationalized email address delivery. It also mentions the backward compatible mechanism for downgrade procedure, as specified in an associated specification.

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1. Introduction

Internationalized email address is different from the internationalized domain name (IDN). It can be solved by exploiting the negotiation mechanism while IDN can not use the negotiation mechanism. So internationalized email address SHOULD be solved in the mail transport-level using the negotiation mechanism, which is an architecturally desirable approach. This document specifies a protocol to solve the problem of internationalized email address based on ESMTP. The protocol proposed here is MTA-level solution which is feasible, architecturally elegant, and not as difficult to be deployed in relevant communities.

1.1. Role of this specification

An overview document [[EAI-overview](#)] specifies the requirements for, and components of, full internationalization of electronic mail. This document specifies an element of that work, specifically the definition of an SMTP extension [[RFC1869](#)] for the internationalized email address transport delivery.

1.2. Proposal Context

In order to use internationalized email addresses, we need to internationalize both the domain part and the local part of the email address. The domain part of the email address has been internationalized through IDNA [RFC 3490](#) [[RFC3490](#)]. But the local part of the email address still remains as non-internationalized.

The syntax of Internet email addresses is restricted to a subset of 7-bit ASCII for the domain-part, with a less-restricted subset for the local-part. These restrictions are specified in [RFC 2821](#) [[RFC2821](#)]. To be able to deliver internationalized email through SMTP servers, we need to upgrade SMTP server to be able to carry the internationalized email address. Since the older SMTP servers, the mail-reading clients and other systems that are downstream from them might not be prepared to handle these extended addresses, an SMTP extension is specified to identify and protect the addressing mechanism.

This specification describes a change to the email transport mechanism that permits non-ASCII address in both the envelope and header fields of messages. The context for the change is described in [[EAI-overview](#)] and the details of the header changes are described in [[EAI-utf8header](#)].

1.3. Terminology

The key words "MUST", "SHALL", "REQUIRED", "SHOULD", "RECOMMENDED", and "MAY" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

All specialized terms used in this specification are defined in the EAI overview [[EAI-overview](#)] or in [[RFC2821](#)] and [[RFC2822](#)]. The terms "ASCII address", "internationalized email address", "non-ASCII address", "i18mail address", "UTF8SMTP", "message" and "mailing list" are used with the definitions from the EAI overview document.

This document defines only those syntax rules that are different from those of the base email specifications [[RFC2821](#)][[RFC2822](#)] and, where the earlier rules are upgraded or extended, gives them new names. When the new rule is a small upgrade to the older one, it is typically given a name starting with "u". Rules that are undefined here may be found in the base email documents under the same names.

This document is being discussed on the EAI mailing list. See <https://www1.ietf.org/mailman/listinfo/ima> for information about subscribing. The list's archive is at <http://www1.ietf.org/mail-archive/web/ima/index.html>.

2. Mail Transport-level Protocol

2.1. Framework for the Internationalization Extension

The following service extension is defined:

1. The name of the SMTP service extension is "Email Address Internationalization";
2. The EHLO keyword value associated with this extension is "UTF8SMTP";
3. No parameter values are defined for this EHLO keyword value. In order to permit future (although unanticipated) extensions, the EHLO response MUST NOT contain any parameters for that keyword. If a parameter appears, the SMTP client that is conformant to this version of this specification MUST treat the ESMTP response as if the "UTF8SMTP" keyword did not appear.
4. An optional parameter is added to the SMTP MAIL and RCPT commands. The parameter is named as ALT-ADDRESS. The "ALT-ADDRESS" requires an all-ASCII address as a substitute for the i18mail addresses that we call the primary address; you can learn more in [[EAI-overview](#)] or [[EAI-downgrading](#)]. The value of "ALT-ADDRESS" is set by the sender when MUA and the Submission server have a communication.

5. No additional SMTP verbs are defined by this extension.
6. Servers offering this extension MUST provide support for, and announce, the 8BITMIME extension [[RFC1652](#)].

2.2. The Address Internationalization Service Extension

An SMTP Server that announces this extension MUST be prepared to accept a UTF-8 string [[RFC3629](#)] in any position in which [RFC 2821](#) specifies that a "mailbox" MAY appear. That string MUST be parsed only as specified in [RFC 2821](#), i.e., by separating the mailbox into source route, local part and domain part, using only the characters colon (U+003A), comma (U+002C), and at-sign (U+0040) as specified there. Once isolated by this parsing process, the local part MUST be treated as opaque unless the SMTP Server is the final delivery MTA. Any domain names that are to be looked up in the DNS MUST first be processed into the form as specified in IDNA [[RFC3490](#)] by means of the ToASCII() operation unless they are already in that form. Any domain names that are to be compared to local strings SHOULD be checked for validity and then MUST be compared as specified in [section 3.4](#) of IDNA.

An SMTP Client that receives the UTF8SMTP extension keyword in response to the "EHLO" command MAY transmit a mailbox name as an internationalized string in UTF-8 form and MAY send an internationalized mail header [[EAI-utf8header](#)]. It MAY transmit the domain part of that string in either punycode (derived from the IDNA process) or UTF-8 form. If it sends the domain in UTF-8 form, the original SMTP client SHOULD first verify that the string is valid for a domain name according to IDNA rules. As required by [RFC 2821](#), it MUST not attempt to parse, evaluate, or transform the local part in any way if the UTF8SMTP SMTP extension is offered by the server. If the UTF8SMTP SMTP extension is not offered by the Server, the SMTP Client MUST NOT transmit an internationalized address and MUST NOT transmit a mail body which contains internationalized mail headers [[EAI-utf8header](#)]. Instead, it MUST either return the message to the user as undeliverable or replace it with the alternate ASCII address. If it is replaced, the replacement MUST be the ASCII-only address specified with the ALT-ADDRESS parameter. [[EAI-downgrading](#)].

2.3. Extended Mailbox Address Syntax

[RFC 2821, section 4.1.2](#), defines the syntax of a mailbox entirely in terms of ASCII characters, using the production for "Mailbox" and those on which it depends.

The key changes made by this specification are, informally, to

- o Change the definition of "sub-domain" to permit either the definition above or a UTF-8 string representing a DNS label that is conformant with IDNA [[RFC3490](#)]. That label MUST NOT contain the characters "@" or ".", even though those characters can normally be inserted into a DNS label.
- o Change the definition of "Atom" to permit either the definition above or a UTF-8 string. That string MUST NOT contain any of the ASCII characters (either graphics or controls) that are not permitted in "atext"; it is otherwise unrestricted.

According to the description above, define the syntax of an internationalized email mailbox with ABNF [[RFC4234](#)] as


```
uMailbox = uLocal-part "@" uDomain
           ; Replace Mailbox in RFC 2821, section 4.1.2

uLocal-part = uDot-string / uQuoted-string
           ; MAY be case-sensitive
           ; Replace Local-part in RFC 2821, section 4.1.2

uDot-string = uAtom *("." uAtom)
           ; Replace Dot-string in RFC 2821, section 4.1.2

uAtom = 1*ucharacter
           ; Replace Atom in RFC 2821, section 4.1.2

ucharacter = atext / Non-ASCII
           ; Replace character in RFC 2821, section 4.1.2
           ; atext is defined in RFC 2822
           ; UTF8-2, UTF8-3 and UTF8-4 are defined in RFC 3629

uQuoted-string = DQUOTE *uqcontent DQUOTE
           ; Replace Quoted-string in RFC 2821, section 4.1.2
           ; DQUOTE is Double Quote defined in RFC 4234

uqcontent = qcontent / Non-ASCII
           ; qcontent is defined in RFC 2822, section 3.2.5

uDomain = (sub-udomain 1*("." sub-udomain)) / address-literal
           ; Replace Domain in RFC 2821, section 4.1.2
           ; address-literal is defined in RFC2821 section 4.1.2

sub-udomain = uLet-dig [uLdh-str]
           ; Replace sub-domain in RFC 2821, section 4.1.2

uLet-dig = Let-dig / Non-ASCII
           ; Let-dig in the right of '=' is defined in RFC 2822

uLdh-str = *( ALPHA / DIGIT / "-" / Non-ASCII) uLet-dig
           ; Replace Ldh-str in RFC 2821, section 4.1.2

Non-ASCII = UTF8-2 / UTF8-3 / UTF8-4
```

The value of "udomain" SHOULD be verified with [[RFC3490](#)]; If failed, the email address with that udomain can not be regarded as the valid email address.

2.4. The ALT-ADDRESS parameter

If the UTF8SMTP extension is offered, the syntax of the SMTP MAIL and RCPT commands is extended to support the optional esmtp-keyword "ALT-ADDRESS", to specify the conditions under which the SMTP server may use ALT-ADDRESS for the possible downgrading. If the ALT-ADDRESS esmtp-keyword is used, it MUST have an associated esmtp-value (ALT-ADDRESS-esmtp-value which is defined below) which requires an all-ASCII email address.

Based on the definition of mail-parameters in [RFC2821], the ALT-ADDRESS parameter usage in the commands of "mail from" and "rcpt to" is defined below.

```
"MAIL FROM:" SP <uReverse-path> [ SP <mail-parameters> ]<CRLF>
      ; Update mail command in RFC 2821, section 3.3
```

```
"RCPT TO:" SP <uForward-path> [ SP <rcpt-parameters> ]<CRLF>
      ; Update rcpt command in RFC 2821, section 3.3
```

```
uReverse-path = uPath
      ; Replace Reverse-path in RFC 2821, section 4.1.2
```

```
uForward-path = uPath
      ; Replace Forward-path in RFC 2821, section 4.1.2
```

```
uPath = "<" [ uA-d-l ":" ] uMailbox ">"
      ; Replace Path in RFC 2821, section 4.1.2
```

```
uA-d-l = uAt-domain *( "," uA-d-l )
      ; Replace A-d-l in RFC 2821, section 4.1.2
```

```
uAt-domain = "@" udomain
      ; Replace At-domain in RFC 2821, section 4.1.2
      ; udomain is defined in section 2.3 of this document
```

```
ALT-ADDRESS-esmtp-value=Mailbox
      ; Mailbox is defined in RFC 2821, section 4.1.2
```

The use of the ALT-ADDRESS is specified below: If some involved SMTP servers can not support UTF8SMTP capability and if the sender has already set the ALT-ADDRESS value, the client SMTP server will use this address as the email address when the SMTP server does the subsequent operations. If the ALT-ADDRESS value is not set by the sender, the email must be bounced to the original sender. If the email is bounced due to the incapability of supporting UTF8SMTP, the relative server should issue the response error code "5.3.3" defined

in [[RFC3463](#)] which means that System is not capable of selected features, permanent failure.

2.5. The Suggestion of the Value of the ALT-ADDRESS parameter

The "ALT-ADDRESS" requires an all-ASCII address. There are two alternative ways to set ALT-ADDRESS value: one is set by the sender using the all-ASCII address, the other is set using the transformed email address.

Some may prefer transforming the non-ASCII address to the ASCII Compatible Encoding(ACE) address as the value of the ALT-ADDRESS. A significant obstacle with applying an ACE to all local-parts is that the sending or converting system doesn't know if there are some specific data or instructions embedded in the address that the ACE process would hide. Some SMTP servers may depend on these specific data or instructions to do some operations while the local parts applied with ACE will lose or hide these data or instructions. SMTP [[RFC2821](#)] prohibits SMTP relays from converting local parts because the level of SMTP relays' knowledge on the structure of local parts is assumed to be zero. However, we can raise the knowledge level by supplying additional information. Many human users' email addresses do not have any embedded structure processed by the final delivery MTA. In that case, the sender can specify that these email addresses are safe to be converted in the predefined way. The final delivery SMTP server can revert the addresses even though they are as in all ASCII form. Unless the MUA or the submission server clearly knows that the non-ASCII address can be safely transformed into the all-ASCII address, the non-ASCII address should not be transformed because transformed email address may cause some potential problems.

This document suggests that the ALT-ADDRESS is set directly by the sender; In default, the all-ASCII address should not be gotten from the transformation of the non-ASCII address.

2.6. Body Parts and SMTP Extensions

While this specification requires that servers support the 8BITMIME extension [[RFC1652](#)] to ensure that servers have adequate handling capability for 8-bit data and to avoid a number of complex encoding problems, the use of internationalized addresses obviously does not require non-ASCII body parts in the MIME message. The UTF8SMTP extension MAY be used with the BODY=8BITMIME parameter if that is appropriate given the body content or, if the server advertises it and it is appropriate, with the BODY=BINARYMIME parameter specified in [[RFC3030](#)].

Assuming that the server advertises UTF8SMTP and 8BITMIME, and at

least one non-ASCII address, with or without ALT-ADDRESS, the precise interpretation of these parameters on the MAIL command is:

1. Headers are in UTF-8, body parts are in ASCII.
2. Headers are in UTF-8, some or all body parts contain 8-bit line-oriented data.
3. Headers are in UTF-8, some or all body parts contain binary data without restriction as to line lengths or delimiters.

2.7. Additional ESMTP Changes and Clarifications

The mail transport process involves addresses ("mailboxes") and domain names in contexts in addition to the MAIL and RCPT commands and extended alternatives to them. In general, the rule is that, when [RFC 2821](#) specifies a mailbox, this document expects UTF-8 to be used for the entire string; when [RFC 2821](#) specifies a domain name, the name SHOULD be in punycode form if its raw form is non-ASCII.

The following subsections list and discuss all of the relevant cases.

Support and use of this extension requires support for 8BITMIME. It means that 8BITMIME MUST be advertised by the UTF8SMTP capability SMTP server.

2.7.1. The Initial SMTP Exchange

When an SMTP or ESMTP connection is opened, the server sends a "banner" response consisting of the 220 reply code and some information. The client then sends the EHLO command. Since the client cannot know whether the server supports UTF8SMTP until after it receives the response from EHLO, any domain names that appear in this dialogue, or in responses to EHLO, MUST be in hostname form, i.e., internationalized ones MUST be in punycode form.

2.7.2. Message Retry

When an MSA or MTA encounters a server that doesn't support UTF8SMTP while relaying a message that requires such support, it is RECOMMENDED that an alternate MX be tried, and/or the message is requeued for a later attempt, rather than immediately downgrading or bouncing. If the message is requeued, the total elapsed time before bouncing or downgrading SHOULD be smaller than the value used for other SMTP error conditions such as host unreachable or persistent 4xx response codes.

This alternate-MX-or-retry-later technique SHOULD NOT be used when the message's return path is a non-ASCII address and the specific forward path being attempted is an ASCII address (because the implication that the delivery path normally supports UTF8SMTP does

not hold in this case).

The selection of submission servers is presumably under the control of the sender's client, while the selection of potential intermediate relays is under the control of the administration of the final delivery server. Hence, there is a presumption, at least when the recipient address is non-ASCII, that the delivery path servers normally support UTF8SMTP (if the sender's client or MSA didn't support UTF8SMTP, the message would not have been accepted for delivery in the first place). Thus, a lack of UTF8SMTP support is likely to be a temporary situation, such as a normal inbound server being down and a cooperating site acting as a backup MX. If the lack of UTF8SMTP in the delivery path of a message is a temporary situation, and the message is sent successfully after retrying, then it was a good thing to do. Of course, if there is always an ASCII-only SMTP server in the path, then retrying only adds delay to the failure (bounce or downgrade).

2.7.3. Trace Information

When an SMTP server receives a message for delivery or further processing, it MUST insert trace ("time stamp" or "Received") information at the beginning of the message content. The most important use of Received: lines is for debugging mail faults. For the trace information, we update the time stamp line and the return path line [[RFC2821](#)] formally defined as follows:

```
uReturn-path-line = "Return-Path:" FWS uReverse-path <CRLF>
    ; Replaces Return-path-line in the section 4.4 of \[RFC2821\]
    ; uReverse-path is defined in Section 2.3

uTime-stamp-line = "Received:" FWS uStamp <CRLF>
    ; Replaces Time-stamp-line in the section 4.4 of \[RFC2821\]

uStamp = From-domain By-domain uOpt-info ";" FWS date-time
    ; Replaces Stamp in the section 4.4 of \[RFC2821\]

uOpt-info = [Via] [With] [ID] [uFor]
    ; Replaces Opt-info in the section 4.4 of \[RFC2821\]
    ; [With]'s protocol value will allow UTF8SMTP value

uFor = "FOR" FWS 1*( Path / uMailbox ) CFWS
    ; Replaces For in the section 4.4 of \[RFC2821\]
    ; uReverse-path is defined in Section 2.4
```

Except in the 'uFor' and 'uReverse-path' line where non-ASCII domain

name may be used, internationalized domain names in Received fields MUST be transmitted in the punycode form. The [With]'s protocol value will have the value of 'UTF8SMTP' for UTF8SMTP extension. We will give more information about this in "IANA consideration" section of this document. If a "for" clause containing non-ASCII is encountered when downgrading a message, it is better to just drop the "for" clause rather than figure out some creative way to encode it. When only the domain portion of a "for" clause address contains non-ASCII, this document suggests using the punycode form of the domain portion. For more detailed information, you may see it in [[EAI-utf8header](#)].

[2.7.4.](#) Mailing List Question

How a mixture of traditional and internationalized addresses on a mailing list will impact message flows, error reports, and delivery notifications in all plausible combinations of UTF8SMTP capability and un-capability servers is discussed and specified in the [[EAI-mailing list](#)].

[2.7.5.](#) Message Header Label

Today it is routine that many MTAs scan every message for spam, virus or other reasons. It seems that few MTAs depend on "Header-Type" fields or marker to decide the message's type. The better choice is to rely on scanning the message to decide the message's type: UTF8SMTP or ASCII, instead of the header label "Header-Type" fields or marker. The message header label "Header-Type" SHOULD NOT be used to identify and distinguish the i18mail message from the normal message when SMTP messages are transmitted on wire. This issue is discussed and specified in [[EAI-utf8header](#)].

[2.7.6.](#) POP and IMAP

While SMTP mainly takes care of the transportation of messages and the header fields on wire, POP essentially handles the retrieval of mail objects from the server by a client. In order to use internationalized user names based on i18mail for the retrieval of messages from a mail server using the POP protocol, a new capability SHOULD be introduced following the POP3 extension mechanism [[RFC2449](#)]. This is discussed and specified in the [[EAI-pop](#)].

IMAP [[RFC3501](#)] uses the traditional user name which is based on ASCII. IMAP SHOULD be updated to support the internationalized user names based on i18mail for the retrieval of messages from a mail server. This is discussed and specified in the [[EAI-imap](#)].

2.7.7. SMTP Service Extension for DSNs

The existing draft standard Delivery status notifications (DSNs)[[RFC3461](#)] is presently limited to US-ASCII text in the machine readable portions of the protocol. "International Delivery and Disposition Notifications" [[EAI-dsn](#)] adds a new address type for international email addresses so an original recipient address with non-US-ASCII characters can be correctly preserved even after downgrading. If an SMTP server advertises both the UTF8SMTP and the DSN extension, that server MUST implement EAI-dsn [[EAI-dsn](#)] including support for the ORCPT parameter.

3. Potential problems

3.1. Impact to IRI

The mailto: schema in IRI [[RFC3987](#)] MAY need to be modified when EAI is standardized.

3.2. Impact to [RFC 2476](#) and many email related RFC

The EAI protocols will impact on many email related RFC documents such as Message Submission [[RFC2476](#)]. These protocols SHOULD be considered when implementing the EAI protocol.

4. Implementation Advice

In the absence of this extension, SMTP clients and servers are constrained to using only those addresses permitted by [RFC 2821](#). The local parts of those addresses MAY be made up of any ASCII characters, although some of them MUST be quoted as specified there. It is notable in an internationalization context that there is a long history on some systems of using overstruck ASCII characters (a character, a backspace, and another character) within a quoted string to approximate non-ASCII characters. This form of internationalization SHOULD be phased out as this extension becomes widely deployed but backward-compatibility considerations require that it continue to be supported.

5. IANA Considerations

IANA is requested to add "UTF8SMTP" to the SMTP extensions registry with the entry pointing to this specification for its definition.

The "Mail Transmission Types" registry is requested to be updated to

include the following new entries:

WITH protocol types	Description	Reference
-----	-----	-----
UTF8SMTP	UTF8SMTP with Service Extensions	[RFCxxxx]
UTF8SMTPA	UTF8SMTP with SMTP AUTH	[RFCxxxx]
UTF8SMTPS	UTF8SMTP with STARTTLS	[RFCxxxx]
UTF8SMTPSA	UTF8SMTP with both STARTTLS and SMTP AUTH	[RFCxxxx]

6. Security considerations

See the extended security considerations discussion in [[EAI-overview](#)]

7. Acknowledgements

Much of the text in the initial version of this document was derived or copied from [[Klensin-emailaddr](#)] with the permission of the author. Significant comments and suggestions were received from Xiaodong LEE, Nai-Wen Hsu, Yangwoo KO, Yoshiro YONEYA, and other members of the JET team and were incorporated into the document. Special thanks to those contributors for this version of document, those includes (but not limited to) John C Klensin, Charles Lindsey, Dave Crocker, Harald Tveit Alvestrand, Marcos Sanz, Chris Newman, Martin Duerst, Edmon Chung, Tony Finch, Kari Hurtta, Randall Gellens.

8. Change History

[[anchor21: REMOVE THIS: This section is used for tracking the update of this document. It may be useful to retain parts of it to facilitate establishing dates and documents for the history of this work.]]

8.1. [draft-ietf-eai-smtpext](#): Version 00

This version supercedes [draft-yao-ima-smtpext-03.txt](#). It refines the ABNF definiton of the internationalized email address. It represents as the EAI working group document.

8.2. [draft-ietf-eai-smtpext](#): Version 01

- o Upgraded to reflect discussions during IETF 66.
- o Remove the atomic parameter.
- o Add the new section of "the Suggestion of the value of the ALT-ADDRESS parameter".

8.3. [draft-ietf-eai-smtpext](#): Version 02

- o Upgraded to reflect the recent discussion of the ima@ietf.org mailing list.
- o Add the section of "Body Parts and SMTP Extensions".
- o Add the new section of "Change History".
- o Add the subsection about SMTP extensions for DSN.

8.4. [draft-ietf-eai-smtpext](#): Version 03

- o Update the syntax related to mailbox.
- o Update the trace field section.
- o Add the new section about message retry.
- o Update the subsection about SMTP extensions for DSN.

9. References

9.1. Normative References

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