

Email Address Internationalization J.  
Klensin  
(EAI)  
Internet-Draft Y.  
Ko  
Expires: November 25, 2006 MOCOCO,  
Inc. May 24,  
2006

**Overview and Framework for Internationalized Email  
draft-ietf-eai-framework-00.txt**

Status of this Memo

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Abstract

Full use of electronic mail throughout the world requires that people be able to use their own names, written correctly in their own languages and scripts, as mailbox names in email addresses. This document introduces a series of specifications and operational suggestions that define mechanisms and protocol extensions needed to fully support internationalized email addresses. These changes include an SMTP extension and extension of email header syntax to



accommodate UTF-8 data. The document set also will include discussion of key assumptions and issues in deploying fully internationalized email.

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## 1. Introduction

[[anchor1: NOTE IN DRAFT: The next version of this document (-01) will include references that are updated as appropriate to utilize the new names of documents and a list of documents that are harmonized with the WG Charter. This version is transitional and those reading it are asked to be tolerant of the transition.]]

In order to use internationalized email addresses, we need to internationalize both domain part and local part of email address. The domain part of email addresses is already internationalized [[RFC3490](#)], while the local part is not. Without these extensions, the mailbox name is restricted to a subset of 7-bit ASCII in [[RFC2821](#)]. Though MIME enables the transport of non-ASCII data, it does not provide a mechanism for internationalized email address. [[RFC2047](#)] defines an encoding mechanism for some specific message header fields to accommodate non-ASCII data. However, it does not address the issue of email addresses that include non-ASCII characters. Without the extensions defined here, or some equivalent set, the only way to incorporate non-ASCII characters in email addresses is to use [RFC2047](#) coding to embed them in what [RFC 2822](#) [[RFC2822](#)] calls the "display name" (known as a "name phrase" or by other terms elsewhere) of the relevant headers. Of course, that type of coding is invisible in the message envelope and would not be considered by many to be part of the address at all.

### 1.1. Role of This Specification

This document presents the overview and framework for an approach to the next stage of email internationalization. This new stage requires not only internationalization of addresses and headers, but also associated transport and delivery models. The history of developments and design ideas leading to this specification is described in [[I18Nemail-history](#)].

This document describes how the various elements of email internationalization fit together and provides a roadmap for navigating the various documents involved.

### 1.2. Problem statement

[[anchor2: Note in draft: this section needs very significant reworking for both content and presentation. Changed with -01c, but may still not be good enough]]

Though domain names are already internationalized, the internationalized forms are far from general adoption by ordinary users. One of the reasons for this is that we do not yet have fully



internationalized naming schemes. Domain names are just one of the various names and identifiers that are required to be internationalized.

Email addresses are a particularly important example of where internationalization of domain names alone is not sufficient.

Unless

email addresses are presented to the user in familiar characters and formats, the user's perception will not be of internationalization and behavior that is culturally friendly. One thing most of us have almost certainly learned from the experience with email usage is

that

users strongly prefer email addresses that closely resemble names or initials to those involving meaningless strings of letters or numbers. If the names or initials of the names in the email address can be expressed in the native languages and writing systems of the users, the Internet will be perceived as more natural by those whose native language is not written in a subset of a Roman-derived script (this is the same collection of characters known as "Latin" in Unicode Consortium and ISO/IEC JTC1 publications. In much of the linguistic literature, the term "Latin Script" is used exclusively for the characters used to write the Latin language at the time of the Roman Republic, so its use for all characters constructed from that base has been a source of confusion.).

Internationalization of email addresses is not merely a matter of changing the SMTP envelope, or of modifying the From, To, and Cc headers, or of permitting upgraded mail user agents (MUAs) to decode a special coding and display local characters. To be perceived as usable by end users, the addresses must be internationalized, and handled consistently, in all of the contexts in which they occur. That requirement has far-reaching implications: collections of patches and workarounds are not adequate. Even if they were adequate, that approach risks an assortment of implementations with different sets of patches and workarounds having been applied with consequent user confusion about what is actually be run and supported. Instead, we need to build a fully internationalized

email

environment, focusing on permitting efficient communication among those who share a language or other community (see [I18Nemail-constraints] for an extended discussion of this optimization).

That,

in turn, implies changes to the mail header environment to permit the

full range of Unicode characters where that makes sense, an SMTP extension to permit UTF-8 [[RFC3629](#)] mail addressing and delivery of those extended headers, and (finally) a requirement for support of the 8BITMIME option so that all of this can be transported through the mail system without having to overcome the limitation that headers do not have content-transfer-encodings.

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### **1.3. Terminology**

This document assumes a reasonable understanding of the protocols and terminology of the core email standards as documented in [[RFC2821](#)] and [[RFC2822](#)].

Much of the description in this document depends on the abstractions of "Mail Transfer Agent" ("MTA") and "Mail User Agent" ("MUA"). However, it is important to understand that those terms and the underlying concepts postdate the design of the Internet's email architecture and the "protocols on the wire" principle. That email architecture, as it has evolved, and the "wire" principle have prevented any strong and standardized distinctions about how MTAs and

MUAs interact on a given origin or destination host (or even whether they are separate).

In this document, an address is "all-ASCII" if every character in the address is in the ASCII character repertoire [[ASCII](#)]; an address is "non-ASCII" if any character is not in the ASCII character repertoire. The term "all-ASCII" is also applied to other protocol elements when the distinction is important, with "non-ASCII" or "internationalized" as its opposite.

The term "internationalized email address", or "EAI", refers to an address permitted by this specification. [[anchor4: Note in Draft/Placeholder: it appears that the terms "EAI" and the earlier "IMA" are not used in a precise and consistent way across the document set.

It is sometimes used to refer simply to a "non-ASCII" address; sometimes to an address that contains non-ASCII characters, even if that address is encoded into ASCII characters (i.e., as an ACE); and sometimes as an address that may contain non-ASCII characters but may

also be a traditional address. The definition needs to be clarified in an upcoming draft and all uses of the term brought into line with the definition.]]

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

## **2. Overview of the Approach**

This set of specifications changes both SMTP and the format of email headers to permit non-ASCII characters to be represented directly. Each important component of the work is described in a separate document. The document set, whose members are described in the next section, also contains informational documents whose purpose is to

provide operational and implementation suggestions and guidance for

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the protocols.

### **3. Document Roadmap**

In addition to this document, the following documents make up this specification and provide advice and context for it.

- o SMTP extensions. This document provides an SMTP extension for internationalized addresses, as provided for in [RFC 2821](#) [[I18Nemail-SMTPext](#)].
- o Email headers in UTF-8. This document essentially updates [RFC 2822](#) to permit some information in email headers to be expressed directly by Unicode characters encoded in UTF-8 when the SMTP extension is used [[I18Nemail-UTF8](#)].
- o In-transit downgrading from internationalized addressing with the SMTP extension and UTF-8 headers to traditional email formats and characters [[I18Nemail-downgrade](#)]. Downgrading either at the point of message origination or after the mail has successfully been received by a final delivery SMTP server (sometimes called an "MDA") involve different constraints and possibilities; see [Section 4.3](#) and [Section 5](#), below.
- o Extensions to the IMAP and POP protocols to support internationalized headers [[I18Nemail-imap](#)] and [[I18Nemail-pop](#)].
- o Operational guidelines and suggestions for the deployment of internationalized email [[I18Nemail-ops](#)].
- o Special considerations for mailing lists and similar distributions during the transition to internationalized email [[I18Nemail-Exploder](#)].
- o Design decisions, history, and alternative models for internationalized Internet email [[I18Nemail-history](#)].

## **4. Overview of Protocol Extensions and Changes**

### **4.1. SMTP Extension for Internationalized eMail Address**

An SMTP extension, "Email18N" [[anchor8: Extension name should be corrected when we make a final decision and synchronized with the "I18Nemail-SMTPext" document]] is specified that

- o Permits the use of UTF-8 strings in email addresses, both local parts and domain names
- o Permits the selective use of UTF-8 strings in email headers (see the next subsection)
- o Requires that the server advertise the 8BITMIME extension [[RFC1652](#)] and that the client support 8-bit transmission so that header information can be transmitted without using a special content-transfer-encoding.



- o Provides information to support downgrading mechanisms.

Some general principles apply to this work.

1. Whatever encoding is used should apply to the whole address and be directly compatible with software used at the user interface.
2. An SMTP relay must
  - \* Either recognize the format explicitly, agreeing to do so via an ESMTP option,
  - \* Select and use an ASCII-only address, or
  - \* Bounce the message so that the sender can make another plan.

If the message cannot be forwarded because the next-hop system cannot accept the extension and insufficient information is available to reliably downgrade it, it MUST be bounced.

3. In the interest of interoperability, charsets other than UTF-8 are prohibited. There is no practical way to identify them properly with an extension similar to this without introducing great complexity.

Conformance to the group of standards specified here for email transport and delivery requires implementation of the SMTP Extension specification, including recognition of the keywords associated with alternate and synthesized addresses, and the UTF-8 Header specification. Support for downgrading is not required, but, if implemented, MUST be implemented as specified.

#### **4.2. Transmission of Email Header in UTF-8 Encoding**

There are many places in MUAs or in user presentation in which email addresses or domain names appear. Examples include the conventional From, To, or Cc header fields; Message-IDs; In-Reply-To fields that may contain addresses or domain names; in message bodies; or elsewhere. We must examine all of them from an internationalization perspective. The user will expect to see mailbox and domain names

in local characters, and to see them consistently. If non-obvious encodings, such as protocol-specific ACE variants, are used, the user will inevitably see them, at least occasionally, rather than "native"

characters and will find that discomfiting or astonishing. Similarly, if different codings are used for mail transport and message bodies, the user is particularly likely to be surprised, if only as a consequence of the long-established "things leak" principle. But the only practical way to avoid these sources of discomfort, in both the medium and the longer term, is to have the encodings used in transport be as nearly as possible the same as the encodings used in message headers and message bodies.

It seems clear that the point at which email local parts are internationalized is the point that email headers should simply be

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shifted to a full internationalized form, presumably using UTF-8 rather than ASCII as the base character set for other than protocol elements such as the header field names themselves. The transition to that model includes support for address, and address-related, fields within the headers of legacy systems. This is done by extending the encoding models of [\[RFC2045\]](#) and [\[RFC2231\]](#). However, our target should be fully internationalized headers, as discussed [\[I18Nemail-UTF8\]](#).

### **4.3. Downgrading Mechanism for Backward Compatibility**

As with any use of the SMTP extension mechanism, there is always a possibility of a client that requires the feature encountering a server that does not. In the case of email address and header internationalization, the risk should be minimized by the fact that the selection of submission servers are presumably under the control of the sender's client and the selection of potential intermediate relays is under the control of the administration of the final delivery server.

For those situations, there are basically two possibilities:

- o Reject or bounce the message, requiring the sender to resubmit it with traditional-format addresses and headers.
- o Figure out a way to downgrade the envelope or message body in transit. Especially when internationalized addresses are involved, downgrading will require either that an all-ASCII address be obtained from some source or computed. An optional extension parameter is provided as a way of transmitting an alternate address. Computing an all-ASCII form of a non-ASCII address requires that the sender have some knowledge. This knowledge is normally restricted to final delivery servers, but some extensions may be feasible there too. Downgrade issues and

a specification are discussed in [\[I18Nemail-downgrade\]](#).

The first of these two options, that of rejecting or returning the message to the sender MAY always be chosen.

There is also a third case, one in which the client is I18Nemail-capable, the server is not, but the message does not require the extended capabilities. In other words, both the addresses in the envelope and the entire set of headers of the message are entirely

in

ASCII (perhaps including encoded-words in the headers). In that case, the client SHOULD send the message whether or not the server announces the capability specified here.

## **5. Downgrading Before and After SMTP Transactions**





In addition to the in-transit downgrades discussed above,  
downgrading

may also occur before or during initial message submission or after delivery to the final delivery MTA. Because these cases have a different set of available information from in-transit cases, the constraints and opportunities may be somewhat different too. These two cases are discussed in the subsections below.

### **5.1. Downgrading Before or During Message Submission**

Perhaps obviously, the most convenient time to convert an address or message from internationalized to conventional ASCII form is at the originating MUA, either before the message is sent or after the internationalized form of the message is rejected or bounced by some MTA in the path to the presumed destination. At that point, the user

has a full range of choices available, including contacting the intended recipient out of band for an alternate address, consulting appropriate directories, arranging for translation of both addresses and message content into a different language, and so on. While it is natural to think of message downgrading as optimally being a fully-automated process, we should not underestimate the capabilities

of a user of at least moderate intelligence who wishes to communicate with another such user.

In this context, one can easily imagine modifications to message submission servers (as described in [RFC 4409](#) [[RFC4409](#)]) so that they would perform downgrading, or perhaps even upgrading, operations, receiving messages with one or more of the internationalization extensions discussed here and adapting the outgoing message, as needed, to respond to the delivery or next-hop environment it encounters.

### **5.2. Downgrading or Other Processing After Final SMTP Delivery**

When an email message is received by a final delivery SMTP server,  
it

is usually stored in some form. Then it is retrieved by client software via some email retrieval mechanisms such as POP, IMAP or others.

The SMTP extension described in [Section 4.1](#) provides protection only in transport. It does not prevent MUAs and email retrieval mechanisms that have not been upgraded to understand internationalized addresses and UTF-8 headers from accessing stored internationalized emails.

Since the final delivery SMTP server (to be more specific, its corresponding mail storage agent) cannot safely assume that agents accessing email storage will be always be capable of handling the

extensions proposed here, it MAY either downgrade internationalized

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emails or specially identify messages that utilize these extensions, or both. If this is the case, the final delivery SMTP server MUST include a mechanism to preserve the original internationalized forms without information loss to support access by I18Nemail-aware agents.

The method and format for downgrading at the final delivery SMTP server is [\[\[anchor10: will be\]\]](#) discussed in [\[I18Nemail-pop\]](#) and [\[I18Nemail-imap\]](#).

[\[\[anchor11: Note in draft: There are at least four cases. Both MUA and IMAP/POP are compliant. Both are non compliant. And only of them is compliant. Do we need to invent different methods for each case?\]\]](#)

## **6. Advice to Designers and Operators of Mail-receiving Systems**

[\[\[anchor13: Note in draft: The material that follows contains some forward-looking, predictive, statements about discussions to occur and documents to be written. Be sure they are true before Last Call.\]\]](#)

In addition to the protocol specification materials in this set of documents, the working group has had extensive discussions about operational considerations in the use of internationalized addresses.

Those topics include how such addresses should be chosen, how they should relate to ASCII alternatives if such alternatives exist, the management of mailing lists that might support and contain a mixture of all-ASCII and non-ASCII addresses, and so on. Those issues are discussed in [\[I18Nemail-ops\]](#) and [\[I18Nemail-Exploder\]](#).

## **7. Internationalization Considerations**

This entire specification addresses issues in internationalization and especially the boundaries between internationalization and localization and between network protocols and client/user interface actions.

## **8. Additional Issues**

This section identifies issues that are not covered as part of this set of specifications, but that will need to be considered as part of deployment of email address and header internationalization.



### **8.1. Impact on IRIs**

The mailto: schema defined in [[RFC2368](#)] and discussed in IRI [[RFC3987](#)] may need to be modified when this work is completed and standardized.

### **8.2. POP and IMAP**

While SMTP takes care of the transportation of messages, IMAP [[RFC3501](#)] and POP3 [[RFC1939](#)] are among mechanisms used to handle the retrieval of mail objects from a mail store by a client. The use of internationalized mail addresses or UTF-8 headers will require extensions to POP and IMAP and/or modifications to the design and implementation of mail stores and the mechanisms that final delivery SMTP servers use to put mail into them. However, those mechanisms are separate from those associated with transport across the network and are discussed only minimally in this series of documents. The general issues, and proposed required modifications to the protocols,

are [[anchor18: will be]] covered in [[I18Nemail-pop](#)] and [[I18Nemail-imap](#)]. Some preliminary discussion appears in in [Section 5.2](#). Implementation of internationalized POP and IMAP support is, of course, not required for implementation of the transport and in-transit header extensions specified in other documents or this set (or vica versa).

## **9. IANA Considerations**

This overview description and framework document does not contemplate

any IANA registrations or other actions. Some of the documents in the group have their own IANA considerations sections and requirements.

## **10. Security Considerations**

Any expansion of permitted characters and encoding forms in email addresses raises some risks. There have been discussions on so called "IDN-spoofing" or "IDN homograph attacks". These attacks allow an attacker (or "phisher") to spoof the domain or URLs of businesses. The same kind of attack is also possible on the local part of internationalized email addresses. It should be noted that one of the proposed fixes for, e.g., URLs, does not work for email local parts since they are case-sensitive. That fix involves forcing

all elements that are displayed to be in lower-case and normalized.

Since email addresses are often transcribed from business cards and notes on paper, they are subject to problems arising from confusable

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characters. These problems are somewhat reduced if the domain associated with the mailbox is unambiguous and supports a relatively small number of mailboxes whose names follow local system conventions; they are increased with very large mail systems in which users can freely select their own addresses.

The internationalization of email addresses and headers must not leave the Internet less secure than it is that without the required extensions. The requirements and mechanisms documented in this set of specifications do not, in general, raise any new security issues. They do require a review of issues associated with confusable characters -- a topic that is being explored thoroughly elsewhere [[IDN-nextsteps](#)] -- and, potentially, some issues with UTF-8 canonicalization, discussed in [[RFC3629](#)]. The latter is also part of

the subject of ongoing work discussed in [[Net-Unicode](#)]. Specific issues are discussed in more detail in the other documents in this set. However, in particular, caution should be taken that any "downgrading" mechanism, or use of downgraded addresses, does not inappropriately assume authenticated bindings between the internationalized and ASCII addresses.

In addition, email addresses are used in many contexts other than sending mail, such as for identifiers under various circumstances. Each of those contexts will need to be evaluated, in turn, to determine whether the use of non-ASCII forms is appropriate and what particular issues they raise.

## **11. Acknowledgements**

This document, and the related ones, were originally derived from drafts by John Klensin and the JET group [[Klensin-emailaddr](#)], [JET-IMA]. The work drew inspiration from discussions on the "IMAA" mailing list, sponsored by the Internet Mail Consortium and especially from an early draft by Paul Hoffman and Adam Costello [[Hoffman-IMAA](#)] that attempted to define an MUA-only solution to the address internationalization problem. [[anchor21: Note in draft: may want to move some of this to "history" or reference it]]

## **12. Change History**

[[anchor23: This section to be restructured prior to publication. It may be useful to retain parts of it to facilitate establishing dates and documents for the history of this work.]]

This document has evolved through several titles as well as the usual version numbers. The list below tries to trace that thread as well

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as changes within the substance of the document. The first document of the series was posted as [draft-klensin-emailaddr-i18n-00.txt](#) in October 2003.

### **12.1. draft-klensin-ima-framework: Version 00**

This version supercedes [draft-lee-jet-ima-00](#) and [draft-klensin-emailaddr-i18n-03](#). It represents a major rewrite and change of architecture from the former and incorporates many ideas and some text from the latter.

### **12.2. draft-klensin-ima-framework: Version 01**

- o Some clarifications of terminology (more to follow) and general editorial improvements.
- o Upgrades to reflect discussions during IETF 64.
- o Improved treatment of downgrading before and after message transport.

### **12.3. draft-ietf-eai-framework: Version 00**

This version supercedes [draft-klensin-ima-framework-01](#); its file name should represent the form to be used until the IETF email address and header internationalization ("EAI") work concludes.

- o Changed "display name" terminology to be consistent with [RFC 2822](#).  
Also clarified some other terminology issues.
- o Added a comment about the possible role of MessageSubmission servers in downgrading.
- o Removed the "IMA" terminology, converting it to either "EAI" or prose.
- o Per meeting and mailing list discussion, added conformance statements about bouncing if neither forwarding nor downgrading were possible and about implementation requirements.
- o Updated several references. Some documents are still tentative.
- o Fixed many typographical errors.

## **13. References**

### **13.1. Normative References**

[ASCII] American National Standards Institute (formerly United States of America Standards Institute), "USA Code for Information Interchange", ANSI X3.4-1968, 1968.

ANSI X3.4-1968 has been replaced by newer versions with slight modifications, but the 1968 version remains

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definitive for the Internet.

[I18Nemail-Exploder]  
"Placeholder: whatever we call the mailing list  
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This document is expected to be developed by the WG. The date given here is purely arbitrary.

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[RFC3490] Faltstrom, P., Hoffman, P., and A. Costello,



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[RFC3629] Yergeau, F., "UTF-8, a transformation format of ISO  
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### **13.2. Informative References**

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[I18Nemail-imap]

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[I18Nemail-ops]

"Placeholder: whatever we call the operations document",  
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## Acknowledgment

Funding for the RFC Editor function is currently provided by the

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