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Post-delivery Message Downgrading for Internationalized Email Messages
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Abstract

The Email Address Internationalization (SMTPUTF8) extension to SMTP allows UTF-8 characters in mail header fields. Upgraded POP and IMAP servers support internationalized Email messages. If a POP/IMAP client does not support Email Address Internationalization, POP/IMAP servers cannot deliver Internationalized Email Headers to the client and cannot remove the message. To avoid the situation, this document describes a conversion mechanism for internationalized Email messages to be in traditional message format. In the process, message elements requiring internationalized treatment are recoded or removed and receivers are able to know that they received messages containing such elements even if they cannot process the internationalized elements.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on April 25, 2013.

Table of Contents

1. Introduction

1.1. Problem statement

Traditional (legacy) mail systems, which are defined by [RFC5322] and other specifications, allow only ASCII characters in mail header field values. The SMTPUTF8 extension ([RFC6530], [RFC6531] and [RFC6532]) allow raw UTF-8 in those mail header fields.

If a header field contains non-ASCII strings, POP/IMAP servers cannot deliver Internationalized Email Headers to legacy clients which does not send UTF8 command or UTF8 capability, and because they have no obvious or standardized way to explain what is going on to those clients, cannot even safely discard the message.

1.2. Possible solutions

There are four plausible approaches to the problem, with the preferred one depending on the particular circumstances and relationship among the delivery SMTP server, the mail store, the POP or IMAP server, and the users and their MUA clients:

1. If the delivery MTA has sufficient knowledge about the POP and/or IMAP servers and clients being used, the message may be rejected as undeliverable.

2. The message may be downgraded by the POP or IMAP server, in a way that preserves maximum information at the expense of some complexity, and does not create security or operational problems in the mail system.

3. Some intermediate downgrading may be applied that balances more information loss against lower complexity and greater ease of implementation.

4. The POP or IMAP server may fabricate a message whose intent is to notify the client that an internationalized message is waiting but cannot be delivered until an upgraded client is available.

1.3. Approach taken in this specification

This specification describes the second of those options. It is worth noticing that, at least in the general case, none of these options preserve sufficient information to guarantee that it is possible to reply to an incoming message without loss of information, so the choice may be considered to be among "least bad" options. While this document specifies a well designed mechanism, it is only an interim solution while clients are being upgraded

[I-D.ietf-eai-rfc5721bis] [I-D.ietf-eai-5738bis].

This message downgrading mechanism converts mail header fields to an all-ASCII representation. The POP/IMAP servers can use the downgrading mechanism and deliver the Internationalized Email message as a traditional form. Receivers can know they received some internationalized messages or some unknown or broken messages.

[RFC6532] allows UTF-8 characters to be used in mail header fields and MIME header fields. [RFC6531] allows UTF-8 characters to be used in some trace header fields. The message downgrading mechanism specified here describes the conversion method from the internationalized messages that are defined in [RFC6530], and [RFC6532] to the traditional email messages defined in [RFC5322].

This document provides a precise definition of the minimum-information-loss message downgrading process.

Downgrading consists of the following three parts:

- New header field definitions
- Email header field downgrading
- MIME header field downgrading

Email header field downgrading is described in Section 3. It generates ASCII-only header fields.

In Section 3.1.10 of this document, header fields starting with "Downgraded-" are introduced. They preserve the information that appeared in the original header fields.

The definition of MIME header fields in Internationalized Email Messages is described in [RFC6532]. MIME header field downgrading is described in Section 4.1. It generates ASCII-only MIME header fields.

Displaying downgraded messages that originally contained internationalized header fields is out of scope of this document. A POP/IMAP client which does not support UTF8 extensions as defined for POP3 [UTF8 command] and IMAP ["ENABLE UTF8=ACCEPT" command] does not know internationalized message format described in [RFC6532].

2. Terminology

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 RFC 2119 [RFC2119].

All specialized terms used in this specification are defined in the Overview and Framework for Internationalized Email [RFC6530], in the mail message specifications [RFC5322], or in the MIME documents [RFC2045] [RFC2047] [RFC2183] [RFC2231]. The terms "U-label", "A-label" and "IDNA" are used with the definitions from [RFC5890]. The terms "ASCII address", "non-ASCII address", "SMTPUTF8", "message", "internationalized message" are used with the definitions from [RFC6530]. The term "non-ASCII string" is used with the definitions from [RFC6532].

3. Email Header Fields Downgrading

This section defines the conversion method to ASCII for each header field that may contain non-ASCII strings. Section 3.1 describes rewriting methods for each ABNF element. Section 3.2 describes rewriting methods for each header field.

3.1. Downgrading Method for Each ABNF Element

Header field downgrading is defined below for each ABNF element. Converting the header field terminates when no non-ASCII strings remain in the header field.

[RFC5322] describes ABNF elements <group>, <mailbox>, <unstructured>, <word>, <comment>, <display-name>. [RFC2045] describes ABNF element <value>. <domain> is updated to allow non-ASCII characters in Section 3.3 of [RFC6531] and Section 3.2 of [RFC6532].

3.1.1. UNSTRUCTURED Downgrading

If the header field has an <unstructured> field that contains non-ASCII strings, apply [RFC2047] encoding with charset UTF-8.

3.1.2. WORD Downgrading

If the header field has any <word> fields that contain non-ASCII strings, apply [RFC2047] encoding with charset UTF-8.

3.1.3. COMMENT Downgrading

If the header field has any <comment> fields that contain non-ASCII strings, apply [RFC2047] encoding with charset UTF-8.

3.1.4. MIME-VALUE Downgrading

If the header field has any <value> elements defined by [RFC2045] and the elements contain non-ASCII strings, encode the <value> elements according to [RFC2231] with charset UTF-8 and leave the language information empty. If the <value> element is <quoted-string> and it contains <CFWS> outside the DQUOTE, remove the <CFWS> before this conversion.

3.1.5. DISPLAY-NAME Downgrading

If the header field has any <address> (<mailbox> or <group>) elements and they have <display-name> elements that contain non-ASCII strings, encode the <display-name> elements according to [RFC2047] with charset UTF-8. DISPLAY-NAME downgrading is the same algorithm as WORD downgrading.

3.1.6. DOMAIN Downgrading

If the header field has any <domain> elements that contain U-labels, rewrite the non-ASCII domain name into ASCII domain name using A-labels as specified in IDNA [RFC5891].

3.1.7. GROUP Downgrading

<group> is defined in Section 3.4 of [RFC5322]. The <group> elements may contain <mailbox>es which contain non-ASCII addresses.

If a <group> element contains <mailbox> elements and one of <mailbox>es contains a non-ASCII <local-part>, rewrite the <group> element as

```
display-name " " ENCODED_WORD " :;"
```

where the <ENCODED_WORD> is the original <group-list> encoded according to [RFC2047].

Otherwise, the <group> element does not contain non-ASCII <local-part>. If the <group> element contain non-ASCII <mailbox>es, they contains non-ASCII domain names. Rewrite the non-ASCII domain names into ASCII domain names using A-labels as specified in IDNA [RFC5891]. Generated <mailbox>es contain ASCII addresses only.

3.1.8. MAILBOX Downgrading

If the <local-part> of the <mailbox> element does not contain non-ASCII characters, the <domain> element contains non-ASCII characters. Rewrite the non-ASCII domain name into ASCII domain name using A-labels as specified in IDNA [RFC5891].

Otherwise, the <local-part> contains non-ASCII characters. The non-ASCII <local-part> has no equivalent format for ASCII addresses. The <addr-spec> element that contains non-ASCII strings may appear in two forms as:

"<" addr-spec ">"
addr-spec

Rewrite both as:

ENCODED-WORD " :;"

where the <ENCODED-WORD> is the original <addr-spec> encoded according to [RFC2047].

3.1.9. TYPED-ADDRESS Downgrading

If the header field contains <utf-8-type-addr> and the <utf-8-type-addr> contains raw non-ASCII strings, it is in utf-8-address form. Convert it to utf-8-addr-xtext form. Those forms are described in [RFC6533]. COMMENT downgrading is also performed in this case. If the address type is unrecognized and the header field contains non-ASCII strings, then fall back to using ENCAPSULATION on the entire header field specified in Section 3.1.10.

3.1.10. ENCAPSULATION: A Last Resort

As a last resort when header fields cannot be converted as discussed in the previous section, the fields are deleted and replaced by specialized new header fields. Those fields are defined to preserve, in encoded form, as much information as possible from the header field values of the incoming message. The syntax of these new header fields is:

```
fields                    =/ downgraded

downgraded =  "Downgraded-Message-Id:"         unstructured CRLF /
              "Downgraded-Resent-Message-Id:"  unstructured CRLF /
              "Downgraded-In-Reply-To:"        unstructured CRLF /
              "Downgraded-References:"         unstructured CRLF /
              "Downgraded-Original-Recipient:" unstructured CRLF /
              "Downgraded-Final-Recipient:"    unstructured CRLF
```

Applying this procedure to "Received:" header field is prohibited. ENCAPSULATION Downgrading is allowed for "Message-ID", "In-Reply-To:", "References:", "Original-Recipient" and "Final-Recipient" header fields.

To preserve a header field in a "Downgraded-" header field:

1. Generate a new header field.

    * The field name is a concatenation of "Downgraded-" and the original field name.

    * The initial new field value is the original header field value.

2. Treat the initial new header field value as if it were unstructured, and then apply [RFC2047] encoding with charset UTF-8 as necessary so that the resulting new header field value is completely in ASCII.

3. Remove the original header field.

3.2. Downgrading Method for Each Header Field

[RFC4021] establishes a registry of header fields. This section describes the downgrading method for each header field.

If the whole mail header field does not contain non-ASCII strings, email header field downgrading is not required. Each header field's downgrading method is described below.

3.2.1. Address Header Fields That Contain <address>s

From:
Sender:
To:
Cc:
Bcc:
Reply-To:
Resent-From:
Resent-Sender:
Resent-To:
Resent-Cc:
Resent-Bcc:
Resent-Reply-To:
Return-Path:
Disposition-Notification-To:

If the header field contains non-ASCII characters, first perform COMMENT downgrading and DISPLAY-NAME downgrading as described in the corresponding subsections of Section 3.1. If the header field still contains non-ASCII characters after that, do the following two steps:

1. If the header field contains <group> elements that contain non-ASCII addresses, perform GROUP downgrading on those elements.

2. If the header field contains <mailbox> elements that contain non-ASCII addresses, perform MAILBOX downgrading on those elements.

This procedure may generate empty <group> elements in "From:", "Sender:" and "Reply-To:" header fields.
[I-D.leiba-5322upd-from-group] updates [RFC5322] to allow (empty) <group> elements in "From:", "Sender:" and "Reply-To:" header fields.

3.2.2. Downgrading Non-ASCII in Comments

Date:
Resent-Date:
MIME-Version:
Content-ID:
Content-Transfer-Encoding:
Content-Language:
Accept-Language:
Auto-Submitted:

These header fields do not contain non-ASCII strings except in comments. If the header field contains UTF-8 characters in comments, perform COMMENT downgrading.

3.2.3. Message-ID Header Fields

Message-ID:
Resent-Message-ID:
In-Reply-To:
References:

Perform ENCAPSULATION as specified in Section 3.1.10.

3.2.4. Received Header Field

Received:

If <domain> elements or <mailbox> elements contains U-labels, perform DOMAIN downgrading specified in Section 3.1.6. Comments may contain non-ASCII strings, perform COMMENT downgrading.

After the DOMAIN downgrading and the COMMENT downgrading, if the FOR clause contains a non-ASCII <local-part>, remove the "FOR" clause. If the ID clause contains a non-ASCII values, remove the "ID" clause.

3.2.5. MIME Content Header Fields

Content-Type:
Content-Disposition:

Perform MIME-VALUE downgrading and COMMENT downgrading.

3.2.6. Non-ASCII in <unstructured>

Subject:
Comments:
Content-Description:

Perform UNSTRUCTURED downgrading.

3.2.7. Non-ASCII in <phrase>

Keywords:

Perform WORD downgrading.

3.2.8. Other Header Fields

There are other header fields that contain non-ASCII strings. They are user-defined and missing from this document, or future defined header fields. They are treated as "Optional Fields" and their field values are treated as unstructured described in Section 3.6.8 of [RFC5322].

Perform UNSTRUCTURED downgrading.

If the software understands the header field's structure and a downgrading algorithm other than UNSTRUCTURED is applicable, that software SHOULD use that algorithm; UNSTRUCTURED downgrading is used as a last resort.

Mailing list header fields (those that start in "List-") are part of this category.

4. MIME Downgrading

Both MIME Body-Part header fields and contents of a delivery status notification may contain non-ASCII characters.

4.1. MIME Body-Part Header Field Downgrading

MIME body-part header fields may contain non-ASCII strings [RFC6532]. This section defines the conversion method to ASCII-only header fields for each MIME header field that contains non-ASCII strings. Parse the message body's MIME structure at all levels and check each MIME header field to see whether it contains non-ASCII strings. If the header field contains non-ASCII strings in the header field value, the header field is a target of the MIME body-part header field's downgrading. Each MIME header field's downgrading method is described below. COMMENT downgrading, MIME-VALUE downgrading, and UNSTRUCTURED downgrading are described in Section 3.

Content-ID:
   The "Content-ID:" header field does not contain non-ASCII strings except in comments. If the header field contains UTF-8 characters in comments, perform COMMENT downgrading.

Content-Type:
Content-Disposition:
   Perform MIME-VALUE downgrading and COMMENT downgrading.

Content-Description:
   Perform UNSTRUCTURED downgrading.

4.2. Delivery Status Notification downgrading

If the message contains a delivery status notification defined at Section 6 of [RFC3461], perform the following tests and conversions.

If there are "Original-Recipient:" and "Final-Recipient:" header fields, and the header fields contain non-ASCII strings, perform TYPED-ADDRESS downgrading.

5. Security Considerations

The purpose of post-delivery message downgrading is to allow POP/IMAP servers to deliver internationalized messages to traditional POP/IMAP clients and permit the clients to display those messages. Users who receive such messages can know that they were internationalized. It does not permit receivers to read the messages in their original form and, in general, will not permit generating replies, at least without significant user intervention.

A downgraded message's header fields contain ASCII characters only. But they still contain MIME-encapsulated header fields that contain non-ASCII strings. Furthermore, the body part may contain UTF-8 characters. Implementations parsing Internet messages need to accept

UTF-8 body parts and UTF-8 header fields that are MIME-encoded. Thus, this document inherits the security considerations of MIME-encoded header fields ([RFC2047] and [RFC3629]).

Rewriting header fields increases the opportunities for undetected spoofing by malicious senders. However, the rewritten header field values are preserved in equivalent MIME form or in newly defined header fields for which traditional MUAs have no special processing procedures.

The techniques described here invalidate methods that depend on digital signatures over any part of the message, which includes the top-level header fields and body-part header fields. Depending on the specific message being downgraded, at least the following techniques are likely to break: DomainKeys Identified Mail (DKIM), and possibly S/MIME and Pretty Good Privacy (PGP). The downgrade mechanism SHOULD NOT remove signatures even if the signatures will fail validation after downgrading. As much of the information as possible from the original message SHOULD be preserved.

While information in any email header field should usually be treated with some suspicion, current email systems commonly employ various mechanisms and protocols to make the information more trustworthy. Information in the new Downgraded-* header fields is not inspected by traditional MUAs, and may be even less trustworthy than the traditional header fields. Note that the Downgraded-* header fields could have been inserted with malicious intent (and with content unrelated to the traditional header fields), however traditional MUAs do not parse Downgraded-* header fields.

In addition, if an Authentication-Results header field [RFC5451] is present, traditional MUAs may treat that the digital signatures are valid.

See the "Security Considerations" section in [I-D.leiba-5322upd-from-group] and [RFC6530] for more discussion.

6. Implementation Notes

6.1. RFC 2047 Encoding

While [RFC2047] has a specific algorithm to deal with whitespace in adjacent encoded words, there are a number of deployed implementations that fail to implement the algorithm correctly. As a result, whitespace behavior is somewhat unpredictable in practice when multiple encoded words are used. While RFC 5322 states that implementations SHOULD limit lines to not more than 78 characters, implementations MAY choose to allow overly long encoded words in

order to work around faulty [RFC2047] implementations. Implementations that choose to do so SHOULD have an optional mechanism to limit line length to 78 characters.

7. IANA Considerations

[[RFC Editor: Please change "is asked to" to "has" (and change the verb correspondingly) when the IESG approval and IANA actions are complete.]]

[RFC5504] specified that no new header fields be registered that begin with "Downgraded-". That restriction is now lifted, and this document makes a new set of registrations, replacing the experimental fields with standard ones.

7.1. Obsolescence of Existing Downgraded-* Header Fields

The "Downgraded-*" header fields that were registered as experimental fields in [RFC5504] are no longer in use. IANA is asked to change the status from "experimental" to "obsoleted" for every name in the Permanent Message Header Field registry that begins with "Downgraded-".

7.2. Registration of New Downgraded-* Header Fields

[[RFC Editor: Please change "should be" to "have been" when the IANA actions are complete.]]

The following header fields should be registered in the Permanent Message Header Field registry, in accordance with the procedures set out in [RFC3864].

Header field name: Downgraded-Message-Id
Applicable protocol: mail
Status: standard
Author/change controller: IETF
Specification document(s): This document (Section 3.1.10)

Header field name: Downgraded-In-Reply-To
Applicable protocol: mail
Status: standard
Author/change controller: IETF
Specification document(s): This document (Section 3.1.10)

Header field name: Downgraded-References
Applicable protocol: mail
Status: standard
Author/change controller: IETF
Specification document(s): This document (Section 3.1.10)

Header field name: Downgraded-Original-Recipient
Applicable protocol: mail
Status: standard
Author/change controller: IETF
Specification document(s): This document (Section 3.1.10)

Header field name: Downgraded-Final-Recipient
Applicable protocol: mail
Status: standard
Author/change controller: IETF
Specification document(s): This document (Section 3.1.10)

8. Acknowledgements

This document draws heavily from the experimental in-transit message downgrading procedure described in RFC 5504 [RFC5504]. The contribution of the co-author of that earlier document, Y. Yoneya, are gratefully acknowledged. Significant comments and suggestions were received from John Klensin, Barry Leiba, Randall Gellens, Pete Resnick, Martin J. Durst, and other WG participants.

9. References

9.1. Normative References

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9.2. Informative References

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[RFC5504] Fujiwara, K. and Y. Yoneya, "Downgrading Mechanism for Email Address Internationalization", RFC 5504, March 2009.

Appendix A. Examples

A.1. Downgrading Example

This appendix shows an message downgrading example. Consider a received mail message where:

- The sender address is a non-ASCII address, "NON-ASCII-LOCAL@example.com". Its display-name is "DISPLAY-LOCAL".

- The "To:" header field contains two non-ASCII addresses, "NON-ASCII-REMOTE1@example.net" and "NON-ASCII-REMOTE2@example.com" Its display-names are "DISPLAY-REMOTE1" and "DISPLAY-REMOTE2".

- The "Cc:" header field contains a non-ASCII address, "NON-ASCII-REMOTE3@example.org". Its display-name is "DISPLAY-REMOTE3".

- Four display names contain non-ASCII characters.

- The Subject header field is "NON-ASCII-SUBJECT", which contains non-ASCII strings.

- The "Message-Id:" header field contains "NON-ASCII-MESSAGE_ID", which contains non-ASCII strings.

- There is an unknown header field "X-Unknown-Header" which contains non-ASCII strings.

```
Return-Path: <NON-ASCII-LOCAL@example.com>
Received: from ... by ... for <NON-ASCII-REMOTE1@example.net>
Received: from ... by ... for <NON-ASCII-REMOTE1@example.net>
From: DISPLAY-LOCAL <NON-ASCII-LOCAL@example.com>
To: DISPLAY-REMOTE1 <NON-ASCII-REMOTE1@example.net>,
    DISPLAY-REMOTE2 <NON-ASCII-REMOTE2@example.com>
Cc: DISPLAY-REMOTE3 <NON-ASCII-REMOTE3@example.org>
Subject: NON-ASCII-SUBJECT
Date: Mon, 30 Jul 2012 01:23:45 -0000
Message-Id: NON-ASCII-MESSAGE_ID
Mime-Version: 1.0
Content-Type: text/plain; charset="UTF-8"
Content-Transfer-Encoding: 8bit
X-Unknown-Header: NON-ASCII-CHARACTERS

MAIL_BODY
```

Figure 1: Received message in a mail drop

The downgraded message is shown in Figure 2. "Return-Path:", "From:", "To:" and "Cc:" header fields are rewritten. "Subject:" and "X-Unknown-Header:" header fields are encoded using [RFC2047]. "Message-Id:" header field is encapsulated as "Downgraded-Message-Id:" header field.

```
Return-Path: =?UTF-8?Q?NON-ASCII-LOCAL@example.com?= :;
Received: from ... by ...
Received: from ... by ...
From: =?UTF-8?Q?DISPLAY-LOCAL?=
      =?UTF-8?Q?NON-ASCII-LOCAL@example.com?= :;
To:   =?UTF-8?Q?DISPLAY-REMOTE1?=
      =?UTF-8?Q?NON-ASCII-REMOTE1@example.net?= :;,
      =?UTF-8?Q?DISPLAY-REMOTE2?=
      =?UTF-8?Q?NON-ASCII-REMOTE2@example.com?= :;,
Cc:   =?UTF-8?Q?DISPLAY-REMOTE3?=
      =?UTF-8?Q?NON-ASCII-REMOTE3@example.org?= :;
Subject: =?UTF-8?Q?NON-ASCII-SUBJECT?=
Date: Mon, 30 Jul 2012 01:23:45 -0000
Downgraded-Message-Id: =?UTF-8?Q?MESSAGE_ID?=
Mime-Version: 1.0
Content-Type: text/plain; charset="UTF-8"
Content-Transfer-Encoding: 8bit
X-Unknown-Header: =?UTF-8?Q?NON-ASCII-CHARACTERS?=

MAIL_BODY
```

Figure 2: Downgraded message

Appendix B. Change History

[[RFC Editor: Please remove this section prior to publication.]]

This section is used for tracking the update of this document. Will be removed after finalize.

B.1. Version 00

- Initial version
- Imported header field downgrading from RFC 5504

B.2. Version 01

- same as Version 00

B.3. Version 02

- Added updating RFC 5322 to allow <group> syntax in From: and Sender
- Added GROUP Downgrading

B.4. Version 03

- Replaced <utf8-addr-spec> with <addr-spec>
- Added updating RFC 5322 to allow <group> syntax in From: and Sender
- Added one sentence in Security considerations
- Updated IANA considerations

B.5. Version 04

- Removed "Internationalized Address removed" from GROUP and MAILBOX downgrading
- Updated "Updating RFC 5322"
- Compacted new header field definition
- Compacted security considerations
- Updated IANA considerations to remove obsoleting header fields that are registered by RFC 5504
- Added a discussion of alternate downgrading models for the POP and IMAP cases.
- Incorporated a large number of editorial changes to improve clarity.

B.6. Version 05

- Some text corrections
- Terminology change: only to use non-ASCII address, non-ASCII message, non-ASCII string and imported them from RFC 6530 and RFC 6532
- Replace "non-ASCII character" with "non-ASCII string"
- Removed 5.1.1. RECEIVED Downgrading

B.7. Version 06

- Removed "Updating RFC 5322"

- Added reference to draft-leiba-5322upd-from-group

B.8. Version 07

- Updated by WGLC comments
- Fixed Received downgrading and added to refer "RFC 6531", "RFC 5890", "RFC 5891"
- Added Domain downgrading for Received, Group and Mailbox
- Swapped section 3 and 4

B.9. Version 08

- Updated by IETF Last call and IESG comments
- Removed "Address Header Fields with Typed Addresses" and added "Delivery Status Notification downgrading" in MIME downgrading
- Added a space between display-name and ENCODED_WORD.
- Moved "ENCAPSULATION: A Last Resort" from section 4 to section 3.1.10.
- Updated address header fields downgrading
- Updated introduction, security considerations and iana considerations

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