

Internet Engineering Task Force (IETF)
Request for Comments: 8098
STD: 85
Obsoletes: 3798
Updates: 2046, 3461
Category: Standards Track
ISSN: 2070-1721

T. Hansen, Ed.
AT&T Laboratories
A. Melnikov, Ed.
Isode Ltd
February 2017

Message Disposition Notification

Abstract

This memo defines a MIME content type that may be used by a Mail User Agent (MUA) or electronic mail gateway to report the disposition of a message after it has been successfully delivered to a recipient. This content type is intended to be machine processable. Additional message header fields are also defined to permit Message Disposition Notifications (MDNs) to be requested by the sender of a message. The purpose is to extend Internet Mail to support functionality often found in other messaging systems, such as X.400 and the proprietary "LAN-based" systems, and are often referred to as "read receipts," "acknowledgements," or "receipt notifications." The intention is to do this while respecting privacy concerns, which have often been expressed when such functions have been discussed in the past.

Because many messages are sent between the Internet and other messaging systems (such as X.400 or the proprietary "LAN-based" systems), the MDN protocol is designed to be useful in a multiprotocol messaging environment. To this end, the protocol described in this memo provides for the carriage of "foreign" addresses, in addition to those normally used in Internet Mail. Additional attributes may also be defined to support "tunneling" of foreign notifications through Internet Mail.

This document is an Internet Standard. It obsoletes RFC 3798 and updates RFC 2046 (message/partial media type handling) and RFC 3461 (Original-Recipient header field generation requirement).

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at <http://www.rfc-editor.org/info/rfc8098>.

Copyright Notice

Copyright (c) 2017 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	4
1.1.	Purposes	4
1.2.	Requirements	4
1.3.	Terminology	5
2.	Requesting Message Disposition Notifications	5
2.1.	The Disposition-Notification-To Header	5
2.2.	The Disposition-Notification-Options Header	8
2.3.	The Original-Recipient Header Field	9
2.4.	Use with the Message/Partial Media Type	10
3.	Format of a Message Disposition Notification	10
3.1.	The Message/Disposition-Notification Media Type	12
3.2.	Message/Disposition-Notification Content Fields	15
3.3.	Extension-Fields	21
4.	Timeline of Events	22
5.	Conformance and Usage Requirements	23
6.	Security Considerations	24
6.1.	Forgery	24
6.2.	Privacy	24
6.2.1.	Disclosure of Product Information	25
6.2.2.	MUA Fingerprinting	25
6.3.	Non-repudiation	25
6.4.	Mail Bombing	26
7.	Collected ABNF Grammar	26
8.	Guidelines for Gatewaying MDNs	29
8.1.	Gatewaying from Other Mail Systems to MDNs	29
8.2.	Gatewaying from MDNs to Other Mail Systems	29
8.3.	Gatewaying of MDN-Requests to Other Mail Systems	30
9.	Example	30
10.	IANA Considerations	31
10.1.	Disposition-Notification-Options Header Field disposition-notification-parameter Names	32
10.2.	Disposition Modifier Names	33
10.3.	MDN Extension Field Names	33
11.	References	33
11.1.	Normative References	33
11.2.	Informative References	34
	Appendix A. Changes from RFC 3798	36
	Acknowledgements	37
	Authors' Addresses	37

1. Introduction

This memo defines a media type [RFC2046] for Message Disposition Notifications (MDNs). An MDN can be used to notify the sender of a message of any of several conditions that may occur after successful delivery, such as display of the message contents, printing of the message, deletion (without display) of the message, or the recipient's refusal to provide MDNs. The "message/disposition-notification" content type defined herein is intended for use within the framework of the "multipart/report" content type defined in RFC-REPORT [RFC6522].

This memo defines the format of the notifications and the RFC-MSGFMT [RFC5322] header fields used to request them.

1.1. Purposes

The MDNs defined in this memo are expected to serve several purposes:

- a. Inform human beings of the disposition of messages after successful delivery in a manner that is largely independent of human language;
- b. Allow mail user agents to keep track of the disposition of messages sent by associating returned MDNs with earlier message transmissions;
- c. Convey disposition notification requests and disposition notifications between Internet Mail and "foreign" mail systems via a gateway;
- d. Allow "foreign" notifications to be tunneled through a MIME-capable messaging system and back into the original messaging system that issued the original notification, or even to a third messaging system;
- e. Allow language-independent, yet reasonably precise, indications of the disposition of a message to be delivered.

1.2. Requirements

These purposes place the following constraints on the notification protocol:

- a. It must be readable by humans and must be machine parsable.

- b. It must provide enough information to allow message senders (or their user agents) to unambiguously associate an MDN with the message that was sent and the original recipient address for which the MDN was issued (if such information is available), even if the message was forwarded to another recipient address.
- c. It must also be able to describe the disposition of a message independent of any particular human language or of the terminology of any particular mail system.
- d. The specification must be extensible in order to accommodate future requirements.

1.3. 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-KEYWORDS [RFC2119].

All syntax descriptions use the ABNF specified by RFC-MSGFMT [RFC5322] in which the lexical tokens (used below) are defined: "CRLF", "FWS", "CFWS", "field-name", "mailbox-list", "msg-id", and "text". The following lexical token is defined in RFC-SMTP [RFC5321]: "Atom".

2. Requesting Message Disposition Notifications

Message disposition notifications are requested by including a Disposition-Notification-To header field in the message containing one or more addresses specifying where dispositions should be sent. Further information to be used by the recipient's Mail User Agent (MUA) [RFC5598] in generating the MDN may be provided by also including Original-Recipient and/or Disposition-Notification-Options header fields in the message.

2.1. The Disposition-Notification-To Header

A request for the receiving user agent to issue message disposition notifications is made by placing a Disposition-Notification-To header field into the message. The syntax of the header field is

```
mdn-request-header = "Disposition-Notification-To" ":"  
                    mailbox-list CRLF
```

A Disposition-Notification-To header field can appear in a message at most once.

The presence of a Disposition-Notification-To header field in a message is merely a request for an MDN. The recipients' user agents are always free to silently ignore such a request.

An MDN **MUST NOT** itself have a Disposition-Notification-To header field. An MDN **MUST NOT** be generated in response to an MDN.

A user agent **MUST NOT** issue more than one MDN on behalf of each particular recipient. That is, once an MDN has been issued on behalf of a recipient, no further MDNs may be issued on behalf of that recipient by the same user agent, even if another disposition is performed on the message. However, if a message is forwarded, an MDN may have been issued for the recipient doing the forwarding, and the recipient of the forwarded message may also cause an MDN to be generated.

It is also possible that if the same message is being accessed by multiple user agents (for example, using POP3), then multiple dispositions might be generated for the same recipient. User agents **SHOULD** leverage support in the underlying message access protocol to prevent multiple MDNs from being generated. In particular, when the user agent is accessing the message using RFC-IMAP [RFC3501], it **SHOULD** implement the procedures specified in RFC-IMAP-MDN [RFC3503].

While Internet standards normally do not specify the behavior of user interfaces, it is strongly recommended that the user agent obtain the user's consent before sending an MDN. This consent could be obtained for each message through some sort of prompt or dialog box, or globally through the user's setting of a preference. The user might also indicate globally that MDNs are to never be sent. The purpose of obtaining user's consent is to protect user's privacy. The default value should be not to send MDNs.

MDNs **MUST NOT** be sent automatically if the address in the Disposition-Notification-To header field differs from the address in the Return-Path header field (see RFC-MSGFMT [RFC5322]). In this case, confirmation from the user **MUST** be obtained, if possible. If obtaining consent is not possible (e.g., because the user is not online at the time or the client is not an interactive email client), then an MDN **MUST NOT** be sent.

Confirmation from the user **MUST** be obtained (or no MDN sent) if there is no Return-Path header field in the message or if there is more than one distinct address in the Disposition-Notification-To header field.

The comparison of the addresses is done using only the addr-spec (local-part "@" domain) portion, excluding any angle brackets, phrase, and route. As prescribed by RFC 5322, the comparison is case sensitive for the local-part and case insensitive for the domain part. The local-part comparison SHOULD be done after performing local-part canonicalization, i.e., after removing the surrounding double-quote characters, if any, as well as any escaping "\" characters. (See RFC-MSGFMT [RFC5322] for more details.) Implementations MAY treat known domain aliases as equivalent for the purpose of comparison.

Note that use of subaddressing (see [RFC5233]) can result in a failure to match two local-parts and thus result in possible suppression of the MDN. This document doesn't recommend special handling for this case, as the receiving MUA can't reliably know whether or not the sender is using subaddressing.

If the message contains more than one Return-Path header field, the implementation may pick one to use for the comparison or treat the situation as a failure of the comparison.

The reason for not automatically sending an MDN if the comparison fails or more than one address is specified is to reduce the possibility of mail loops and of MDNs being used for mail bombing.

It's especially important that a message that contains a Disposition-Notification-To header field also contain a Message-ID header field to permit user agents to automatically correlate MDNs with their original messages.

If the request for message disposition notifications for some recipients and not others is desired, two copies of the message should be sent, one with a Disposition-Notification-To header field and one without. Many of the other header fields of the message (e.g., To, Cc) will be the same in both copies. The recipients in the respective message envelopes determine from whom message disposition notifications are requested and from whom they are not. If desired, the Message-ID header field may be the same in both copies of the message. Note that there are other situations (e.g., Bcc) in which it is necessary to send multiple copies of a message with slightly different header fields. The combination of such situations and the need to request MDNs for a subset of all recipients may result in more than two copies of a message being sent, some with a Disposition-Notification-To header field and some without.

If it is possible to determine that a recipient is a newsgroup, do not include a Disposition-Notification-To header field for that recipient. Similarly, if an existing message is resent or gatewayed to a newsgroup, the agent that is resending/gatewaying **SHOULD** strip the Disposition-Notification-To header field. See Section 5 for more discussion. Clients that see an otherwise valid Disposition-Notification-To header field in a newsgroup message **SHOULD NOT** generate an MDN.

2.2. The Disposition-Notification-Options Header

Extensions to this specification may require that information be supplied to the recipient's MUA for additional control over how and what MDNs are generated. The Disposition-Notification-Options header field provides an extensible mechanism for such information. The syntax of this header field is as follows:

```
Disposition-Notification-Options =  
    "Disposition-Notification-Options" ":" [FWS]  
        disposition-notification-parameter-list CRLF  
  
disposition-notification-parameter-list =  
    disposition-notification-parameter  
    *([FWS] ";" [FWS] disposition-notification-parameter)  
  
disposition-notification-parameter = attribute [FWS] "="  
    [FWS] importance [FWS] "," [FWS] value  
    *([FWS] "," [FWS] value)  
  
importance = "required" / "optional"  
  
attribute = Atom  
  
value = word
```

A Disposition-Notification-Options header field can appear in a message at most once.

An importance of "required" indicates that interpretation of the disposition-notification-parameter is necessary for proper generation of an MDN in response to this request. An importance of "optional" indicates that an MUA that does not understand the meaning of this disposition-notification-parameter **MAY** generate an MDN in response anyway, ignoring the value of the disposition-notification-parameter.

No disposition-notification-parameter attribute names are defined in this specification. Attribute names may be defined in the future by later revisions or extensions to this specification. Disposition-

notification-parameter attribute names **MUST** be registered with the Internet Assigned Numbers Authority (IANA) using the "Specification Required" registration policy [RFC5226]. The "X-" prefix has historically been used to denote unregistered "experimental" protocol elements that are assumed not to become common use. Deployment experience of this and other protocols has shown that this assumption is often false. This document allows the use of the "X-" prefix primarily to allow the registration of attributes that are already in common use. The prefix has no meaning for new attributes. Its use in substantially new attributes may cause confusion and is therefore discouraged. (See Section 10 for a registration form.)

2.3. The Original-Recipient Header Field

Since electronic mail addresses may be rewritten while the message is in transit, it is useful for the original recipient address to be made available by the delivering Message Transfer Agent (MTA) [RFC5598]. The delivering MTA may be able to obtain this information from the ORCPT parameter of the SMTP RCPT TO command, as defined in RFC-SMTP [RFC5321] and RFC-DSN-SMTP [RFC3461].

RFC-DSN-SMTP [RFC3461] is amended as follows: if the ORCPT information is available, the delivering MTA **SHOULD** insert an Original-Recipient header field at the beginning of the message (along with the Return-Path header field). The delivering MTA **MAY** delete any other Original-Recipient header fields that occur in the message. The syntax of this header field is as follows:

```
original-recipient-header =
    "Original-Recipient" ":" OWS address-type OWS
    ";" OWS generic-address OWS
```

```
OWS = [CFWS]
    ; Optional whitespace.
    ; MDN generators SHOULD use "*WSP"
    ; (Typically a single space or nothing.
    ; It SHOULD be nothing at the end of a field.),
    ; unless an RFC 5322 "comment" is required.
    ;
    ; MDN parsers MUST parse it as "[CFWS]".
```

The address-type and generic-address tokens are as specified in the description of the Original-Recipient field in Section 3.2.3.

The purpose of carrying the original recipient information and returning it in the MDN is to permit automatic correlation of MDNs with the original message on a per-recipient basis.

2.4. Use with the Message/Partial Media Type

The use of the header fields `Disposition-Notification-To`, `Disposition-Notification-Options`, and `Original-Recipient` with the MIME message/partial content type (RFC-MIME-MEDIA [RFC2046]) requires further definition.

When a message is segmented into two or more message/partial fragments, the three header fields mentioned in the above paragraph **SHOULD** be placed in the "inner" or "enclosed" message (using the terms of RFC-MIME-MEDIA [RFC2046]). If these header fields are found in the header fields of any of the fragments, they are ignored.

When the multiple message/partial fragments are reassembled, the following applies. If these header fields occur along with the other header fields of a message/partial fragment message, they pertain to an MDN that will be generated for the fragment. If these header fields occur in the header fields of the "inner" or "enclosed" message (using the terms of RFC-MIME-MEDIA [RFC2046]), they pertain to an MDN that will be generated for the reassembled message. Section 5.2.2.1 of RFC-MIME-MEDIA [RFC2046] is amended to specify that, in addition to the header fields specified there, the three header fields described in this specification are to be appended, in order, to the header fields of the reassembled message. Any occurrences of the three header fields defined here in the header fields of the initial enclosing message **MUST NOT** be copied to the reassembled message.

3. Format of a Message Disposition Notification

A message disposition notification is a MIME message with a top-level content type of `multipart/report` (defined in RFC-REPORT [RFC6522]). When `multipart/report` content is used to transmit an MDN:

- a. The `report-type` parameter of the `multipart/report` content is `"disposition-notification"`.
- b. The first component of the `multipart/report` contains a human-readable explanation of the MDN, as described in RFC-REPORT [RFC6522].
- c. The second component of the `multipart/report` is of content type `message/disposition-notification`, described in Section 3.1 of this document.

- d. If the original message or a portion of the message is to be returned to the sender, it appears as the third component of the multipart/report. The decision of whether or not to return the message or part of the message is up to the MUA generating the MDN. However, in the case of encrypted messages requesting MDNs, if the original message or a portion thereof is returned, it **MUST** be in its original encrypted form.

NOTE: For message disposition notifications gatewayed from foreign systems, the header fields of the original message may not be available. In this case, the third component of the MDN may be omitted, or it may contain "simulated" RFC-MSGFMT [RFC5322] header fields that contain equivalent information. In particular, it is very desirable to preserve the subject and date fields from the original message.

The MDN **MUST** be addressed (in both the message header field and the transport envelope) to the address(es) from the Disposition-Notification-To header field from the original message for which the MDN is being generated.

The From header field of the MDN **MUST** contain the address of the person for whom the message disposition notification is being issued.

The envelope sender address (i.e., SMTP "MAIL FROM") of the MDN **MUST** be null (<>), specifying that no Delivery Status Notification messages nor other messages indicating successful or unsuccessful delivery are to be sent in response to an MDN.

A message disposition notification **MUST NOT** itself request an MDN. That is, it **MUST NOT** contain a Disposition-Notification-To header field.

The Message-ID header field (if present) for an MDN **MUST** be different from the Message-ID of the message for which the MDN is being issued.

A particular MDN describes the disposition of exactly one message for exactly one recipient. Multiple MDNs may be generated as a result of one message submission, one per recipient. However, due to the circumstances described in Section 2.1, it's possible that some of the recipients for whom MDNs were requested will not generate MDNs.

3.1. The Message/Disposition-Notification Media Type

The message/disposition-notification media type is defined as follows:

Type name: message

Subtype name: disposition-notification

Required parameters: none

Optional parameters: none

Encoding considerations: "7bit" encoding is sufficient and MUST be used to maintain readability when viewed by non-MIME mail readers.

Security considerations: discussed in Section 6 of RFC 8098.

Interoperability considerations: none

Published specification: RFC 8098

Applications that use this media type: Mail Transfer Agents and email clients that support multipart/report generation and/or parsing.

Fragment identifier considerations: N/A

Additional information:

Deprecated alias names for this type: N/A

Magic number(s): none

File extension(s): .disposition-notification

Macintosh file type code(s): The 'TEXT' type code is suggested as files of this type are typically used for diagnostic purposes and suitable for analysis in a text editor. A Uniform Type Identifier (UTI) of "public.utf8-email-message-header" is suggested. This type conforms to "public.plain-text".

Person & email address to contact for further information:
ART Area Mailing List <art@ietf.org>

Intended usage: COMMON

Restrictions on usage: This media type contains textual data in the US-ASCII charset, which is always 7bit.

Author: See the Authors' Addresses section of RFC 8098.

Change controller: IETF

Provisional registration? no

(While the 7bit restriction applies to the message/disposition-notification portion of the multipart/report content, it does not apply to the optional third portion of the multipart/report content.)

The message/disposition-notification report type for use in the multipart/report is "disposition-notification".

The body of a message/disposition-notification consists of one or more "fields" formatted according to the ABNF of RFC-MSGFMT [RFC5322] header "fields". The syntax of the message/disposition-notification content is as follows:

```
disposition-notification-content = [ reporting-ua-field CRLF ]  
                                [ mdn-gateway-field CRLF ]  
                                [ original-recipient-field CRLF ]  
                                final-recipient-field CRLF  
                                [ original-message-id-field CRLF ]  
                                disposition-field CRLF  
                                *( error-field CRLF )  
                                *( extension-field CRLF )
```

```
extension-field = extension-field-name ":" *([FWS] text)
```

```
extension-field-name = field-name
```

Note that the order of the above fields is recommended but not fixed. Extension fields can appear anywhere.

3.1.1. General Conventions for Fields

Since these fields are defined according to the rules of RFC-MSGFMT [RFC5322], the same conventions for continuation lines and comments apply. Notification fields may be continued onto multiple lines by beginning each additional line with a SPACE or HTAB. Text that appears in parentheses is considered a comment and not part of the contents of that notification field. Field names are case insensitive, so the names of notification fields may be spelled in

any combination of uppercase and lowercase letters. RFC-MSGFMT [RFC5322] comments in notification fields may use the "encoded-word" construct defined in RFC-MIME-HEADER [RFC2047].

3.1.2. "-type" Subfields

Several fields consist of a "-type" subfield, followed by a semi-colon, followed by "*text". For these fields, the keyword used in the address-type or MTA-type subfield indicates the expected format of the address or MTA-name that follows.

The "-type" subfields are defined as follows:

- a. An "address-type" specifies the format of a mailbox address. For example, Internet Mail addresses use the "rfc822" address-type. Other values can appear in this field as specified in the "Address Types" IANA subregistry established by RFC-DSN-FORMAT [RFC3464].

address-type = Atom

Atom = <The version from RFC 5321 (not from RFC 5322)
is used in this document.>

- b. An "MTA-name-type" specifies the format of a mail transfer agent name. For example, for an SMTP server on an Internet host, the MTA name is the domain name of that host, and the "dns" MTA-name-type is used. Other values can appear in this field as specified in the "MTA Name Types" IANA subregistry established by RFC-DSN-FORMAT [RFC3464].

mta-name-type = Atom

Values for address-type and mta-name-type are case insensitive. Thus, address-type values of "RFC822" and "rfc822" are equivalent.

The Internet Assigned Numbers Authority (IANA) maintains a registry of address-type and mta-name-type values, along with descriptions of the meanings of each or a reference to one or more specifications that provide such descriptions. (The "rfc822" address-type is defined in RFC-DSN-SMTP [RFC3461].) Registration forms for address-type and mta-name-type appear in RFC-DSN-FORMAT [RFC3464].

3.2. Message/Disposition-Notification Content Fields

3.2.1. The Reporting-UA Field

```
reporting-ua-field = "Reporting-UA" ":" OWS ua-name OWS  
                    [ ";" OWS ua-product OWS ]
```

ua-name = *text-no-semi

ua-product = *([FWS] text)

text-no-semi = %d1-9 / ; "text" characters excluding NUL, CR,
 %d11 / %d12 / %d14-58 / %d60-127 ; LF, or semi-colon

The Reporting-UA field is defined as follows:

An MDN describes the disposition of a message after it has been delivered to a recipient. In all cases, the Reporting-UA is the MUA that performed the disposition described in the MDN.

The "Reporting-UA" field contains information about the MUA that generated the MDN, which is often used by servers to help identify the scope of reported interoperability problems, to work around or tailor responses to avoid particular MUA limitations, and for analytics regarding MUA or operating system use. An MUA **SHOULD** send a "Reporting-UA" field unless specifically configured not to do so.

If the reporting MUA consists of more than one component (e.g., a base program and plug-ins), this may be indicated by including a list of product names.

A reporting MUA **SHOULD** limit generated product identifiers to what is necessary to identify the product; a sender **MUST NOT** generate advertising or other nonessential information within the product identifier.

A reporting MUA **SHOULD NOT** generate a "Reporting-UA" field containing needlessly fine-grained detail and **SHOULD** limit the addition of subproducts by third parties. Overly long and detailed "Reporting-UA" field values increase the risk of a user being identified against their wishes ("fingerprinting").

Likewise, implementations are encouraged not to use the product tokens of other implementations in order to declare compatibility with them, as this circumvents the purpose of the field. If an MUA masquerades as a different MUA, recipients can assume that the user

intentionally desires to see responses tailored for that identified MUA, even if they might not work as well for the actual MUA being used.

Example:

Reporting-UA: Foomail 97.1

3.2.2. The MDN-Gateway Field

The MDN-Gateway field indicates the name of the gateway or MTA that translated a foreign (non-Internet) message disposition notification into this MDN. This field **MUST** appear in any MDN that was translated by a gateway from a foreign system into MDN format and **MUST NOT** appear otherwise.

```
mdn-gateway-field = "MDN-Gateway" ":" OWS mta-name-type OWS  
                    ";" OWS mta-name OWS
```

mta-name = *text

For gateways into Internet Mail, the MTA-name-type will normally be "dns", and the mta-name will be the Internet domain name of the gateway.

3.2.3. Original-Recipient Field

The Original-Recipient field indicates the original recipient address as specified by the sender of the message for which the MDN is being issued. For Internet Mail messages, the value of the Original-Recipient field is obtained from the Original-Recipient header field from the message for which the MDN is being generated. If there is an Original-Recipient header field in the message, or if information about the original recipient is reliably available some other way, then the Original-Recipient field **MUST** be included. Otherwise, the Original-Recipient field **MUST NOT** be included. If there is more than one Original-Recipient header field in the message, the MUA may choose the one to use or act as if no Original-Recipient header field is present.

```
original-recipient-field =  
    "Original-Recipient" ":" OWS address-type OWS  
    ";" OWS generic-address OWS
```

generic-address = *text

The address-type field indicates the type of the original recipient address. If the message originated within the Internet, the address-

type field will normally be "rfc822", and the address will be according to the syntax specified in RFC-MSGFMT [RFC5322]. The value "unknown" should be used if the Reporting MUA cannot determine the type of the original recipient address from the message envelope. This address is the same as that provided by the sender and can be used to automatically correlate MDN reports with original messages on a per-recipient basis.

3.2.4. Final-Recipient Field

The Final-Recipient field indicates the recipient for which the MDN is being issued. This field **MUST** be present.

The syntax of the field is as follows:

```
final-recipient-field = "Final-Recipient" ":" OWS address-type OWS  
                        ";" OWS generic-address OWS
```

The generic-address subfield of the Final-Recipient field **SHOULD** contain the mailbox address of the recipient (which will be the same as the From header field of the MDN) as it was when the MDN was generated by the MUA.

One example of when this field might not contain the final recipient address of the message is when an alias (e.g., <customer-support@example.com>) forwards mail to a specific personal address (e.g., <bob@example.com>). Bob might want to be able to send MDNs but not give away his personal email address. In this case, the Final-Recipient field can contain:

```
Final-Recipient: rfc822;customer-support@example.com
```

in place of:

```
Final-Recipient: rfc822;bob@example.com
```

The Final-Recipient address may differ from the address originally provided by the sender, because it may have been transformed during forwarding and gatewaying into a totally unrecognizable mess. However, in the absence of the optional Original-Recipient field, the Final-Recipient field and any returned content may be the only information available with which to correlate the MDN with a particular message recipient.

The address-type subfield indicates the type of address expected by the reporting MTA in that context. Recipient addresses obtained via SMTP will normally be of address-type "rfc822", but can be other

values from the "Address Types" subregistry of the "Delivery Status Notification (DSN) Types" IANA registry.

Since mailbox addresses (including those used in the Internet) may be case sensitive, the case of alphabetic characters in the address MUST be preserved.

3.2.5. Original-Message-ID Field

The Original-Message-ID field indicates the message-ID of the message for which the MDN is being issued. It is obtained from the Message-ID header field of the message for which the MDN is issued. This field MUST be present if and only if the original message contained a Message-ID header field. The syntax of the field is as follows:

```
original-message-id-field =  
    "Original-Message-ID" ":" msg-id
```

The msg-id token is as specified in RFC-MSGFMT [RFC5322].

3.2.6. Disposition Field

The Disposition field indicates the action performed by the Reporting MUA on behalf of the user. This field MUST be present.

The syntax for the Disposition field is:

```
disposition-field =  
    "Disposition" ":" OWS disposition-mode OWS ";"  
    OWS disposition-type  
    [ OWS "/" OWS disposition-modifier  
    *( OWS "," OWS disposition-modifier ) ] OWS
```

```
disposition-mode = action-mode OWS "/" OWS sending-mode
```

```
action-mode = "manual-action" / "automatic-action"
```

```
sending-mode = "MDN-sent-manually" / "MDN-sent-automatically"
```

```
disposition-type = "displayed" / "deleted" / "dispatched" /  
    "processed"
```

```
disposition-modifier = "error" / disposition-modifier-extension
```

```
disposition-modifier-extension = Atom
```

The disposition-mode, disposition-type, and disposition-modifier values may be spelled in any combination of uppercase and lowercase US-ASCII characters.

3.2.6.1. Disposition Modes

Disposition mode consists of two parts: action mode and sending mode.

The following action modes are defined:

"manual-action" The disposition described by the disposition type was a result of an explicit instruction by the user rather than some sort of automatically performed action. (This might include the case when the user has manually configured her MUA to automatically respond to valid MDN requests.) Unless prescribed otherwise in a particular mail environment, in order to preserve the user's privacy, this **MUST** be the default for MUAs.

"automatic-action" The disposition described by the disposition type was a result of an automatic action rather than an explicit instruction by the user for this message. This is typically generated by a Mail Delivery Agent (e.g., MDN generations by Sieve reject action [RFC5429], Fax-over-Email [RFC3249], voice message system (see Voice Profile for Internet Mail (VPIM) [RFC3801]), or upon delivery to a mailing list).

"Manual-action" and "automatic-action" are mutually exclusive. One or the other **MUST** be specified.

The following sending modes are defined:

"MDN-sent-manually" The user explicitly gave permission for this particular MDN to be sent. Unless prescribed otherwise in a particular mail environment, in order to preserve the user's privacy, this **MUST** be the default for MUAs.

"MDN-sent-automatically" The MDN was sent because the MUA had previously been configured to do so automatically.

"MDN-sent-manually" and "MDN-sent-automatically" are mutually exclusive. One or the other **MUST** be specified.

3.2.6.2. Disposition Types

The following disposition-types are defined:

"displayed"	The message has been displayed by the MUA to someone reading the recipient's mailbox. There is no guarantee that the content has been read or understood.
"dispatched"	The message has been sent somewhere in some manner (e.g., printed, faxed, forwarded) without necessarily having been previously displayed to the user. The user may or may not see the message later.
"processed"	The message has been processed in some manner (i.e., by some sort of rules or server) without being displayed to the user. The user may or may not see the message later, or there may not even be a human user associated with the mailbox.
"deleted"	The message has been deleted. The recipient may or may not have seen the message. The recipient might "undelete" the message at a later time and read the message.

3.2.6.3. Disposition Modifiers

Only the extension disposition modifiers are defined:

disposition-modifier-extension

Disposition modifiers may be defined in the future by later revisions or extensions to this specification. MDN disposition value names **MUST** be registered with the Internet Assigned Numbers Authority (IANA) using the "Specification Required" registration policy. (See Section 10 for a registration form.) MDNs with disposition modifier names not understood by the receiving MUA **MAY** be silently ignored or placed in the user's mailbox without special interpretation. They **MUST NOT** cause any error message to be sent to the sender of the MDN.

It is not required that an MUA be able to generate all of the possible values of the Disposition field.

A user agent **MUST NOT** issue more than one MDN on behalf of each particular recipient. That is, once an MDN has been issued on behalf of a recipient, no further MDNs may be issued on behalf of that recipient, even if another disposition is performed on the message. However, if a message is forwarded, a "dispatched" MDN **MAY** be issued for the recipient doing the forwarding and the recipient of the forwarded message may also cause an MDN to be generated.

3.2.7. Error Field

The Error field is used to supply additional information in the form of text messages when the "error" disposition modifier appears. The syntax is as follows:

error-field = "Error" ":" *([FWS] text)

Note that syntax of these header fields doesn't include comments, so the "encoded-word" construct defined in RFC-MIME-HEADER [RFC2047] can't be used to convey non-ASCII text. Applications that need to convey non-ASCII text in these fields should consider implementing the message/global-disposition-notification media type specified in [RFC6533] instead of this specification.

3.3. Extension-Fields

Additional MDN fields may be defined in the future by later revisions or extensions to this specification. MDN field names **MUST** be registered with the Internet Assigned Numbers Authority (IANA) using the "Specification Required" registration policy. (See Section 10 for a registration form.) MDN Extension-fields may be defined for the following reasons:

- a. To allow additional information from foreign disposition reports to be tunneled through Internet MDNs. The names of such MDN fields should begin with an indication of the foreign environment name (e.g., X400-Physical-Forwarding-Address).
- b. To allow transmission of diagnostic information that is specific to a particular Mail User Agent (MUA). The names of such MDN fields should begin with an indication of the MUA implementation that produced the MDN (e.g., Foomail-information).

4. Timeline of Events

The following timeline shows when various events in the processing of a message and generation of MDNs take place:

- User composes message.
- User tells MUA to send message.
- MUA passes message to Mail Submission Agent (MSA) and original recipient information is passed along.
- MSA sends message to next MTA.
- Final MTA receives message.
- Final MTA delivers message to recipient's mailbox (possibly generating a Delivery Status Notification (DSN)).
- (Recipient's) MUA discovers a new message in recipient's mailbox and decides whether an MDN should be generated. If the MUA has information that an MDN has already been generated for this message, no further MDN processing described below is performed. If MUA decides that no MDN can be generated, no further MDN processing described below is performed.
- MUA performs automatic processing and might generate corresponding MDNs ("dispatched", "processed", or "deleted" disposition type with "automatic-action" and "MDN-sent-automatically" disposition modes). The MUA remembers that an MDN was generated.
- MUA displays list of messages to user.
- User selects a message and requests that some action be performed on it.
- MUA performs requested action; if an automatic MDN has not already been generated, with user's permission, sends an appropriate MDN ("displayed", "dispatched", "processed", or "deleted" disposition type, with "manual-action" and "MDN-sent-manually" or "MDN-sent-automatically" disposition mode). The MUA remembers that an MDN was generated.
- User possibly performs other actions on message, but no further MDNs are generated.

5. Conformance and Usage Requirements

An MUA or gateway conforms to this specification if it generates MDNs according to the protocol defined in this memo. It is not necessary to be able to generate all of the possible values of the Disposition field.

MUAs and gateways **MUST NOT** generate the Original-Recipient field of an MDN unless the mail protocols provide the address originally specified by the sender at the time of submission. Ordinary SMTP does not make that guarantee, but the SMTP extension defined in RFC--DSN-SMTP [RFC3461] permits such information to be carried in the envelope if it is available. The Original-Recipient header field defined in this document provides a way for the MTA to pass the original recipient address to the MUA.

Each sender-specified recipient address may result in more than one MDN. If an MDN is requested for a recipient that is forwarded to multiple recipients of an "alias" (as defined in Section 6.2.7.3 of RFC-DSN-SMTP [RFC3461]), each of the recipients may issue an MDN.

Successful distribution of a message to a mailing list exploder or gateway to Usenet newsgroup **SHOULD** be considered the final disposition of the message. A mailing list exploder **MAY** issue an MDN with a disposition type of "processed" and disposition modes of "automatic-action" and "MDN-sent-automatically" indicating that the message has been forwarded to the list. In this case, the request for MDNs is not propagated to the members of the list.

Alternatively (if successful distribution of a message to a mailing list exploder / Usenet newsgroup is not considered the final disposition of the message), the mailing list exploder can issue no MDN and propagate the request for MDNs to all members of the list. The latter behavior is not recommended for any but small, closely knit lists, as it might cause large numbers of MDNs to be generated and may cause confidential subscribers to the list to be revealed. The mailing list exploder can also direct MDNs to itself, correlate them, and produce a report to the original sender of the message.

This specification places no restrictions on the processing of MDNs received by user agents or mailing lists.

6. Security Considerations

The following security considerations apply when using MDNs.

6.1. Forgery

MDNs can be (and are, in practice) forged as easily as ordinary Internet electronic mail. User agents and automatic mail handling facilities (such as mail distribution list exploders) that wish to make automatic use of MDNs should take appropriate precautions to minimize the potential damage from denial-of-service attacks.

Security threats related to forged MDNs include the sending of:

- a. A falsified disposition notification when the indicated disposition of the message has not actually occurred, and
- b. Unsolicited MDNs.

Similarly, a forged spam or phishing email message can contain Disposition-Notification-To header field that can trick the recipient to send an MDN. MDN processing should only be invoked once authenticity of an email message is verified.

6.2. Privacy

Another dimension of security is privacy. There may be cases in which a message recipient does not wish the disposition of messages addressed to him to be known, or is concerned that the sending of MDNs may reveal other sensitive information (e.g., when the message was read, using which email client, and which OS was used). In this situation, it is acceptable for the MUA to silently ignore requests for MDNs.

If the Disposition-Notification-To header field is passed on unmodified when a message is distributed to the subscribers of a mailing list, the subscribers to the list may be revealed to the sender of the original message by the generation of MDNs.

Headers of the original message returned in part 3 of the multipart/report, as well as content of the message/disposition-notification part, could reveal confidential information about host names and/or network topology inside a firewall.

Disposition mode (Section 3.2.6.1) can leak information about recipient's MUA configuration, in particular, whether MDNs are

acknowledged manually or automatically. If this is a concern, MUAs can return "manual-action/MDN-sent-manually" disposition mode in generated MDNs.

In general, any optional MDN field may be omitted if the Reporting MUA site or user determines that inclusion of the field would impose too great a compromise of site confidentiality. The need for such confidentiality must be balanced against the utility of the omitted information in MDNs.

In some cases, someone with access to the message stream may use the MDN request mechanism to monitor the mail reading habits of a target. If the target is known to generate MDN reports, they could add a `Disposition-Notification-To` header field containing the envelope from address. This risk can be minimized by not sending MDN's automatically.

6.2.1. Disclosure of Product Information

The "Reporting-UA" field (Section 3.2.1), User-Agent header field, and other header fields often reveal information about the respective sender's software systems. In theory, this can make it easier for an attacker to exploit known security holes; in practice, attackers tend to try all potential holes regardless of the apparent software versions being used. Also note that the "Reporting-UA" field doesn't provide any new information in comparison to the "User-Agent" and/or (undocumented) "X-Mailer" header fields used by many MUAs.

6.2.2. MUA Fingerprinting

The "Reporting-UA" field (Section 3.2.1) might contain enough information to uniquely identify a specific device, usually when combined with other characteristics, particularly if the user agent sends excessive details about the user's system or extensions. Even when the guidance in Section 3.2.1 is followed to avoid fingerprinting, other sources of unique information may still be present, such as the `Accept-Language` header fields.

6.3. Non-repudiation

MDNs do not provide non-repudiation with proof of delivery. Within the framework of today's Internet Mail, the MDNs defined in this document provide valuable information to the mail user; however, MDNs cannot be relied upon as a guarantee that a message was or was not seen by the recipient. Even if MDNs are not actively forged, they may be lost in transit. The recipient may bypass the MDN issuing mechanism in some manner.

One possible solution for this purpose can be found in RFC-SEC-SERVICES [RFC2634].

6.4. Mail Bombing

The MDN request mechanism introduces an additional way of mail bombing a mailbox. The MDN request notification provides an address to which MDN's should be sent. It is possible for an attacking agent to send a potentially large set of messages to otherwise unsuspecting third party recipients with a false Disposition-Notification-To address. Automatic or simplistic processing of such requests would result in a flood of MDN notifications to the target of the attack. Additionally, as generated MDN notifications can include the full content of messages that caused them and thus they can be bigger than such messages, they can be used for bandwidth amplification attacks. Such an attack could overrun the storage capacity of the targeted mailbox and/or of the mail transport system, and deny service.

For that reason, MDN's SHOULD NOT be sent automatically where the Disposition-Notification-To address is different from the SMTP "MAIL FROM" address (which is carried in the Return-Path header field). See Section 2.1 for further discussion.

7. Collected ABNF Grammar

NOTE: The following lexical tokens are defined in RFC-MSGFMT [RFC5322]: CRLF, FWS, CFWS, field-name, mailbox-list, msg-id, text, comment, and word. The following lexical tokens are defined in RFC-SMTP [RFC5321]: Atom. (Note that RFC-MSGFMT [RFC5322] also defines "atom", but the version from RFC-SMTP [RFC5321] is more restrictive and this more restrictive version is used in this document.) The "encoded-word" construct defined in RFC-MIME-HEADER [RFC2047] is allowed everywhere where RFC-MSGFMT [RFC5322] "comment" is used, for example, in CFWS.

```
OWS = [CFWS]
      ; Optional whitespace.
      ; MDN generators SHOULD use "*WSP"
      ; (Typically a single space or nothing.
      ; It SHOULD be nothing at the end of a field.),
      ; unless an RFC 5322 "comment" is required.
      ;
      ; MDN parsers MUST parse it as "[CFWS]".
```

Message header fields:

```
mdn-request-header =
    "Disposition-Notification-To" ":" mailbox-list CRLF
```

Disposition-Notification-Options =
 "Disposition-Notification-Options" ":" [FWS]
 disposition-notification-parameter-list CRLF

disposition-notification-parameter-list =
 disposition-notification-parameter
 *([FWS] ";" [FWS]
 disposition-notification-parameter)

disposition-notification-parameter = attribute [FWS] "=" [FWS]
 importance [FWS] "," [FWS] value *([FWS] ","
 [FWS] value)

importance = "required" / "optional"

attribute = Atom

value = word

original-recipient-header =
 "Original-Recipient" ":" OWS address-type OWS
 ";" OWS generic-address OWS CRLF

Report content:

disposition-notification-content =
 [reporting-ua-field CRLF]
 [mdn-gateway-field CRLF]
 [original-recipient-field CRLF]
 final-recipient-field CRLF
 [original-message-id-field CRLF]
 disposition-field CRLF
 *(error-field CRLF)
 *(extension-field CRLF)

address-type = Atom

mta-name-type = Atom

reporting-ua-field = "Reporting-UA" ":" OWS ua-name OWS [
 ";" OWS ua-product OWS]

ua-name = *text-no-semi

ua-product = *([FWS] text)

text-no-semi = %d1-9 / ; "text" characters excluding NUL, CR,
 %d11 / %d12 / %d14-58 / %d60-127 ; LF, or semi-colon

```
mdn-gateway-field = "MDN-Gateway" ":" OWS mta-name-type OWS
                    ";" OWS mta-name

mta-name = *text

original-recipient-field =
    "Original-Recipient" ":" OWS address-type OWS
    ";" OWS generic-address OWS

generic-address = *text

final-recipient-field =
    "Final-Recipient" ":" OWS address-type OWS
    ";" OWS generic-address OWS

original-message-id-field = "Original-Message-ID" ":" msg-id

disposition-field =
    "Disposition" ":" OWS disposition-mode OWS ";"
    OWS disposition-type
    [ OWS "/" OWS disposition-modifier
    *( OWS "," OWS disposition-modifier ) ] OWS

disposition-mode = action-mode OWS "/" OWS sending-mode
action-mode = "manual-action" / "automatic-action"
sending-mode = "MDN-sent-manually" / "MDN-sent-automatically"
disposition-type = "displayed" / "deleted" / "dispatched" /
    "processed"

disposition-modifier = "error" / disposition-modifier-extension
disposition-modifier-extension = Atom

error-field = "Error" ":" *([FWS] text)

extension-field = extension-field-name ":" *([FWS] text)
extension-field-name = field-name
```

8. Guidelines for Gatewaying MDNs

NOTE: This section provides non-binding recommendations for the construction of mail gateways that wish to provide semi-transparent disposition notifications between the Internet and another electronic mail system. Specific MDN gateway requirements for a particular pair of mail systems may be defined by other documents.

8.1. Gatewaying from Other Mail Systems to MDNs

A mail gateway may issue an MDN to convey the contents of a "foreign" disposition notification over Internet Mail. When there are appropriate mappings from the foreign notification elements to MDN fields, the information may be transmitted in those MDN fields. Additional information (such as what might be needed to tunnel the foreign notification through the Internet) may be defined in extension MDN fields. (Such fields should be given names that identify the foreign mail protocol, e.g., X400-* for X.400 protocol elements [X.400]).

The gateway must attempt to supply reasonable values for the Reporting-UA, Final-Recipient, and Disposition fields. These will normally be obtained by translating the values from the foreign notification into their Internet-style equivalents. However, some loss of information is to be expected.

The sender-specified recipient address and the original message-id, if present in the foreign notification, should be preserved in the Original-Recipient and Original-Message-ID fields.

The gateway should also attempt to preserve the "final" recipient address from the foreign system. Whenever possible, foreign protocol elements should be encoded as meaningful printable ASCII strings.

For MDNs produced from foreign disposition notifications, the name of the gateway **MUST** appear in the MDN-Gateway field of the MDN.

8.2. Gatewaying from MDNs to Other Mail Systems

It may be possible to gateway MDNs from the Internet into a foreign mail system. The primary purpose of such gatewaying is to convey disposition information in a form that is usable by the destination system. A secondary purpose is to allow "tunneling" of MDNs through foreign mail systems in case the MDN may be gatewayed back into the Internet.

In general, the recipient of the MDN (i.e., the sender of the original message) will want to know, for each recipient: the closest available approximation to the original recipient address and the disposition (displayed, printed, etc.).

If possible, the gateway should attempt to preserve the Original-Recipient address and Original-Message-ID (if present) in the resulting foreign disposition report.

If it is possible to tunnel an MDN through the destination environment, the gateway specification may define a means of preserving the MDN information in the disposition reports used by that environment.

8.3. Gatewaying of MDN-Requests to Other Mail Systems

By use of the separate Disposition-Notification-To request header field, this specification offers a richer functionality than most, if not all, other email systems. In most other email systems, the notification recipient is identical to the message sender as indicated in the "from" address. There are two interesting cases when gatewaying into such systems:

1. If the address in the Disposition-Notification-To header field is identical to the address in the SMTP "MAIL FROM", the expected behavior will result, even if the Disposition-Notification-To information is lost. Systems should propagate the MDN request.
2. If the address in the Disposition-Notification-To header field is different from the address in the SMTP "MAIL FROM", gatewaying into a foreign system without a separate notification address will result in unintended behavior. This is especially important when the message arrives via a mailing list expansion software that may specifically replace the SMTP "MAIL FROM" address with an alternate address. In such cases, the MDN request should not be gatewayed and should be silently dropped. This is consistent with other forms of non-support for MDN.

9. Example

NOTE: This example is provided as illustration only and is not considered part of the MDN protocol specification. If the example conflicts with the protocol definition above, the example is wrong.

Likewise, the use of *-type subfield names or extension fields in this example is not to be construed as a definition for those type names or extension fields.

This is an MDN issued after a message has been displayed to the user of an Internet Mail user agent.

Date: Wed, 20 Sep 1995 00:19:00 (EDT) -0400
From: Joe Recipient <Joe_Recipient@example.com>
Message-Id: <199509200019.12345@example.com>
Subject: Disposition notification
To: Jane Sender <Jane_Sender@example.org>
MIME-Version: 1.0
Content-Type: multipart/report; report-type=disposition-notification;
boundary="RAA14128.773615765/example.com"

--RAA14128.773615765/example.com

The message sent on 1995 Sep 19 at 13:30:00 (EDT) -0400 to Joe Recipient <Joe_Recipient@example.com> with subject "First draft of report" has been displayed.
This is no guarantee that the message has been read or understood.

--RAA14128.773615765/example.com
Content-Type: message/disposition-notification

Reporting-UA: joes-pc.cs.example.com; Foomail 97.1
Original-Recipient: rfc822;Joe_Recipient@example.com
Final-Recipient: rfc822;Joe_Recipient@example.com
Original-Message-ID: <199509192301.23456@example.org>
Disposition: manual-action/MDN-sent-manually; displayed

--RAA14128.773615765/example.com
Content-Type: message/rfc822

[original message optionally goes here]

--RAA14128.773615765/example.com--

10. IANA Considerations

IANA has completed the following actions:

1. IANA has updated the registration template for the message/disposition-notification media type to match what appears in Section 3.1 of this document and updated the reference for the media type to point to this document (instead of to RFC 3798).
2. The registries specified here already exist; this section updates their documentation. IANA has changed the reference document for the three Message Disposition Notification Parameters registries to point to this document (instead of to RFC 3798).

This document specifies three types of parameters that must be registered with the Internet Assigned Numbers Authority (IANA). All of them use the "Specification Required" IANA registration policy [RFC5226].

The forms below are for use when registering a new disposition-notification-parameter name for the Disposition-Notification-Options header field, a new disposition modifier name, or a new MDN extension field. Each piece of information required by a registration form may be satisfied either by providing the information on the form itself or by including a reference to a published and publicly available specification that includes the necessary information. IANA MAY reject registrations because of incomplete registration forms or incomplete specifications.

To register, complete the following applicable form and send it via electronic mail to <IANA@IANA.ORG>.

10.1. Disposition-Notification-Options Header Field disposition-notification-parameter Names

A registration for a Disposition-Notification-Options header field disposition-notification-parameter name MUST include the following information:

- a. The proposed disposition-notification-parameter name.
- b. The syntax for disposition-notification-parameter values, specified using BNF, ABNF, regular expressions, or other non-ambiguous language.
- c. If disposition-notification-parameter values are not composed entirely of graphic characters from the US-ASCII repertoire, a specification for how they are to be encoded as graphic US-ASCII characters in a Disposition-Notification-Options header field.
- d. A reference to a permanent and readily available public specification that describes the semantics of the disposition-notification-parameter values.

10.2. Disposition Modifier Names

A registration for a disposition-modifier name (used in the Disposition field of a message/disposition-notification) MUST include the following information:

- a. The proposed disposition-modifier name.
- b. A reference to a permanent and readily available public specification that describes the semantics of the disposition modifier.

10.3. MDN Extension Field Names

A registration for an MDN extension-field name MUST include the following information:

- a. The proposed extension field name.
- b. The syntax for extension values, specified using BNF, ABNF, regular expressions, or other non-ambiguous language.
- c. If extension-field values are not composed entirely of graphic characters from the US-ASCII repertoire, a specification for how they are to be encoded as graphic US-ASCII characters in a Disposition-Notification-Options header field.
- d. A reference to a permanent and readily available public specification that describes the semantics of the extension field.

11. References

11.1. Normative References

- [RFC5321] Klensin, J., "Simple Mail Transfer Protocol", RFC 5321, DOI 10.17487/RFC5321, October 2008, <<http://www.rfc-editor.org/info/rfc5321>>.
- [RFC5322] Resnick, P., Ed., "Internet Message Format", RFC 5322, DOI 10.17487/RFC5322, October 2008, <<http://www.rfc-editor.org/info/rfc5322>>.
- [RFC2045] Freed, N. and N. Borenstein, "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies", RFC 2045, DOI 10.17487/RFC2045, November 1996, <<http://www.rfc-editor.org/info/rfc2045>>.

- [RFC2046] Freed, N. and N. Borenstein, "Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types", RFC 2046, DOI 10.17487/RFC2046, November 1996, <<http://www.rfc-editor.org/info/rfc2046>>.
- [RFC2047] Moore, K., "MIME (Multipurpose Internet Mail Extensions) Part Three: Message Header Extensions for Non-ASCII Text", RFC 2047, DOI 10.17487/RFC2047, November 1996, <<http://www.rfc-editor.org/info/rfc2047>>.
- [RFC6522] Kucherawy, M., Ed., "The Multipart/Report Media Type for the Reporting of Mail System Administrative Messages", STD 73, RFC 6522, DOI 10.17487/RFC6522, January 2012, <<http://www.rfc-editor.org/info/rfc6522>>.
- [RFC3461] Moore, K., "Simple Mail Transfer Protocol (SMTP) Service Extension for Delivery Status Notifications (DSNs)", RFC 3461, DOI 10.17487/RFC3461, January 2003, <<http://www.rfc-editor.org/info/rfc3461>>.
- [RFC3464] Moore, K. and G. Vaudreuil, "An Extensible Message Format for Delivery Status Notifications", RFC 3464, DOI 10.17487/RFC3464, January 2003, <<http://www.rfc-editor.org/info/rfc3464>>.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<http://www.rfc-editor.org/info/rfc2119>>.
- [RFC3503] Melnikov, A., "Message Disposition Notification (MDN) profile for Internet Message Access Protocol (IMAP)", RFC 3503, DOI 10.17487/RFC3503, March 2003, <<http://www.rfc-editor.org/info/rfc3503>>.

11.2. Informative References

- [RFC2634] Hoffman, P., Ed., "Enhanced Security Services for S/MIME", RFC 2634, DOI 10.17487/RFC2634, June 1999, <<http://www.rfc-editor.org/info/rfc2634>>.
- [RFC3249] Cancio, V., Moldovan, M., Tamura, H., and D. Wing, "Implementers Guide for Facsimile Using Internet Mail", RFC 3249, DOI 10.17487/RFC3249, September 2002, <<http://www.rfc-editor.org/info/rfc3249>>.

- [RFC3501] Crispin, M., "INTERNET MESSAGE ACCESS PROTOCOL - VERSION 4rev1", RFC 3501, DOI 10.17487/RFC3501, March 2003, <<http://www.rfc-editor.org/info/rfc3501>>.
- [RFC3801] Vaudreuil, G. and G. Parsons, "Voice Profile for Internet Mail - version 2 (VPIMv2)", RFC 3801, DOI 10.17487/RFC3801, June 2004, <<http://www.rfc-editor.org/info/rfc3801>>.
- [RFC5233] Murchison, K., "Sieve Email Filtering: Subaddress Extension", RFC 5233, DOI 10.17487/RFC5233, January 2008, <<http://www.rfc-editor.org/info/rfc5233>>.
- [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 5226, DOI 10.17487/RFC5226, May 2008, <<http://www.rfc-editor.org/info/rfc5226>>.
- [RFC5429] Stone, A., Ed., "Sieve Email Filtering: Reject and Extended Reject Extensions", RFC 5429, DOI 10.17487/RFC5429, March 2009, <<http://www.rfc-editor.org/info/rfc5429>>.
- [RFC5598] Crocker, D., "Internet Mail Architecture", RFC 5598, DOI 10.17487/RFC5598, July 2009, <<http://www.rfc-editor.org/info/rfc5598>>.
- [RFC6533] Hansen, T., Ed., Newman, C., and A. Melnikov, "Internationalized Delivery Status and Disposition Notifications", RFC 6533, DOI 10.17487/RFC6533, February 2012, <<http://www.rfc-editor.org/info/rfc6533>>.
- [X.400] International Telecommunications Union, "Message handling system and service overview", ITU-T Recommendation F.400/X.400, June 1999.

Appendix A. Changes from RFC 3798

Changed IANA registration for different subregistries to "Specification Required" to match what is already used by IANA.

Updated IANA registration template for message/disposition-notification.

"X-" fields no longer reserved for experimental use and can now be registered in compliance with RFC 6648.

Fixed the default MTA-name-type used in "MDN-Gateway" to be "dns".

Strengthen requirements on obtaining user consent in order to protect user privacy.

Removed discussion of using source routes with MDNs, as source route is a deprecated Email feature.

The values of "dispatched" and "processed" were lost from the ABNF for "disposition-type". (Erratum #691)

Because the warning disposition modifier was previously removed, the warning-field has also been removed. (Erratum #692)

Because the failed disposition type was previously removed, the failure-field has also been removed.

The ABNF for ua-name and ua-product included a semi-colon, which could not be distinguished from *text in the production. The ua-name was restricted to not include semi-colon. Semi-colon can still appear in the ua-product.

Removed recommendation to include the MUA DNS host name in the "Reporting-UA" MDN field.

The ABNF did not indicate all places that whitespace was allowable, in particular folding whitespace, although all implementations allow whitespace and folding in the header fields just like any other header field formatted as described in RFC-MSGFMT [RFC5322]. There were also a number of places in the ABNF that inconsistently permitted comments and whitespace in one leg of the production and not another. The ABNF now specifies FWS and CFWS in several places that should have already been specified by the grammar.

Extension-field was defined in the collected grammar but not in the main text.

The comparison of mailboxes in Disposition-Notification-To to the Return-Path addr-spec was clarified.

The use of the grammar production "parameter" was confusing with the RFC 2045 [RFC2045] production of the same name, as well as other uses of the same term. These have been clarified.

A clarification was added on the extent of the 7bit nature of MDNs.

Uses of the terms "may" and "might" were clarified.

A clarification was added on the order of the fields in the message/disposition-notification content.

Acknowledgements

The contributions of Bruce Lilly, Alfred Hoenes, Barry Leiba, Ben Campbell, Pete Resnick, Donald Eastlake, and Alissa Cooper are gratefully acknowledged for this revision.

The contributions of Roger Fajman and Greg Vaudreuil to earlier draft versions of this document are also gratefully acknowledged.

Authors' Addresses

Tony Hansen (editor)
AT&T Laboratories
200 Laurel Ave. South
Middletown, NJ 07748
United States of America

Email: tony@att.com

Alexey Melnikov (editor)
Isode Ltd
14 Castle Mews
Hampton, Middlesex TW12 2NP
United Kingdom

Email: Alexey.Melnikov@isode.com