Network Working Group
Internet-Draft
Obsoletes: RFC 1891
11 September 2002
Expires: 11 March 2003

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SMTP Service Extension for Delivery Status Notifications

draft-moore-rfc1891bis-02

Comments regarding this internet-draft should be sent by electronic mail to the notifications@cs.utk.edu mailing list. Requests to subscribe to this mailing list should be sent to notifications-REQUEST@cs.utk.edu.

Status of this Memo

This document is an attempt to revise RFC 1891, which is currently a Proposed Standard document. The purpose of this draft is to make any revisions necessary to allow the protocol to advance to Draft Standard status. Reviewers are urged to read this document in light of experience in implementing RFC 1891 and related specifications, and to make suggestions for any corrections or clarifications that would be useful in improving clarity or interoperability of these specifications.

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.

Per an agreement reached during the approval process for RFC 1891, during the review process for this document's advancement to Draft Standard status, any normative text (phrases containing SHOULD, SHOULD NOT, MUST, MUST NOT, or MAY) in this document are to be re-evaluated in light of implementation experience. Reviewers are specifically requested to comment on whether the keyword choices are appropriate. [[Note to ADs and RFC Editor: presumably this paragraph should be removed on publication as a Draft Standard RFC?]]

NOTE TO RFC EDITOR: To minimize the potential for transcription errors in the RFC reformatting process, revisable nroff source for this document is available from http://www.cs.utk.edu/~moore/drafts/rfc1891bis.tar

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1. Abstract

This memo defines an extension to the SMTP service, which allows an SMTP client to specify (a) that delivery status notifications (DSNs) should be generated under certain conditions, (b) whether such notifications should return the contents of the message, and (c) additional information, to be returned with a DSN, that allows the sender to identify both the recipient(s) for which the DSN was issued, and the transaction in which the original message was sent.

2. Introduction

The SMTP protocol [1] requires that an SMTP server provide notification of delivery failure, if it determines that a message cannot be delivered to one or more recipients. Traditionally, such notification consists of an ordinary Internet mail message (format defined by [2]), sent to the envelope sender address (the argument of the SMTP MAIL command), containing an explanation of the error and at least the headers of the failed message.

Experience with large mail distribution lists [3] indicates that such messages are often insufficient to diagnose problems, or even to determine at which host or for which recipients a problem occurred. In addition, the lack of a standardized format for delivery notifications in Internet mail makes it difficult to exchange such notifications with other message handling systems.

Such experience has demonstrated a need for a delivery status notification service for Internet electronic mail, which:

(a) is reliable, in the sense that any DSN request will either be honored at the time of final delivery, or result in a response that indicates that the request cannot be honored,

(b) when both success and failure notifications are requested, provides an unambiguous and nonconflicting indication of whether delivery of a message to a recipient succeeded or failed,

(c) is stable, in that a failed attempt to deliver a DSN should never result in the transmission of another DSN over the network,

(d) preserves sufficient information to allow the sender to identify both the mail transaction and the recipient address which caused the notification, even when mail is forwarded or gatewayed to foreign environments, and

(e) interfaces acceptably with non-SMTP and non-822-based mail systems, both so that notifications returned from foreign mail systems may be useful to Internet users, and so that the notification requests from foreign environments may be honored. Among the requirements implied by this goal are the ability to request non-return-of-content, and the ability to specify whether positive delivery notifications, negative delivery notifications, both, or neither, should be issued.

In an attempt to provide such a service, this memo uses the mechanism defined in [4] to define an extension to the SMTP protocol. Using this mechanism, an SMTP client may request that an SMTP server issue or not issue a delivery status notification (DSN) under certain conditions. The format of a DSN is defined in [5].

3. Framework for the Delivery Status Notification Extension

The following service extension is therefore defined:

(1) The name of the SMTP service extension is "Delivery Status Notification";

(2) the EHLO keyword value associated with this extension is "DSN", the meaning of which is defined in section 4 of this memo;

(3) no parameters are allowed with this EHLO keyword value;

(4) two optional parameters are added to the RCPT command, and two optional parameters are added to the MAIL command:

An optional parameter for the RCPT command, using the esmtp-keyword "NOTIFY", (to specify the conditions under which a delivery status notification should be generated), is defined in section 5.1,

An optional parameter for the RCPT command, using the esmtp-keyword "ORCPT", (used to convey the "original" (sender-specified) recipient address), is defined in section 5.2, and

An optional parameter for the MAIL command, using the esmtp-keyword "RET", (to request that DSNs containing an indication of delivery failure either return the entire contents of a message or only the message headers), is defined in section 5.3,

An optional parameter for the MAIL command, using the esmtp-keyword "ENVID", (used to propagate an identifier for this message transmission envelope, which is also known to the sender and will, if present, be returned in any DSNs issued for this transmission), is defined in section 5.4;

(5) no additional SMTP verbs are defined by this extension.

The remainder of this memo specifies how support for the extension affects the behavior of a message transfer agent.

4. The Delivery Status Notification service extension

An SMTP client wishing to request a DSN for a message may issue the EHLO command to start an SMTP session, to determine if the server supports any of several service extensions. If the server responds with code 250 to the EHLO command, and the response includes the EHLO keyword DSN, then the Delivery Status Notification extension (as described in this memo) is supported.

Ordinarily, when an SMTP server returns a positive (2xx) reply code in response to a RCPT command, it agrees to accept responsibility for either delivering the message to the named recipient, or sending a notification to the sender of the message indicating that delivery has failed. However, an extended SMTP ("ESMTP") server which implements this service extension will accept an optional NOTIFY parameter with the RCPT command. If present, the NOTIFY parameter alters the conditions for generation of delivery status notifications from the default (issue notifications only on failure) specified in [1]. The ESMTP client may also request (via the RET parameter) whether the entire contents of the original message should be returned (as opposed to just the headers of that message), along with the DSN.

In general, an ESMTP server which implements this service extension will propagate delivery status notification requests when relaying mail to other SMTP-based MTAs which also support this extension, and make a "best effort" to ensure that such requests are honored when messages are passed into other environments.

In order that any delivery status notifications thus generated will be meaningful to the sender, any ESMTP server which supports this extension will attempt to propagate the following information to any other MTAs that are used to relay the message, for use in generating DSNs:

(a) for each recipient, a copy of the original recipient address, as used by the sender of the message.

This address need not be the same as the mailbox specified in the RCPT command. For example, if a message was originally addressed to A@B.C and later forwarded to A@D.E, after such forwarding has taken place, the RCPT command will specify a mailbox of A@D.E. However, the original recipient address remains A@B.C.

Also, if the message originated from an environment which does not use Internet-style user@domain addresses, and was gatewayed into SMTP, the original recipient address will preserve the original form of the recipient address.

(b) for the entire SMTP transaction, an envelope identification string, which may be used by the sender to associate any delivery status notifications with the transaction used to send the original message.

5. Additional parameters for RCPT and MAIL commands

The extended RCPT and MAIL commands are issued by a client when it wishes to request a DSN from the server, under certain conditions, for a particular recipient. The extended RCPT and MAIL commands are identical to the RCPT and MAIL commands defined in [1], except that one or more of the following parameters appear after the sender or recipient address, respectively. The general syntax for extended SMTP commands is defined in [4].

NOTE: Although RFC 822 ABNF is used to describe the syntax of these parameters, they are not, in the language of that document, "structured field bodies". Therefore, while parentheses MAY appear within an emstp-value, they are not recognized as comment delimiters.

The syntax for "esmtp-value" in [4] does not allow SP, "=", control characters, or characters outside the traditional ASCII range of 1-127 decimal to be transmitted in an esmtp-value. Because the ENVID and ORCPT parameters may need to convey values outside this range, the esmtp-values for these parameters are encoded as "xtext". "xtext" is formally defined as follows:

```
xtext = *( xchar / hexchar )

xchar = any ASCII CHAR between "!" (33) and "~" (126) inclusive,
      except for "+" and "=".

; "hexchar"s are intended to encode octets that cannot appear
; as ASCII characters within an esmtp-value.

hexchar = ASCII "+" immediately followed by two upper case
        hexadecimal digits
```

When encoding an octet sequence as xtext:

+ Any ASCII CHAR between "!" and "~" inclusive, except for "+" and "=", MAY be encoded as itself. (A CHAR in this range MAY instead be encoded as a "hexchar", at the implementor’s discretion.)

+ ASCII CHARs that fall outside the range above must be encoded as "hexchar".

5.1 The NOTIFY parameter of the ESMTP RCPT command

A RCPT command issued by a client may contain the optional esmtp-keyword "NOTIFY", to specify the conditions under which the SMTP server should generate DSNs for that recipient. If the NOTIFY esmtp-keyword is used, it MUST have an associated esmtp-value, formatted according to the following rules, using the ABNF of RFC 822:

```
notify-esmtp-value = "NEVER" / 1#notify-list-element

notify-list-element = "SUCCESS" / "FAILURE" / "DELAY"
```

Notes:

a. Multiple notify-list-elements, separated by commas, MAY appear in a NOTIFY parameter; however, the NEVER keyword MUST appear by itself.

b. Any of the keywords NEVER, SUCCESS, FAILURE, or DELAY may be spelled in any combination of upper and lower case letters.

The meaning of the NOTIFY parameter values is generally as follows:

+ A NOTIFY parameter value of "NEVER" requests that a DSN not be returned to the sender under any conditions.

+ A NOTIFY parameter value containing the "SUCCESS" or "FAILURE" keywords requests that a DSN be issued on successful delivery or delivery failure, respectively.

+ A NOTIFY parameter value containing the keyword "DELAY" indicates the sender’s willingness to receive "delayed" DSNs. Delayed DSNs may be issued if delivery of a message has been delayed for an unusual amount of time (as determined by the MTA at which the message is delayed), but the final delivery status (whether successful or failure) cannot be determined. The absence of the DELAY keyword in a NOTIFY parameter requests that a "delayed" DSN NOT be issued under any conditions.

The actual rules governing interpretation of the NOTIFY parameter are given in section 6.

For compatibility with SMTP clients that do not use the NOTIFY facility, the absence of a NOTIFY parameter in a RCPT command may be interpreted as either NOTIFY=FAILURE or NOTIFY=FAILURE,DELAY.

5.2 The ORCPT parameter to the ESMTP RCPT command

The ORCPT esmtp-keyword of the RCPT command is used to specify an "original" recipient address that corresponds to the actual recipient to which the message is to be delivered. If the ORCPT esmtp-keyword is used, it MUST have an associated esmtp-value, which consists of the original recipient address, encoded according to the rules below. The ABNF for the ORCPT parameter is:

orcpt-parameter = "ORCPT=" original-recipient-address

original-recipient-address = addr-type ";" xtext

addr-type = atom

The "addr-type" portion MUST be an IANA-registered electronic mail address-type (as defined in [5]), while the "xtext" portion contains an encoded representation of the original recipient address using the rules in section 5 of this document. The entire ORCPT parameter MAY be up to 500 characters in length.

When initially submitting a message via SMTP, if the ORCPT parameter is used, it MUST contain the same address as the RCPT TO address (unlike the RCPT TO address, the ORCPT parameter will be encoded as xtext). Likewise, when a mailing list submits a message via SMTP to be distributed to the list subscribers, if ORCPT is used, the ORCPT parameter MUST match the new RCPT TO address of each recipient, not the address specified by the original sender of the message.)

The "addr-type" portion of the original-recipient-address is used to indicate the "type" of the address which appears in the ORCPT parameter value. However, the address associated with the ORCPT keyword is NOT constrained to conform to the syntax rules for that "addr-type".

Ideally, the "xtext" portion of the original-recipient-address should contain, in encoded form, the same sequence of characters that the sender used to specify the recipient. However, for a message gatewayed from an environment (such as X.400) in which a recipient address is not a simple string of printable characters, the representation of recipient address must be defined by a specification for gatewaying between DSNs and that environment.

Due to limitations in the Delivery Status Notification format, the value of the original recipient address prior to encoding as "xtext" MUST consist entirely of printable (graphic and white space) characters from the US-ASCII [6] repertoire. If an addr-type is defined for addresses which use characters outside of this repertoire, the specification for that addr-type MUST define the means of encoding those addresses in printable US-ASCII characters when are then encoded as xtext.

5.3 The RET parameter of the ESMTP MAIL command

The RET esmtp-keyword on the extended MAIL command specifies whether or not the message should be included in any failed DSN issued for this message transmission. If the RET esmtp-keyword is used, it MUST have an associated esmtp-value, which is one of the following keywords:

FULL
: requests that the entire message be returned in any "failed" delivery status notification issued for this recipient.

HDRS
: requests that only the headers of the message be returned.

The FULL and HDRS keywords may be spelled in any combination of upper and lower case letters.

If no RET parameter is supplied, the MTA MAY return either the headers of the message or the entire message for any DSN containing indication of failed deliveries.

Note that the RET parameter only applies to DSNs that indicate delivery failure for at least one recipient. If a DSN contains no indications of delivery failure, only the headers of the message should be returned.

5.4 The ENVID parameter to the ESMTP MAIL command

The ENVID esmtp-keyword of the SMTP MAIL command is used to specify an "envelope identifier" to be transmitted along with the message and included in any DSNs issued for any of the recipients named in this SMTP transaction. The purpose of the envelope identifier is to allow the sender of a message to identify the transaction for which the DSN was issued.

The ABNF for the ENVID parameter is:

    envid-parameter = "ENVID=" xtext

The ENVID esmtp-keyword MUST have an associated esmtp-value. No meaning is assigned by the mail system to the presence or absence of this parameter or to any esmtp-value associated with this parameter; the information is used only by the sender or his user agent. The ENVID parameter MAY be up to 100 characters in length.

Due to limitations in the Delivery Status Notification format, the value of the ENVID parameter prior to encoding as "xtext" MUST consist entirely of printable (graphic and white space) characters from the US-ASCII [6] repertoire.

5.5 Restrictions on the use of Delivery Status Notification parameters

The RET and ENVID parameters MUST NOT appear more than once each in any single MAIL command. If more than one of either of these parameters appears in a MAIL command, the ESMTP server SHOULD respond with "501 syntax error in parameters or arguments".

The NOTIFY and ORCPT parameters MUST NOT appear more than once in any RCPT command. If more than one of either of these parameters appears in a RCPT command, the ESMTP server SHOULD respond with "501 syntax error in parameters or arguments".

6. Conformance requirements

The Simple Mail Transfer Protocol (SMTP) is used by Message Transfer Agents (MTAs) when accepting, relaying, or gatewaying mail, as well as User Agents (UAs) when submitting mail to the mail transport system. The DSN extension to SMTP may be used to allow UAs to convey the sender's requests as to when DSNs should be issued. A UA which claims to conform to this specification must meet certain requirements as described below.

Typically, a message transfer agent (MTA) which supports SMTP will assume, at different times, both the role of a SMTP client and an SMTP server, and may also provide local delivery, gatewaying to foreign environments, forwarding, and mailing list expansion. An MTA which, when acting as an SMTP server, issues the DSN keyword in response to the EHLO command, MUST obey the rules below for a "conforming SMTP client" when acting as a client, and a "conforming SMTP server" when acting as a server. The term "conforming MTA" refers to an MTA which conforms to this specification, independent of its role of client or server.

6.1 SMTP protocol interactions

The following rules apply to SMTP transactions in which any of the ENVID, NOTIFY, RET, or ORCPT keywords are used:

(a) If an SMTP client issues a MAIL command containing a valid ENVID parameter and associated esmtp-value and/or a valid RET parameter and associated esmtp-value, a conforming SMTP server MUST return the same reply-code as it would to the same MAIL command without the ENVID and/or RET parameters. A conforming SMTP server MUST NOT refuse a MAIL command based on the absence or presence of valid ENVID or RET parameters, or on their associated esmtp-values.

However, if the associated esmtp-value is not valid (i.e. contains illegal characters), or if there is more than one ENVID or RET parameter in a particular MAIL command, the server MUST issue the reply-code 501 with an appropriate message (e.g. "syntax error in parameter").

(b) If an SMTP client issues a RCPT command containing any valid NOTIFY and/or ORCPT parameters, a conforming SMTP server MUST return the same response as it would to the same RCPT command without those NOTIFY and/or ORCPT parameters. A conforming SMTP server MUST NOT refuse a RCPT command based on the presence or absence of any of these parameters.

However, if any of the associated esmtp-values are not valid, or if there is more than one of any of these parameters in a particular RCPT command, the server SHOULD issue the response "501 syntax error in parameter".

6.2 Handling of messages received via SMTP

This section describes how a conforming MTA should handle any messages received via SMTP.

NOTE: A DSN MUST NOT be returned to the sender for any message for which the return address from the SMTP MAIL command was NULL ("<>"), even if the sender's address is available from other sources (e.g. the message header). However, the MTA which would otherwise issue a DSN SHOULD inform the local postmaster of delivery failures through some appropriate mechanism that will not itself result in the generation of DSNs.

DISCUSSION: RFC 1123, section 2.3.3 requires error notifications to be sent with a NULL return address ("reverse-path"). This creates an interesting situation when a message arrives with one or more nonfunctional recipient addresses in addition to a nonfunctional return address. When delivery to one of the recipient addresses fails, the MTA will attempt to send a nondelivery notification to the return address, setting the return address on the notification to NULL. When the delivery of this notification fails, the MTA attempting delivery of that notification sees a NULL return address. If that MTA were not to inform anyone of the situation, the original message would be silently lost. Furthermore, a nonfunctional return address is often indicative of a configuration problem in the sender's MTA. Reporting the condition to the local postmaster may help to speed correction of such errors.

6.2.1 Relay of messages to other conforming SMTP servers

The following rules govern the behavior of a conforming MTA, when relaying a message which was received via the SMTP protocol, to an SMTP server that supports the Delivery Status Notification service extension:

(a) Any ENVID parameter included in the MAIL command when a message was received, MUST also appear on the MAIL command with which the message is relayed, with the same associated esmtp-value. If no ENVID parameter was included in the MAIL command when the message was received, the ENVID parameter MUST NOT be supplied when the message is relayed.

(b) Any RET parameter included in the MAIL command when a message was received, MUST also appear on the MAIL command with which the message is relayed, with the same associated esmtp-value. If no RET parameter was included in the MAIL command when the message was received, the RET parameter MUST NOT supplied when the message is relayed.

(c) If the NOTIFY parameter was supplied for a recipient when the message was received, the RCPT command issued when the message is relayed MUST also contain the NOTIFY parameter along with its associated esmtp-value. If the NOTIFY parameter was not supplied for a recipient when the message was received, the NOTIFY parameter MUST NOT be supplied for that recipient when the message is relayed.

(d) If any ORCPT parameter was present in the RCPT command for a recipient when the message was received, an ORCPT parameter with the identical original-recipient-address MUST appear in the RCPT command issued for that recipient when relaying the message. (For example, the MTA therefore MUST NOT change the case of any alphabetic characters in an ORCPT parameter.)

If no ORCPT parameter was present in the RCPT command when the message was received, an ORCPT parameter MAY be added to the RCPT command when the message is relayed. If an ORCPT parameter is added by the relaying MTA, it MUST contain the recipient address from the RCPT command used when the message was received by that MTA.

6.2.2 Relay of messages to non-conforming SMTP servers

The following rules govern the behavior of a conforming MTA (in the role of client), when relaying a message which was received via the SMTP protocol, to an SMTP server that does not support the Delivery Status Notification service extension:

(a) ENVID, NOTIFY, RET, or ORCPT parameters MUST NOT be issued when relaying the message.

(b) If the NOTIFY parameter was supplied for a recipient, with an esmtp-value containing the keyword SUCCESS, and the SMTP server returns a success (2xx) reply-code in response to the RCPT command, the client MUST issue a "relayed" DSN for that recipient.

(c) If the NOTIFY parameter was supplied for a recipient with an esmtp-value containing the keyword FAILURE, and the SMTP server returns a permanent failure (5xx) reply-code in response to the RCPT command, the client MUST issue a "failed" DSN for that recipient.

(d) If the NOTIFY parameter was supplied for a recipient with an esmtp-value of NEVER, the client MUST NOT issue a DSN for that recipient, regardless of the reply-code returned by the SMTP server. However, if the server returned a failure (5xx) reply-code, the client MAY inform the local postmaster of the delivery failure via an appropriate mechanism that will not itself result in the generation of DSNs.

When attempting to relay a message to an SMTP server that does not support this extension, and if NOTIFY=NEVER was specified for some recipients of that message, a conforming SMTP client MAY relay the message for those recipients in a separate SMTP transaction, using an empty reverse-path in the MAIL command. This will prevent DSNs from being issued for those recipients by MTAs that conform to [1].

(e) If a NOTIFY parameter was not supplied for a recipient, and the SMTP server returns a success (2xx) reply-code in response to a RCPT command, the client MUST NOT issue any DSN for that recipient.

(f) If a NOTIFY parameter was not supplied for a recipient, and the SMTP server returns a permanent failure (5xx) reply-code in response to a RCPT command, the client MUST issue a "failed" DSN for that recipient.

6.2.3 Local delivery of messages

The following rules govern the behavior of a conforming MTA upon successful delivery of a message that was received via the SMTP protocol, to a local recipient's mailbox:

"Delivery" means that the message has been placed in the recipient's mailbox. For messages which are transmitted to a mailbox for later retrieval via IMAP [7], POP [8] or a similar message access protocol, "delivery" occurs when the message is made available to the IMAP (POP, etc.) service, rather than when the message is retrieved by the recipient's user agent.

Similarly, for a recipient address which corresponds to a mailing list exploder, "delivery" occurs when the message is made available to that list exploder, even though the list exploder might refuse to deliver that message to the list recipients.

(a) If the NOTIFY parameter was supplied for that recipient, with an esmtp-value containing the SUCCESS keyword, the MTA MUST issue a "delivered" DSN for that recipient.

(b) If the NOTIFY parameter was supplied for that recipient which did not contain the SUCCESS keyword, the MTA MUST NOT issue a DSN for that recipient.

(c) If the NOTIFY parameter was not supplied for that recipient, the MTA MUST NOT issue a DSN.

6.2.4 Gatewaying a message into a foreign environment

The following rules govern the behavior of a conforming MTA, when gatewaying a message that was received via the SMTP protocol, into a foreign (non-SMTP) environment:

(a) If the the foreign environment is capable of issuing appropriate notifications under the conditions requested by the NOTIFY parameter, and the conforming MTA can ensure that any notification thus issued will be translated into a DSN and delivered to the original sender, then the MTA SHOULD gateway the message into the foreign environment, requesting notification under the desired conditions, without itself issuing a DSN.

(b) If a NOTIFY parameter was supplied with the SUCCESS keyword, but the destination environment cannot return an appropriate notification on successful delivery, the MTA SHOULD issue a "relayed" DSN for that recipient.

(c) If a NOTIFY parameter was supplied with an esmtp-keyword of NEVER, a DSN MUST NOT be issued. If possible, the MTA SHOULD direct the destination environment to not issue delivery notifications for that recipient.

(d) If the NOTIFY parameter was not supplied for a particular recipient, a DSN SHOULD NOT be issued by the gateway. The gateway SHOULD attempt to ensure that appropriate notification will be provided by the foreign mail environment if eventual delivery failure occurs, and that no notification will be issued on successful delivery.

(e) When gatewaying a message into a foreign environment, the return-of-content conditions specified by any RET parameter are nonbinding; however, the MTA SHOULD attempt to honor the request using whatever mechanisms exist in the foreign environment.

6.2.5 Delays in delivery

If a conforming MTA receives a message via the SMTP protocol, and is unable to deliver or relay the message to one or more recipients for an extended length of time (to be determined by the MTA), it MAY issue a "delayed" DSN for those recipients, subject to the following conditions:

(a) If the NOTIFY parameter was supplied for a recipient and its value included the DELAY keyword, a "delayed" DSN MAY be issued.

(b) If the NOTIFY parameter was not supplied for a recipient, a "delayed" DSN MAY be issued.

(c) If the NOTIFY parameter was supplied which did not contain the DELAY keyword, a "delayed" DSN MUST NOT be issued.

NOTE: Although delay notifications are common in present-day electronic mail, a conforming MTA is never required to issue "delayed" DSNs. The DELAY keyword of the NOTIFY parameter is provided to allow the SMTP client to specifically request (by omitting the DELAY parameter) that "delayed" DSNs NOT be issued.

6.2.6 Failure of a conforming MTA to deliver a message

The following rules govern the behavior of a conforming MTA which received a message via the SMTP protocol, and is unable to deliver a message to a recipient specified in the SMTP transaction:

(a) If a NOTIFY parameter was supplied for the recipient with an esmtp-keyword containing the value FAILURE, a "failed" DSN MUST be issued by the MTA.

(b) If a NOTIFY parameter was supplied for the recipient which did not contain the value FAILURE, a DSN MUST NOT be issued for that recipient. However, the MTA MAY inform the local postmaster of the delivery failure via some appropriate mechanism which does not itself result in the generation of DSNs.

(c) If no NOTIFY parameter was supplied for the recipient, a "failed" DSN MUST be issued.

NOTE: Some MTAs are known to forward undeliverable messages to the local postmaster or "dead letter" mailbox. This is still considered delivery failure, and does not diminish the requirement to issue a "failed" DSN under the conditions defined elsewhere in this memo. If a DSN is issued for such a recipient, the Action value MUST be "failed".

6.2.7 Forwarding, aliases, and mailing lists

Delivery of a message to a local email address usually causes the message to be stored in the recipient's mailbox. However, MTAs commonly provide a facility where a local email address can be designated as an "alias" or "mailing list"; delivery to that address then causes the message to be forwarded to each of the (local or remote) recipient addresses associated with the alias or list. It is also common to allow a user to optionally "forward" her mail to one or more alternate addresses. If this feature is enabled, her mail is redistributed to those addresses instead of being deposited in her mailbox.

Following the example of [10] (section 5.3.6), this document defines the difference between an "alias" and "mailing list" as follows: When forwarding a message to the addresses associated with an "alias", the envelope return address (e.g. SMTP MAIL FROM) remains intact. However, when forwarding a message to the addresses associated with a "mailing list", the envelope return address is changed to that of the administrator of the mailing list. This causes DSNs and other nondelivery reports resulting from delivery to the list members to be sent to the list administrator rather than the sender of the original message.

The DSN processing for aliases and mailing lists is as follows:

6.2.7.1 mailing lists

When a message is delivered to a list submission address (i.e. placed in the list's mailbox for incoming mail, or accepted by the process that redistributes the message to the list subscribers), this is considered final delivery for the original message. If the NOTIFY parameter for the list submission address contained the SUCCESS keyword, a "delivered" DSN MUST be returned to the sender of the original message.

NOTE: Some mailing lists are able to reject message submissions, based on the content of the message, the sender's address, or some other criteria. While the interface between such a mailing list and its MTA is not well-defined, it is important that DSNs NOT be issued by both the MTA (to report successful delivery to the list), and the list (to report message rejection using a "failure" DSN.)

However, even if a "delivered" DSN was issued by the MTA, a mailing list which rejects a message submission MAY notify the sender that the message was rejected using an ordinary message instead of a DSN.

Whenever a message is redistributed to an mailing list,

(a) The envelope return address is rewritten to point to the list maintainer. This address MAY be that of a process that recognizes DSNs and processes them automatically, but it MUST forward unrecognized messages to the human responsible for the list.

(b) The ENVID, NOTIFY, RET, and ORCPT parameters which accompany the redistributed message MUST NOT be derived from those of the original message.

(c) The NOTIFY and RET parameters MAY be specified by the local postmaster or the list administrator. If ORCPT parameters are supplied during redistribution to the list subscribers, they SHOULD contain the addresses of the list subscribers in the format used by the mailing list.

6.2.7.2 single-recipient aliases

Under normal circumstances, when a message arrives for an "alias" which has a single forwarding address, a DSN SHOULD NOT be issued. Any ENVID, NOTIFY, RET, or ORCPT parameters SHOULD be propagated with the message as it is redistributed to the forwarding address.

6.2.7.3 multiple-recipient aliases

An "alias" with multiple recipient addresses may be handled in any of the following ways:

(a) Any ENVID, NOTIFY, RET, or ORCPT parameters are NOT propagated when relaying the message to any of the forwarding addresses. If the NOTIFY parameter for the alias contained the SUCCESS keyword, the MTA issues a "relayed" DSN. (In effect, the MTA treats the message as if it were being relayed into an environment that does not support DSNs.)

(b) Any ENVID, NOTIFY, RET, or ORCPT parameters (or the equivalent requests if the message is gatewayed) are propagated to EXACTLY one of the forwarding addresses. No DSN is issued. (This is appropriate when aliasing is used to forward a message to a "vacation" auto-responder program in addition to the local mailbox.)

(c) Any ENVID, RET, or ORCPT parameters are propagated to all forwarding addresses associated with that alias. The NOTIFY parameter is propagated to the forwarding addresses, except that it any SUCCESS keyword is removed. If the original NOTIFY parameter for the alias contained the SUCCESS keyword, an "expanded" DSN is issued for the alias. If the NOTIFY parameter for the alias did not contain the SUCCESS keyword, no DSN is issued for the alias.

6.2.7.4 confidential forwarding addresses

If it is desired to maintain the confidentiality of a recipient's forwarding address, the forwarding may be treated as if it were a mailing list. A DSN will be issued, if appropriate, upon "delivery" to the recipient address specified by the sender. When the message is forwarded it will have a new envelope return address. Any DSNs which result from delivery failure of the forwarded message will not be returned to the original sender of the message and thus not expose the recipient's forwarding address.

6.2.8 DSNs describing delivery to multiple recipients

A single DSN may describe attempts to deliver a message to multiple recipients of that message. If a DSN is issued for some recipients in an SMTP transaction and not for others according to the rules above, the DSN SHOULD NOT contain information for recipients for whom DSNs would not otherwise have been issued.

6.3 Handling of messages from other sources

For messages which originated from "local" users (whatever that means), the specifications under which DSNs should be generated can be communicated to the MTA via any protocol agreed on between the sender's mail composer (user agent) and the MTA. The local MTA can then either relay the message, or issue appropriate delivery status notifications. However, if such requests are transmitted within the message itself (for example in the message headers), the requests MUST be removed from the message before it is transmitted via SMTP.

For messages gatewayed from non-SMTP sources and further relayed by SMTP, the gateway SHOULD, using the SMTP extensions described here, attempt to provide the delivery reporting conditions expected by the source mail environment. If appropriate, any DSNs returned to the source environment SHOULD be translated into the format expected in that environment.

6.4 Implementation limits

A conforming MTA MUST accept ESMTP parameters of at least the following sizes:

(a) ENVID parameter: 100 characters.

(b) NOTIFY parameter: 28 characters.

(c) ORCPT parameter: 500 characters.

(d) RET parameter: 8 characters.

The maximum sizes for the ENVID and ORCPT parameters are intended to be adequate for the transmission of "foreign" envelope identifier and original recipient addresses. However, user agents which use SMTP as a message submission protocol SHOULD NOT generate ENVID parameters which are longer than 38 characters in length.

A conforming MTA MUST be able to accept SMTP command-lines which are at least 1036 characters long (530 characters for the ORCPT and NOTIFY parameters of the RCPT command, in addition to the 512 characters required by [1]). If other SMTP extensions are supported by the MTA, the MTA MUST be able to accept a command-line large enough for each SMTP command and any combination of ESMTP parameters which may be used with that command.

7. Format of delivery notifications

The format of delivery status notifications is defined in [5], which uses the framework defined in [9]. Delivery status notifications are to be returned to the sender of the original message as outlined below.

7.1 SMTP Envelope to be used with delivery status notifications

The DSN sender address (in the SMTP MAIL command) MUST be a null reverse-path ("<>"), as required by section 5.3.3 of [10]. The DSN recipient address (in the RCPT command) is copied from the MAIL command which accompanied the message for which the DSN is being issued. When transmitting a DSN via SMTP, the RET parameter MUST NOT be used. The

NOTIFY parameter MAY be used, but its value MUST be NEVER. The ENVID parameter (with a newly generated envelope-id) and/or ORCPT parameter MAY be used.

7.2 Contents of the DSN

A DSN is transmitted as a MIME message with a top-level content-type of multipart/report (as defined in [5]).

The multipart/report content-type may be used for any of several kinds of reports generated by the mail system. When multipart/report is used to convey a DSN, the report-type parameter of the multipart/report content-type is "delivery-status".

As described in [9], the first component of a multipart/report content-type is a human readable explanation of the report. For a DSN, the second component of the multipart/report is of content-type message/delivery-status (defined in [5]). The third component of the multipart/report consists of the original message or some portion thereof. When the value of the RET parameter is FULL, the full message SHOULD be returned for any DSN which conveys notification of delivery failure. (However, if the length of the message is greater than some implementation-specified length, the MTA MAY return only the headers even if the RET parameter specified FULL.) If a DSN contains no notifications of delivery failure, the MTA SHOULD return only the headers.

The third component must have an appropriate content-type label. Issues concerning selection of the content-type are discussed in [9].

7.3 Message/delivery-status fields

The message/delivery-status content-type defines a number of fields, with general specifications for their contents. The following requirements for any DSNs generated in response to a message received by the SMTP protocol by a conforming SMTP server, are in addition to the requirements defined in [5] for the message/delivery-status type.

When generating a DSN for a message which was received via the SMTP protocol, a conforming MTA will generate the following fields of the message/delivery-status body part:

(a) if an ENVID parameter was present on the MAIL command, an Original-Envelope-ID field MUST be supplied, and the value associated with the ENVID parameter must appear in that field. If the message was received via SMTP with no ENVID parameter, the Original-Envelope-ID field MUST NOT be supplied.

Since the ENVID parameter is encoded as xtext, but the Original-Envelope-ID header is NOT encoded as xtext, the MTA must decode the xtext encoding when copying the ENVID value to the Original-Envelope-ID field.

(b) The Reporting-MTA field MUST be supplied. If Reporting MTA can determine its fully-qualified Internet domain name, the MTA-name-type subfield MUST be "dns", and the field MUST contain the fully-qualified domain name of the Reporting MTA. If the fully-qualified Internet domain name of the Reporting MTA is not known (for example, for an SMTP server which is not directly connected to the Internet), the Reporting-MTA field may contain any string identifying the MTA, however, in this case the MTA-name-type subfield MUST NOT be "dns". A MTA-name-type subfield value of "x-local-hostname" is suggested.

(c) Other per-message fields as defined in [5] MAY be supplied as appropriate.

(d) If the ORCPT parameter was provided for this recipient, the Original-Recipient field MUST be supplied, with its value taken from the ORCPT parameter. If no ORCPT parameter was provided for this recipient, the Original-Recipient field MUST NOT appear.

(e) The Final-Recipient field MUST be supplied. It MUST contain the recipient address from the message envelope. If the message was received via SMTP, the address-type will be "rfc822".

(f) The Action field MUST be supplied.

(g) The Status field MUST be supplied, using a status-code from [11]. If there is no specific code which suitably describes a delivery failure, either 4.0.0 (temporary failure), or 5.0.0 (permanent failure) MUST be used.

(h) For DSNs resulting from attempts to relay a message to one or more recipients via SMTP, the Remote-MTA field MUST be supplied for each of those recipients. The mta-name-type subfields of those Remote-MTA fields will be "dns".

(i) For DSNs resulting from attempts to relay a message to one or more recipients via SMTP, the Diagnostic-Code MUST be supplied for each of those recipients. The diagnostic-type subfield will be "smtp". See section 9.2(a) of this document for a description of the "smtp" diagnostic-code.

(j) For DSNs resulting from attempts to relay a message to one or more recipients via SMTP, an SMTP-Remote-Recipient extension field MAY be supplied for each recipient, which contains the address of that recipient which was presented to the remote SMTP server.

(k) Other per-recipient fields defined in [5] MAY appear, as appropriate.

8. Acknowledgments

The author wishes to thank Eric Allman, Harald Alvestrand, Jim Conklin, Bryan Costales, Peter Cowen, Dave Crocker, Roger Fajman, Ned Freed, Marko Kaittola, Steve Kille, John Klensin, Anastasios Kotsikonas, John Gardiner Myers, Julian Onions, Jacob Palme, Marshall Rose, Greg Vaudreuil, and Klaus Weide for their suggestions for improvement of this document.

9. Appendix – Type-Name Definitions

The following type names are defined for use in DSN fields generated by conforming SMTP-based MTAs:

9.1 "rfc822" address-type

The "rfc822" address-type is to be used when reporting Internet electronic mail address in the Original-Recipient and Final-Recipient DSN fields.

(a) address-type name: rfc822

(b) syntax for mailbox addresses

RFC822 mailbox addresses are generally expected to be of the form

    [route] addr-spec

where "route" and "addr-spec" are defined in [2], and the "domain" portions of both "route" and "addr-spec" are fully-qualified domain names that are registered in the DNS. However, an MTA MUST NOT modify an address obtained from the message envelope to force it to conform to syntax rules.

(c) If addresses of this type 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 DSN Original-Recipient or Final-Recipient DSN field.

RFC822 addresses consist entirely of graphic characters from the US-ASCII repertoire, so no translation is necessary.

9.2 "smtp" diagnostic-type

The "smtp" diagnostic-type is to be used when reporting SMTP reply-codes in Diagnostic-Code DSN fields.

(a) diagnostic-type name: SMTP

(b) A description of the syntax to be used for expressing diagnostic codes of this type as graphic characters from the US-ASCII repertoire.

An SMTP diagnostic-code is of the form

    *(3*DIGIT "-" *text) 3*DIGIT SPACE *text

For a single-line SMTP reply to an SMTP command, the diagnostic-code SHOULD be an exact transcription of the reply. For multi-line SMTP replies, it is necessary to insert a SPACE before each line after the first. For example, an SMTP reply of:

550-mailbox unavailable
550 user has moved with no forwarding address

could appear as follows in a Diagnostic-Code DSN field:

Diagnostic-Code: smtp ; 550-mailbox unavailable
550 user has moved with no forwarding address

(c) A list of valid diagnostic codes of this type and the meaning of each code.

SMTP reply-codes are currently defined in [1], [4], and [10]. Additional codes may be defined by other RFCs.

9.3 "dns" MTA-name-type

The "dns" MTA-name-type should be used in the Reporting-MTA field. An MTA-name of type "dns" is a fully-qualified domain name. The name must be registered in the DNS, and the address Postmaster@{mta-name} must be valid.

(a) MTA-name-type name: dns

(b) A description of the syntax of MTA names of this type, using BNF, regular expressions, ASN.1, or other non-ambiguous language.

MTA names of type "dns" SHOULD be valid Internet domain names. If such domain names are not available, a domain-literal containing the internet protocol address is acceptable. Such domain names generally conform to the following syntax:

domain = real-domain / domain-literal

real-domain = sub-domain *("." sub-domain)

sub-domain = atom

domain-literal = "[" 1*3DIGIT 3("." 1*3DIGIT) "]"

where "atom" and "DIGIT" are defined in [2].

(c) If MTA names of this type do not consist entirely of graphic characters from the US-ASCII repertoire, a specification for how an MTA name of this type should be expressed as a sequence of graphic US-ASCII characters.

MTA names of type "dns" consist entirely of graphic US-ASCII characters, so no translation is needed.

10. Appendix – Example

This example traces the flow of a single message addressed to multiple recipients. The message is sent by Alice@Example.ORG to Bob@Example.COM, Carol@Ivory.EDU, Dana@Ivory.EDU, Eric@Bombs.AF.MIL, Fred@Bombs.AF.MIL, and George@Tax-ME.GOV, with a variety of per-recipient options. The message is successfully delivered to Bob, Dana (via a gateway), Eric, and Fred. Delivery fails for Carol and George.

NOTE: Formatting rules for RFCs require that no line be longer than 72 characters. Therefore, in the following examples, some SMTP commands longer than 72 characters are printed on two lines, with the first line ending in "\". In an actual SMTP transaction, such a command would be sent as a single line (i.e. with no embedded CRLFs), and without the "\" character that appears in these examples.

10.1 Submission

Alice's user agent sends the message to the SMTP server at Example.ORG. Note that while this example uses SMTP as a mail submission protocol, other protocols could also be used.

```
<<< 220 Example.ORG SMTP server here
>>> EHLO Example.ORG
<<< 250-Example.ORG
<<< 250-DSN
<<< 250-EXPN
<<< 250 SIZE
>>> MAIL FROM:<Alice@Example.ORG> RET=HDRS ENVID=QQ314159
<<< 250 <Alice@Example.ORG> sender ok
>>> RCPT TO:<Bob@Example.COM> NOTIFY=SUCCESS \
   ORCPT=rfc822;Bob@Example.COM
<<< 250 <Bob@Example.COM> recipient ok
>>> RCPT TO:<Carol@Ivory.EDU> NOTIFY=FAILURE \
   ORCPT=rfc822;Carol@Ivory.EDU
<<< 250 <Carol@Ivory.EDU> recipient ok
>>> RCPT TO:<Dana@Ivory.EDU> NOTIFY=SUCCESS,FAILURE \
   ORCPT=rfc822;Dana@Ivory.EDU
<<< 250 <Dana@Ivory.EDU> recipient ok
>>> RCPT TO:<Eric@Bombs.AF.MIL> NOTIFY=FAILURE \
   ORCPT=rfc822;Eric@Bombs.AF.MIL
<<< 250 <Eric@Bombs.AF.MIL> recipient ok
>>> RCPT TO:<Fred@Bombs.AF.MIL> NOTIFY=NEVER
<<< 250 <Fred@Bombs.AF.MIL> recipient ok
>>> RCPT TO:<George@Tax-ME.GOV> NOTIFY=FAILURE \
   ORCPT=rfc822;George@Tax-ME.GOV
<<< 250 <George@Tax-ME.GOV> recipient ok
>>> DATA
<<< 354 okay, send message
>>> (message goes here)
>>> .
<<< 250 message accepted
>>> QUIT
<<< 221 goodbye
```

10.2 Relay to Example.COM

The SMTP at Example.ORG then relays the message to Example.COM. (For the purpose of this example, mail.Example.COM is the primary mail exchanger for Example.COM).

```
<<< 220 mail.Example.COM says hello
>>> EHLO Example.ORG
<<< 250-mail.Example.COM
<<< 250 DSN
>>> MAIL FROM:<Alice@Example.ORG> RET=HDRS ENVID=QQ314159
<<< 250 sender okay
>>> RCPT TO:<Bob@Example.COM> NOTIFY=SUCCESS \
   ORCPT=rfc822;Bob@Example.COM
<<< 250 recipient okay
>>> DATA
<<< 354 send message
>>> (message goes here)
>>> .
<<< 250 message received
>>> QUIT
<<< 221 bcnu
```

10.3 Relay to Ivory.EDU

The SMTP at Example.ORG relays the message to Ivory.EDU, which (as it happens) is a gateway to a LAN-based mail system that accepts SMTP mail and supports the DSN extension.

```
<<< 220 Ivory.EDU gateway to FooMail(tm) here
>>> EHLO Example.ORG
<<< 250-Ivory.EDU
<<< 250 DSN
>>> MAIL FROM:<Alice@Example.ORG> RET=HDRS ENVID=QQ314159
<<< 250 ok
>>> RCPT TO:<Carol@Ivory.EDU> NOTIFY=FAILURE \
   ORCPT=rfc822;Carol@Ivory.EDU
<<< 550 error - no such recipient
>>> RCPT TO:<Dana@Ivory.EDU> NOTIFY=SUCCESS,FAILURE \
   ORCPT=rfc822;Dana@Ivory.EDU
<<< 250 recipient ok
>>> DATA
<<< 354 send message, end with '.'
>>> (message goes here)
>>> .
<<< 250 message received
>>> QUIT
<<< 221 bye
```

Note that since the Ivory.EDU refused to accept mail for Carol@Ivory.EDU, and the sender specified NOTIFY=FAILURE, the sender-SMTP (in this case Example.ORG) must generate a DSN.

10.4 Relay to Bombs.AF.MIL

The SMTP at Example.ORG relays the message to Bombs.AF.MIL, which does not support the SMTP extension. Because the sender specified NOTIFY=NEVER for recipient Fred@Bombs.AF.MIL, the SMTP at Example.ORG chooses to send the message for that recipient in a separate transaction with a reverse-path of <>.

```
<<< 220-Bombs.AF.MIL reporting for duty.
<<< 220 Electronic mail is to be used for official business only.
>>> EHLO Example.ORG
<<< 502 command not implemented
>>> RSET
<<< 250 reset
>>> HELO Example.ORG
<<< 250 Bombs.AF.MIL
>>> MAIL FROM:<Alice@Example.ORG>
<<< 250 ok
>>> RCPT TO:<Eric@Bombs.AF.MIL>
<<< 250 ok
>>> DATA
<<< 354 send message
>>> (message goes here)
>>> .
<<< 250 message accepted
>>> MAIL FROM:<>
<<< 250 ok
>>> RCPT TO:<Fred@Bombs.AF.MIL>
<<< 250 ok
>>> DATA
<<< 354 send message
>>> (message goes here)
>>> .
<<< 250 message accepted
>>> QUIT
<<< 221 Bombs.AF.MIL closing connection
```

10.5 Forward from George@Tax-ME.GOV to Sam@Boondoggle.GOV

The SMTP at Example.ORG relays the message to Tax-ME.GOV. (this step is not shown). MTA Tax-ME.GOV then forwards the message to Sam@Boondoggle.GOV (shown below). Both Tax-ME.GOV and Example.ORG support the SMTP DSN extension. Note that RET, ENVID, and ORCPT all retain their original values.

```
<<< 220 BoonDoggle.GOV says hello
>>> EHLO Example.ORG
<<< 250-mail.Example.COM
<<< 250 DSN
>>> MAIL FROM:<Alice@Example.ORG> RET=HDRS ENVID=QQ314159
<<< 250 sender okay
>>> RCPT TO:<Sam@Boondoggle.GOV> NOTIFY=SUCCESS \
   ORCPT=rfc822;George@Tax-ME.GOV
<<< 250 recipient okay
>>> DATA
<<< 354 send message
>>> (message goes here)
>>> .
<<< 250 message received
>>> QUIT
<<< 221 bcnu
```

10.6 "Delivered" DSN for Bob@Example.COM

MTA mail.Example.COM successfully delivers the message to Bob@Example.COM. Because the sender specified NOTIFY=SUCCESS, mail.Example.COM issues the following DSN, and sends it to Alice@Example.ORG.

```
To: Alice@Example.ORG
From: postmaster@mail.Example.COM
Subject: Delivery Notification (success) for Bob@Example.COM
Content-Type: multipart/report; report-type=delivery-status;
   boundary=abcde
MIME-Version: 1.0

--abcde
Content-type: text/plain; charset=us-ascii

Your message (id QQ314159) was successfully delivered to
Bob@Example.COM.

--abcde
Content-type: message/delivery-status

Reporting-MTA: dns; mail.Example.COM
Original-Envelope-ID: QQ314159

Original-Recipient: rfc822;Bob@Example.COM
Final-Recipient: rfc822;Bob@Example.COM
Action: delivered
Status: 2.0.0

--abcde
Content-type: message/rfc822

(headers of returned message go here)

--abcde--
```

10.7 Failed DSN for Carol@Ivory.EDU

Because delivery to Carol failed and the sender specified NOTIFY=FAILURE for Carol@Ivory.EDU, MTA Example.ORG (the SMTP client to which the failure was reported via SMTP) issues the following DSN.

```
To: Alice@Example.ORG
From: postmaster@Example.ORG
Subject: Delivery Notification (failure) for Carol@Ivory.EDU
Content-Type: multipart/report; report-type=delivery-status;
        boundary=bcdef
MIME-Version: 1.0

--bcdef
Content-type: text/plain; charset=us-ascii

Your message (id QQ314159) could not be delivered to
Carol@Ivory.EDU.

A transcript of the session follows:

(while talking to Ivory.EDU)
>>> RCPT TO:<Carol@Ivory.EDU> NOTIFY=FAILURE
<<< 550 error - no such recipient

--bcdef
Content-type: message/delivery-status

Reporting-MTA: dns; Example.ORG
Original-Envelope-ID: QQ314159

Original-Recipient: rfc822;Carol@Ivory.EDU
Final-Recipient: rfc822;Carol@Ivory.EDU
SMTP-Remote-Recipient: Carol@Ivory.EDU
Diagnostic-Code: smtp; 550 error - no such recipient
Action: failed
Status: 5.0.0

--bcdef
Content-type: message/rfc822

(headers of returned message go here)

--bcdef--
```

10.8 Relayed DSN For Dana@Ivory.EDU

Although the mail gateway Ivory.EDU supports the DSN SMTP extension, the LAN mail system attached to its other side does not generate positive delivery confirmations. So Ivory.EDU issues a "relayed" DSN:

```
To: Alice@Example.ORG
From: postmaster@Ivory.EDU
Subject: mail relayed for Dana@Ivory.EDU
Content-Type: multipart/report; report-type=delivery-status;
   boundary=cdefg
MIME-Version: 1.0

--cdefg
Content-type: text/plain; charset=us-ascii

Your message (addressed to Dana@Ivory.EDU) was successfully
relayed to:

ymail!Dana

by the FooMail gateway at Ivory.EDU.

Unfortunately, the remote mail system does not support
confirmation of actual delivery.  Unless delivery to ymail!Dana
fails, this will be the only delivery status notification sent.

--cdefg
Content-type: message/delivery-status

Reporting-MTA: dns; Ivory.EDU
Original-Envelope-ID: QQ314159

Original-Recipient: rfc822;Dana@Ivory.EDU
Final-Recipient: rfc822;Dana@Ivory.EDU
Action: relayed
Status: 2.0.0

--cdefg
Content-type: message/rfc822

(headers of returned message go here)

--cdefg--
```

10.9 Failure notification for Sam@Boondoggle.GOV

The message originally addressed to George@Tax-ME.GOV was forwarded to Sam@Boondoggle.GOV, but the MTA for Boondoggle.GOV was unable to deliver the message due to a lack of disk space in Sam's mailbox. After trying for several days, Boondoggle.GOV returned the following DSN:

```
To: Alice@Example.ORG
From: Postmaster@Boondoggle.GOV
Subject: Delivery failure for Sam@Boondoggle.GOV
Content-Type: multipart/report; report-type=delivery-status;
        boundary=defgh
MIME-Version: 1.0

--defgh
Your message, originally addressed to George@Tax-ME.GOV, and forwarded
from there to Sam@Boondoggle.GOV could not be delivered, for the
following reason:

write error to mailbox, disk quota exceeded

--defgh
Content-type: message/delivery-status

Reporting-MTA: Boondoggle.GOV
Original-Envelope-ID: QQ314159

Original-Recipient: rfc822;George@Tax-ME.GOV
Final-Recipient: rfc822;Sam@Boondoggle.GOV
Action: failed
Status: 4.2.2 (disk quota exceeded)

--defgh
Content-type: message/rfc822

(headers of returned message go here)

--defgh--
```

11. References

References are marked as either normative or non-normative. A normative reference is used to refer to a specification which must be adhered to in order to conform to this specification, such references are thus effectively incorporated into this specification. A non-normative reference does not impose requirements on the implementation; they are included to provide information which might be useful to readers or implementors.

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Appendix – Changes since RFC 1891

- added internet-draft boilerplate, "status of this memo" section
- updated author's address
- In examples, changed Pure-Heart.ORG and Big-Bucks.COM to Example.ORG and Example.COM, respectively. Since publication of RFC 1891, the former two domains have been registered.
- Clarified that ENVID and ORCPT parameters must consist entirely of US-ASCII characters prior to encoding as xtext.