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## RFC 9228

# Delivered-To Email Header Field

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### Abstract

The address to which email is delivered might be different than any of the addresses shown in any of the content header fields that were created by the email's author. For example, the address used by the email transport service is provided separately, such as through SMTP's "RCPT TO" command, and might not match any address in the To: or cc: fields. In addition, before final delivery, handling can entail a sequence of submission/delivery events, using a sequence of different destination addresses that (eventually) lead to the recipient. As well, a receiving system's delivery process can produce local address transformations.

It can be helpful for a message to have a common way to record each delivery in such a sequence, noting each address used in the sequence to that recipient, such as for (1) analyzing the path a message has taken, (2) loop detection, or (3) formulating the author's address in a reply message. This document defines a header field for this information.

Email handling information discloses details about the email infrastructure, as well as about a particular recipient; this can raise privacy concerns.

A header field such as this is not automatically assured of widespread use. Therefore, this document is being published as an Experimental RFC, looking for constituency and for operational utility. This document was produced through the Independent Submission Stream and was not subject to the IETF's approval process.

### Status of This Memo

This document is not an Internet Standards Track specification; it is published for examination, experimental implementation, and evaluation.

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## 1. Introduction

The address to which email is delivered might be different than any of the addresses shown in any of the content header fields [[Mail-Fmt](#)], such as the To: and cc: fields that were created by the author's Message User Agent (MUA) [[Mail-Arch](#)]. The address used by the Message Handling Service (MHS) is provided separately, in envelope information, such as through a "RCPT TO" command in [[SMTP](#)].

As noted in [Section 4.3.3](#) of [[Mail-Arch](#)], 'A transfer of responsibility from the MHS to a Recipient's environment (mailbox) is called "delivery".' That is, when the destination address is fully and successfully processed, and any additional processing is by an agent working on behalf of that address, the message has been delivered. Rather than placing the message into a recipient inbox or otherwise completing the handling of the message, that agent might create additional processing, including to one or more different addresses. Each transition of responsibility, from the MHS to an agent of a current addressee, constitutes a distinct delivery. Given handling sequences that can include aliasing, mailing lists, and the like, the transit of a message from its author to a final recipient might include a series of submission/delivery events. Also, the delivery process at a receiving system can produce local (internal) address transformations.

Header fields that provide information about handling can be used when assessing email traffic issues and when diagnosing specific handling problems. To this end, it can be helpful for a message to have a common way to indicate each delivery in the handling sequence and to include each address that led to the final delivery. This can aid in the analysis of a message's transit handling.

An additional use can be to aid in detecting a delivery sequence loop, based on a specific address. With a problematic loop, the same copy of a message is delivered to the same email address more than once. This is different from having different copies delivered to the same address, such as happens when a message is sent directly to an address, as well as via a mailing list. It is also different from having two copies of the same message arrive at the same, ultimate destination address, having been originally posted to two different addresses. Further, this is different from noting when a message simply transits the same Message Transfer Agent (MTA) more than once, which might be necessary, such as when it is processed through a mailing list; an MTA services many addresses.

Delivering the same copy of a message more than once, to the same address, is almost certainly not an intended activity. An example of a problematic arrangement would be to send a message to mailing list List-A, where List-A contains an entry for List-B, and List-B contains an entry for List-A. The message will enter an infinite loop. Loop detection for email can be a complicated affair. The `Delivered-To:` header field provides helpful information, with a definitive indication that this copy of a message has (already) been delivered to a specific address.

When specifying new activity that is related to existing activity, there is a choice of design approach:

- Seeking to change (some of) the existing behavior
- Adding to the activity without changing what is already being done
- Calling for separate, new activity

On the average, attempting to change existing activities is the least likely to obtain adoption; it can create operational confusion between old and new activities, which in turn creates resistance to adoption. Seeking new activity can make sense when that activity is sufficiently different and deemed sufficiently beneficial. Adding to existing activity has the selling point of building upon an installed base. The current specification builds upon an existing installed base of Delivered-To: activity. It calls for little technical enhancement; rather, it simply provides for a wider range of application.

Considerations:

- Email handling information, such as this, provides information about the email infrastructure, as well as about the recipient. Disclosure of this information might engender privacy concerns.
- A specification is not automatically assured of adoption or use. Therefore, this document is being published as an Experimental RFC, looking for extended constituency and for general operational utility.
- This document was produced through the Independent RFC Stream and was not subject to the IETF's approval process.

## 2. Background

Ad hoc use of a Delivered-To: email header field appears to date back to the 1990s, primarily for loop detection, although documentation is spotty and system specific. A listing of some implementations is offered in [\[Prior\]](#).

It appears that all uses include a string in the form of an email address, although at least one example has leading text that is a comment about the address. In some cases, the string appears to be the email transport destination address, such as the address used in SMTP's "RCPT TO" command. In other cases, it appears to be the result of some internal mapping at the receiving system, although tending to be a variant of the transport address.

Email loop detection tends to be accomplished through a variety of different methods, such as counting Received: header fields. These methods are often combined to greater effect.

The Received: header field's 'for' clause is sometimes useful for disclosing the recipient's address. However, the clause is not used reliably, and its semantics are not thoroughly defined. Also, it references an addressing value that is received but might be different from the value that is ultimately used (as the result of a transformation). That is, the value in a 'for' clause might be a sufficient indicator of delivery addressing, but it might not.

## 3. Framework & Terminology

Unless otherwise indicated, basic architecture and terminology used in this document are taken from:

- [\[Mail-Arch\]](#)

- [\[SMTP\]](#)
- [\[Mail-Fmt\]](#)

and syntax is specified with:

- [\[ABNF\]](#)

Normative language is per [\[RFC8174\]](#):

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [\[RFC2119\]](#) [\[RFC8174\]](#) when, and only when, they appear in all capitals, as shown here.

## 4. Delivered-To

The Delivered-To: header field annotates an email delivery event. The header field contains information about the individual address used to effect that transition.

- When a message is delivered, as a transition from control by the MHS to the recipient's store or their agent, a Delivered-To: header field **SHOULD** be added, with the *addr-spec* value containing the address that was used by the service to reach the recipient.
- If a receiving system's delivery process applies mappings or transformations from the address used by the MHS to a local value, this new value **SHOULD** also be recorded into a separate Delivered-To: field when transit and processing using that address successfully complete. This ensures a detailed record of the sequence of handling addresses used for the message.
- As with some other information, each additional Delivered-To: header field **MUST** be placed at the current 'top' of the message's set of header fields -- that is, as the first header field, in a fashion similar to the trace fields specified in [\[SMTP\]](#) (for example, [Section 4.1.1.4](#) of [\[SMTP\]](#)). This produces a sequence of Delivered-To: header fields that represent the sequence of deliveries, with the first being at the 'bottom' of the sequence and the final one being at the top.
- As with other fields placed incrementally in this way, with each added at the current top, the Delivered-To: header field **MUST NOT** be reordered with respect to other Delivered-To: fields and those other fields. This is intended to preserve the fields as representing the message handling sequence.

The Delivered-To: header field is added at the time of delivery, when responsibility for a message transitions from the Message Handling Service (MHS) to an agent of the specified individual recipient address. The field can also be added as a result of internal system processing, to note address transformations.

Note: The presence of an existing Delivered-To: header field, for the same address, typically indicates a handling loop for this instance of the message.

The syntax of the header field is:

```
"Delivered-To:" FWS addr-spec FWS CRLF ; addr-spec is from [Mail-Fmt]
```

The field records information about a single address, for one recipient. See [Section 6](#) for the privacy-related concerns about divulging addresses.

## 5. Multi-Delivery Example

The Delivered-To: header field can be used to document a sequence of deliveries of a message. Each time an address is fully processed, a Delivered-To: header field is added, recording a handling sequence, with the most recent one being towards the 'top' of the sequence of header fields.

This example demonstrates a message traveling from its original posting, through a remote group mailing list, on through an independent personal aliasing mechanism, and then reaching final delivery at yet another independent email provider.

### 1. Origination at com.example

The message, as submitted. The destination address is the same as the value in the message's To: header field.

```
From: Ann Author <aauthor@com.example>
Date: Mon, 25 Jan 2021 18:29:06 -0500
To: list@org.example
Subject: [list] Sending through a list and alias
Sender: Ann Author <aauthor@com.example>
```

### 2. List processing at org.example

As delivered, with one Delivered-To: header field, to the list processing module, which will then resubmit the message for further transport to the list member "Recipient-alumn@edu.example".

```
Delivered-To: list@org.example
Received: by submit.org.example with SMTP id i17so174806891jn.1
        for <list@org.example> from mail.com.example;
        Mon, 25 Jan 2021 15:29:19 -0800 (PST)
Received: by mail.com.example; Mon, 25 Jan 2021 15:29:00 -0800 (PST)
From: Ann Author <aauthor@com.example>
Date: Mon, 25 Jan 2021 18:29:06 -0500
To: list@org.example
Subject: [list] Sending through a list and alias
Sender: Ann Author <aauthor@com.example>
```

### 3. Alias processing at edu.example

The message, as delivered with two Delivered-To: header fields, to the alias processing module, which sends the message on to "theRecipient@example.net".

```
Delivered-To: Recipient-alumn@edu.example
Received: from mail.org.example
  by relay.edu.example; Mon, 25 Jan 2021 23:29:24 +0000 (UTC)
Received: by submit.org.example;
  Mon, 25 Jan 2021 23:29:21 +0000 (UTC)
Delivered-To: list@org.example
Received: by submit.org.example with SMTP id i17so17480689ljn.1
  for <list@org.example> from mail.com.example;
  Mon, 25 Jan 2021 15:29:19 -0800 (PST)
Received: by mail.com.example; Mon, 25 Jan 2021 15:29:00 -0800 (PST)
From: Ann Author <aauthor@com.example>
Date: Mon, 25 Jan 2021 18:29:06 -0500
To: list@org.example
Subject: [list] Sending through a list and alias
Sender: list-bounces@org.example
```

#### 4. Final delivery to the recipient at example.net

The message, as finally delivered with three Delivered-To: header fields, to the recipient at "theRecipient@example.net".

```
Delivered-To: theRecipient@example.net
Received: from mail.edu.example (mail.edu.example [4.31.198.45])
  by relay.example.net; Mon, 25 Jan 2021 23:29:24 +0000 (UTC)
Delivered-To: Recipient-alumn@edu.example
Received: from mail.org.example
  by relay.edu.example; Mon, 25 Jan 2021 23:29:24 +0000 (UTC)
Received: by submit.org.example;
  Mon, 25 Jan 2021 23:29:21 +0000 (UTC)
Delivered-To: list@org.example
Received: by submit.org.example with SMTP id i17so17480689ljn.1
  for <list@org.example> from mail.com.example;
  Mon, 25 Jan 2021 15:29:19 -0800 (PST)
Received: by mail.com.example; Mon, 25 Jan 2021 15:29:00 -0800 (PST)
From: Ann Author <aauthor@com.example>
Date: Mon, 25 Jan 2021 18:29:06 -0500
To: list@org.example
Subject: [list] Sending through a list and alias
Sender: list-bounces@org.example
```

## 6. Security Considerations

As with Received: header fields, the presence of a Delivered-To: header field discloses handling information and, possibly, personal information.

Security and privacy are essential, if challenging, topics for email in general and for the handling of metadata in particular. The purpose of this section is to note points of potential concern, rather than to provide details for mitigation. The basic mechanism described here has a long history of use, with no history of being problematic. However, the expanded use described here might create new scenarios that are problematic.

An issue specific to this mechanism is disclosure of a sequence of addresses, applied to the same recipient, if a message goes through a series of recipient address replacements. This document calls for each of these addresses to be recorded in a separate Delivered-To: field. This does not disclose addresses of other recipients, but it does disclose an address-transformation handling path for the recipient.

This disclosure is most likely to be a concern when a recipient manually forwards a message and includes all of the original header fields. This will expose, to a later recipient, any intermediate addresses used for getting the original message to the original recipient. Such a disclosure is likely to be unintended and might be (highly) problematic. Note that a basic version of this unintended disclosure has long existed, by virtue of a later recipient's seeing Received: header fields, but especially any with a 'for' clause. However, a Delivered-To: header field sequence can disclose significantly more recipient-specific handling detail.

An issue that is entirely implementation specific -- and therefore out of scope for this document -- is that in some systems, a message that is for multiple (local) recipients is stored as a single, shared version. Supporting Delivered-To:, while maintaining recipient privacy, creates a challenge in this case, since exposing different recipient addresses to other recipients can be problematic.

## 7. IANA Considerations

IANA has registered the Delivered-To: header field as below, per [[RFC3864](#)] in the "Provisional Message Header Field Names" registry:

Header Field Name: Delivered-To

Protocol: mail

Status: Provisional

Author/Change controller: Dave Crocker

Specification document(s): \*\*\* This document \*\*\*

Related information: None.



## 8. Experimental Goals

Specific feedback is sought concerning:

- Technical issues in recording the Delivered-To: field into a message, through its entire submission/delivery sequence
- Market interest in the uses described here
- Utility for the purposes described here, or for other uses

So the questions to answer for this Experimental RFC are:

- Is there demonstrated interest by MSA/MTA/MDA (Message Submission Agent / Message Transfer Agent / Message Delivery Agent) developers?
- If the capability is implemented and the header field generated, is it used by operators or MUAs?
- Does the presence of the header field create any operational problems?
- Does the presence of the header field demonstrate additional security issues?
- What specific changes to the document are needed?
- What other comments will aid in use of this mechanism?

Please send comments to [ietf-smtp@ietf.org](mailto:ietf-smtp@ietf.org).

## 9. References

### 9.1. Normative References

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## Acknowledgements

Even a simple, narrow specification can elicit a remarkable range and intensity of debate. In spite of the current document's being a case of that challenge, useful discussion has taken place, first in the IETF's emailcore working group mailing list, and then on the long-standing ietf-smtp mailing list.

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