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Mapping and Interworking of Diversion Information between Diversion and History-Info Header Fields in the Session Initiation Protocol (SIP)

Abstract

Although the SIP History-Info header field described in RFC 7044 is the solution adopted in IETF, the non-standard Diversion header field described, as Historic, in RFC 5806 is nevertheless already implemented and used for conveying call-diversion-related information in Session Initiation Protocol (SIP) signaling.

RFC 7044 obsoletes the original RFC 4244 and redefines the History-Info header field for capturing the history information in requests.

Since the Diversion header field is used in existing network implementations for the transport of call diversion information, its interworking with the SIP History-Info standardized solution is needed. This document describes a recommended interworking guideline between the Diversion header field and the History-Info header field to handle call diversion information. This work is intended to enable the migration from non-standard implementations toward IETF specification-based implementations.

This document obsoletes RFC 6044, which describes the interworking between the Diversion header field defined in RFC 5806 and the obsoleted History-Info header field defined on RFC 4244.

Status of This Memo

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1. Introduction

1.1. Overview

For some services based on VoIP (Voice over IP) services (e.g., voicemail, Interactive Voice Recognition (IVR), or automatic call distribution), it is helpful for the called SIP user agent to identify from whom and why the session was diverted. For this information to be used by various service providers or by applications, it needs to pass through the network. This is possible with two different SIP header fields: the History-Info header field defined in [RFC7044] and the historic Diversion header field defined in [RFC5806]. Both of these header fields are able to transport diversion information in SIP signaling.

Although the Diversion header field is not standardized, it has been widely implemented. Therefore, it is useful to have guidelines to make this header field interwork with the standard History-Info header field.

Note that new implementation and deployment of the Diversion header field are strongly discouraged.

This document provides a mechanism for the translation of header field content between the Diversion header field and the History-Info header field.

This document obsoletes [RFC6044].

1.2. Background

The obsoleted History-Info header field [RFC4244] and its extension for forming SIP service URIs (including Voicemail URI) [RFC4458] used to be recommended by IETF to convey redirection information. They also used to be recommended in the Communication Diversion (CDIV) 3GPP specification [TS_24.604].

The Diversion header field was originally described in a document that was submitted to the SIP Working Group and was eventually published as an Independent Submission as [RFC5806] for the historical record; it serves as a reference for this RFC.

This header field contains a list of diverting URIs and associated information providing specific information as the reason for the call diversion. Most of the first SIP-based implementations have implemented the Diversion header field when no standard solution was ready to deploy. The IETF has standardized the History-Info header field partly because it can transport general history information.

This allows the receiving party to determine how and why the session is received. As the History-Info header field may contain further information than call diversion information, it is critical to avoid losing information and to be able to extract the relevant data using the retargeting cause URI parameter described in [RFC4458] for the transport of the call forwarding reason.

The Diversion header field and the History-Info header field have different syntaxes, which are described in this document. Note that the main difference is that the History-Info header field is a chronological writing header whereas the Diversion header field applies a reverse chronology (i.e., the first diversion entry read corresponds to the last diverting user).

Appendix A provides an interworking guideline between the Diversion header field and the Voicemail URI, which is another way to convey diversion information without using the History-Info header field. The Voicemail URI is defined in [RFC4458].

1.3. From RFC 4244 to RFC 7044

The details of why and how [RFC4244] was obsoleted by [RFC7044] are provided in Section 16 of [RFC7044].

The main changes for implementation of the History-Info header field are as follows:

1. The header field parameters "mp", "rc", and "np" were added to capture the specific method by which a target is determined.

2. A way to indicate a gap in the History-Info header field was added by using a "0" in the index.

3. To apply privacy, entries were anonymized rather than removed.

4. Many SHOULDs were changed into MUSTs to have a more reliable header.

Backward-compatibility aspects are discussed in Section 8 of this document.

2. Problem Statement

This section provides the baseline terminology used in the rest of the document and defines the scope of interworking between the Diversion header field and the History-Info header field.

There are many ways in which SIP signaling can be used to modify a session destination before it is established and many reasons for doing so. The behavior of the SIP entities that will have to further process the session downstream will sometimes vary depending on the reasons that led to changing the destination, for example, whether it is for a simple proxy to route the session or for an application server (AS) to provide a supplementary service. The Diversion header field and the History-Info header field differ in the approach and scope of addressing this problem.

For clarity, the following vocabulary is used in this document:

- Retarget/redirect: these terms refer to the process of a Proxy Server/User Agent Client (UAC) changing a Request-URI (Section 7.1 of [RFC3261]) in a request and thus changing the target of the request. This includes changing the Request-URI due to a location service lookup and redirect processing. This also includes internal (to a proxy/SIP intermediary) changes of the URI prior to forwarding of the request. The term "retarget" is defined in [RFC7044].

- Call forwarding/call diversion/communication diversion: these terms are equivalent and refer to the Communications Diversion (CDIV) supplementary services, based on the ISDN Communication diversion supplementary services and defined in 3GPP [TS_24.604]. They are applicable to entities that are intended to modify the original destination of an IP multimedia session during or prior to the session establishment.

This document does not intend to describe when or how History-Info or Diversion header fields should be used. Hereafter is provided clarification on the context in which the interworking is required.

The Diversion header field has exactly the same scope as the call diversion service, and each header field entry reflects a call diversion invocation. The Diversion header field is used for recording call forwarding information that could be useful to network entities downstream. Today, this SIP header field is implemented by several manufacturers and deployed in networks.

The History-Info header field is used to store all retargeting information, including call diversion information. As such, the History-Info header field [RFC7044] is used to convey call-diversion-related information by using a cause URI parameter [RFC4458] in the relevant entry.

Note, however, that the use of cause URI parameter [RFC4458] in a History-Info entry for a call diversion is specific to the 3GPP specification [TS_24.604]. [RFC4458] focuses on retargeting toward a voicemail server and does not specify whether the cause URI parameter should be added in a URI for other cases. As a consequence, implementations that do not use the cause URI parameter for call forwarding information are not considered for the mapping described in this document. Nevertheless, some recommendations are given in the next sections on how to avoid the loss of non-mapped information at the boundary between a network region using the History-Info header field and one using the Diversion header field.

[RFC7044] defines three header field parameters: "rc", "mp", and "np". The header field parameters "rc" and "mp" indicate the mechanism by which a new target for a request is determined. The header field "np" reflects that the target has not changed. All parameters contain an index whose value refers to the hi-index of the hi-entry, which contains a hi-targeted-to-uri that represents the Request-URI that was retargeted.

Since both header fields address call forwarding needs, diverting information could be mixed up or be inconsistent if both are present in an uncoordinated fashion in the INVITE request. So, Diversion and History-Info header fields must not independently coexist in the same session signaling. This document addresses how to convert information between the Diversion header field and the History-Info header field and when and how to preserve both header fields to cover additional cases.

For the transportation of consistent diversion information downstream, it is necessary to make the two header fields interwork. Interworking between the Diversion header field and the History-Info header field is introduced in Sections 5 and 6. Since the coexistence scenario may vary from one use case to another, guidelines regarding interaction of header fields are proposed in Section 3.

3. Interworking Recommendations

3.1. General Recommendations

Interworking function (IWF):

In a normal case, the network topology assumption is that the interworking described in this document should be performed by a specific SIP border device that is aware, by configuration, that it is at the border between two regions, one using the History-Info header field and one using the Diversion header field.

As the History-Info header field is a standard solution, a network using the Diversion header field must be able to provide information to a network using the History-Info header field. In this case, to avoid coexistence of header fields, it is required to replace, as often as possible, the Diversion header field with the History-Info header field in the INVITE request during the interworking.

Since, the History-Info header field has a wider scope than the Diversion header field, it may be used for needs and services other than call diversion. In addition, to trace call diversion information, the History-Info header field also acts as a session history and can store all successive Request-URI values. Consequently, even if it should be better to remove the History-Info header field after the creation of the Diversion header field to avoid confusion, the History-Info header field must remain unmodified in the SIP signaling if it contains supplementary (non-diversion) information. It is possible to have History-Info header fields that do not have values that can be mapped into the Diversion header field. In this case, no interworking with the Diversion header field should be performed, and it must be defined per implementation what to do in this case. This point is out of the scope of this document.

In conclusion, it is recommended to have local policies minimizing the loss of information and find the best way to keep it up to the terminating user agent.

The following sections describe the basic use cases. Additional interworking cases are described in Section 7.4.

3.2. Privacy Considerations

When a SIP message is forwarded to a domain for which the SIP intermediary is not responsible, a Privacy Service at the boundary of the domain applies the appropriate privacy based on the value of the Privacy header field in the message header or in the privacy parameter within the concerned header:

1. For the History-Info header field, it is the Privacy header field included as the "headers" component of the hi-targeted-to-uri in the individual hi-entries with the priv-value "history".

2. For the Diversion header field, it is the diversion-privacy parameter "privacy" in each Diversion header field.

For the History-Info header field, as recommended in [RFC7044]:

- If there is a Privacy header field in the message header of a request with a priv-value of "header" or "history", then all the hi-targeted-to-uris (in the hi-entries associated with the domain for which the SIP intermediary is responsible) are anonymized by the Privacy Service. The Privacy Service must change any hi-targeted-to-uri in these hi-entries that have not been anonymized to the anonymous SIP URI "anonymous@anonymous.invalid" as recommended in Sections 4.1.1.2 and 4.1.1.3 of [RFC3323].

- If there is a Privacy header field in the "headers" component of a hi-targeted-to-uri with a priv-value of "history", then all the concerned hi-entries must be anonymized as described above prior to forwarding.

The Privacy Service must remove the Privacy header field from the "headers" component of the hi-targeted-to-uris of the concerned hi-entries and the priv-value of "history" from the Privacy header field in the message header of the request prior to forwarding. If there are no remaining priv-values in the Privacy header field, the Privacy Service must remove the Privacy header field from the request.

For the Diversion header field:

- If there is a Privacy header field in the message header of a request with a priv-value of "header", then all the addresses in the Diversion header fields (associated with the domain for which the SIP intermediary is responsible) are anonymized by the Privacy Service by changing the address to the anonymous SIP URI "anonymous@anonymous.invalid" as recommended in Sections 4.1.1.2 and 4.1.1.3 of [RFC3323] prior to forwarding.

- For each Diversion header field or each entry in the Diversion header field, if there is a diversion-privacy parameter with a value set to "full", "uri", or "name", then the concerned Diversion header field address must be anonymized as described above prior to forwarding.

In the concerned Diversion header field entries, the diversion-privacy parameter must be removed from the header.

The privacy information interworking as described in Sections 5 and 6 must only be considered within a trusted domain that ensures correct application of the privacy requirements.

3.3. Headers in SIP Method

The recommended interworking presented in this document should apply only for INVITE requests.

In 3xx responses:

Both History-Info and Diversion header fields could be present in 3xx responses.

When a proxy wants to interwork with a network supporting the other header field, it should apply the interworking between Diversion header field and History-Info header field in the 3xx response.

When a recursing proxy redirects an initial INVITE after receiving a 3xx response, it should add as a last entry either a Diversion header field or a History-Info header field (according to its capabilities) in the forwarded INVITE. Local policies could apply regarding whether or not to send the received header field in the next INVITE.

In SIP responses other than 100:

All SIP responses where the History-Info header field could be present are not used for the call forwarding service and should not be changed into the Diversion header field. The destination network must be transparent to the received History-Info header field.

Note: The following mapping is inspired by the ISDN User Part (ISUP) to SIP interworking described in [TS_29.163].

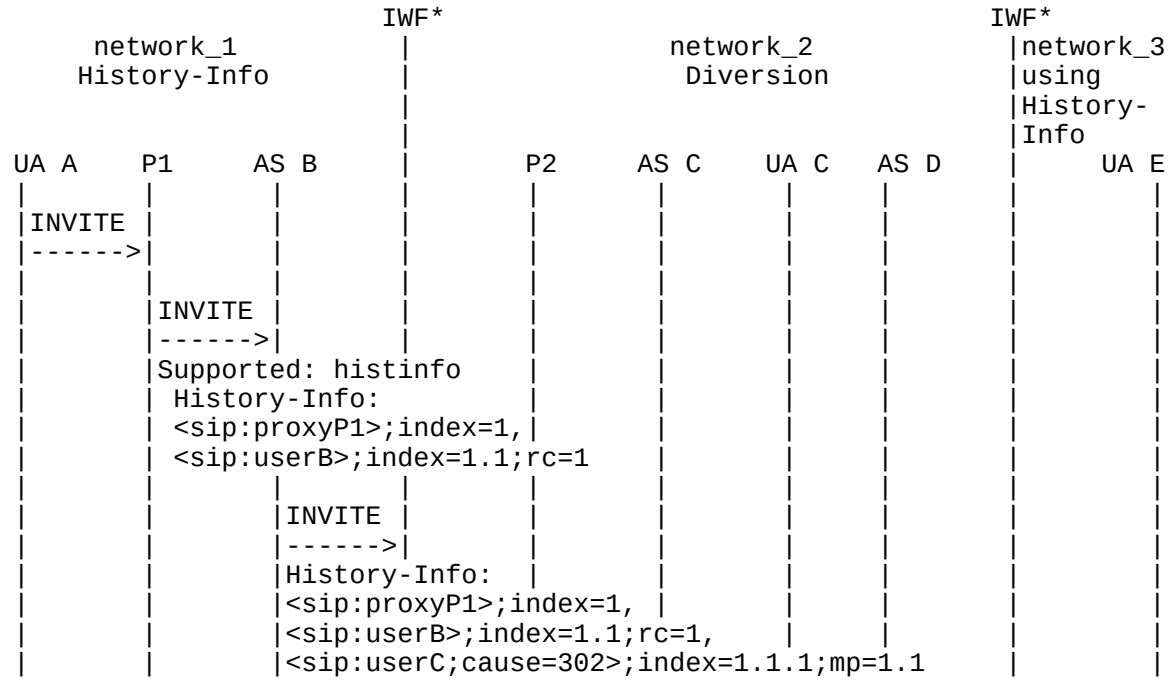
3.4. SIP Network/Terminal Using Diversion Header Field to SIP Network/ Terminal Using History-Info Header Field

When the Diversion header field is used to create a History-Info header field, the Diversion header field must be removed in the outgoing INVITE. It is assumed that all the information present in the Diversion header field is transferred in the History-Info header field.

If a History-Info header field is also present in the incoming INVITE (in addition to the Diversion header field), the Diversion header field and History-Info header field present must be mixed, and only the diversion information not yet present in the History-Info header

field must be inserted as a last entry (most recent) in the existing History-Info header field, following the creation process recommended in [RFC7044].

As an example, this could be the case of an INVITE coming from network_2 using the Diversion header field but previously passed through network_1 using the History-Info header field (or the network_2 uses History-Info header field to transport successive URI information) and going to network_3 using the History-Info header field.



In this case, the incoming INVITE contains a Diversion header field and a History-Info header field. Therefore, as recommended in this document, it is necessary to create, for network_3, a single History-Info header field gathering existing information from both the History-Info and the Diversion header fields received. Anyway, it is required that network_2 (i.e., IWF) remove the Diversion header field when the message is going to a network not using the Diversion header field. Then, network_3 could use call forwarding information that is present in a single header field and add its own diversion information if necessary.

Notes:

1. If a network is not able either to use only one header field each time or to maintain both header fields up to date, the chronological order cannot be certified.

2. It is not possible to have only a Diversion header field when the History-Info header field contains more than call diversion information. If previous policy recommendations are applied, the chronological order is respected as Diversion entries are inserted at the end of the History-Info header field taking into account the Diversion internal chronology.

3.5. SIP Network/Terminal Using History-Info Header Field to SIP Network/Terminal Using Diversion Header Field

When the History-Info header field is interpreted to create a Diversion header field, some precautions must be taken.

If the History-Info header field contains only call forwarding information, then it must be deleted after the interworking.

If the History-Info header field contains other information, then only the information of concern to the diverting user must be used to create entries in the Diversion header field, and the History-Info header field must be kept as received in the INVITE and forwarded downstream.

Note: The History-Info header field could be used for reasons other than call diversion services, for example, by a service that needs to know if a specific AS has yet been invoked in the signaling path. If the call is later forwarded to a network using the History-Info header field, it would be better not to lose history information due to passing though the network that only supports the Diversion header field. A recommended solution must not disrupt the standard behavior, and networks that do not implement the History-Info header field must be transparent to a received History-Info header field.

If a Diversion header field is present in the incoming INVITE (in addition to the History-Info header field), only diversion information present in the History-Info header field but not in the Diversion header field must be inserted from the last entry (most recent) into the existing Diversion header field as recommended in [RFC5806].

Note that the chronological order could not be certified. If previous policy recommendations are respected, this case should not happen.

Forking case:

> The History-Info header field enables the recording of sequential forking for the same served user. During an interworking from the History-Info header field to the Diversion header field, the History-Info entries containing a forking situation (with an incremented "index" parameter) could possibly be mapped if they contain a call forwarding "cause" parameter. The interworking entity could choose to create only a Diversion entry or not apply the interworking. The choice could be done according a local policy.

The same logic is applied for an interworking with Voicemail URI (see Appendix A).

4. Reminder of the Syntax for Header Fields

4.1. History-Info Header Field Syntax

The ABNF syntax [RFC5234] for the History-Info header field and header field parameters is as follows.

```
History-Info       = "History-Info" HCOLON hi-entry *(COMMA hi-entry)
hi-entry           = hi-targeted-to-uri *(SEMI hi-param)
hi-targeted-to-uri = name-addr
hi-param           = hi-index/hi-target-param/hi-extension
hi-index           = "index" EQUAL index-val
index-val          =  number *("." number)
number             =  [ %x31-39 *DIGIT ] DIGIT
hi-target-param    = rc-param / mp-param / np-param
rc-param           = "rc" EQUAL index-val
mp-param           = "mp" EQUAL index-val
np-param           = "np" EQUAL index-val
hi-extension       = generic-param
```

The ABNF definitions for "generic-param", "name-addr", "HCOLON", "COMMA", "SEMI", and "EQUAL" are from [RFC3261].

The History-Info header field is specified in [RFC7044]. The top-most History-Info entry (first in the list) corresponds to the oldest history information.

Cause URI parameter:

A hi-entry may contain a cause URI parameter expressing the diversion reason. This cause URI parameter is defined in [RFC4458]. The ABNF grammar [RFC5234] for the cause-param parameter is shown below as it has been subject to Erratum ID 1409 [Err1409] for [RFC4458]. The Status-Code is defined in [RFC3261].

cause-param = "cause=" Status-Code

The cause-param parameter is a SIP/SIPS URI parameter and should be inserted in the History-Info entry (URI) of the diverted-to user in case of call diversion as recommended in the 3GPP CDIV specification [TS_24.604]. The cause values used in the cause-param for the diverting reason are listed in [RFC4458]. Because it is a parameter dedicated to call forwarding service, its presence is used to determine that a hi-entry is a diverting user. More precisely, each diverting user is located in the hi-entry before the one containing a cause-param with cause value as listed in [RFC4458].

Reason header field:

The Reason header field defined in [RFC3326] should be escaped in the hi-entry of the diverting user when the call diversion is due to a received SIP response. The Reason header field contains a cause parameter set to the true SIP response code received (Status-Code).

Therefore, in case of call diversion due to a SIP response, both cause parameters should be used. The complexity is that these parameters could be used at the same time in the History-Info header field but not in the same hi-entry and not with the same meaning. Only the cause-param is dedicated to call diversion service. The ’cause’ Reason header field parameter is not taken into account in the mapping with a Diversion header field.

Target URI parameter:

[RFC4458] also defines the ’target’ URI parameter, which could be inserted in a Request-URI and consequently in the hi-targeted-to-uri. This parameter is used to keep the diverting user address in the downstream INVITE request in Voicemail URI implementation. As this information is already present in the hi-entries, the ’target’ URI parameter is not taken into account regarding the interworking with the Diversion header field. From the Diversion header field, it could be possible to create the

’target’ URI parameter in the hi-entries and/or in the Request-URI, but this possibility is based on local policies not described in this document.

Privacy header field:

A Privacy header field as defined in [RFC3323] could also be embedded in hi-entries with the ’history’ value defined in [RFC7044].

Index header field parameter:

The index parameter is a string of digits, separated by dots, to indicate the number of forward hops and retargets.

Note: A history entry could contain the "gr" parameter. Regardless of the rules concerning the "gr" parameter defined in [TS_24.604], which must be applied, this parameter has no impact on the mapping and must only be copied with the served user address.

Missing entry:

If the request clearly has a gap in the hi-entry (i.e., the last hi-entry and Request-URI differ), the entity adding a hi-entry must add a single index with a value of "0" (i.e., the non-negative integer zero) prior to adding the appropriate index for the action to be taken (e.g., Index=1.1.2.0.1). Prior to any application usage of the History-Info header field parameters, the SIP entity that processes the hi-entries must evaluate the hi-entries and determine if there are any gaps in them.

"histinfo" option tag:

According to [RFC7044], a proxy that receives a Request with the "histinfo" option tag in the Supported header field should return captured History-Info in subsequent, provisional, and final responses to the Request. The behavior depends upon whether or not the local policy supports the capture of History-Info.

Example:

History-Info:
<sip:diverting_user1_addr?Privacy=none&Reason=SIP%3Bcause%3D302>;
index=1,
<sip:diverting_user2_addr;cause=480?Privacy=history>;index=1.1;mp=1,
<sip:last_diversion_target;cause=486>;index=1.1.1;mp=1.1

4.2. Diversion Header Field Syntax

The following text is restating the exact syntax that the production rules in [RFC5806] define, but using ABNF [RFC5234]:

```
 Diversion           = "Diversion" HCOLON diversion-params
                                  *(COMMA diversion-params)
 diversion-params    = name-addr *(SEMI (diversion-reason /
                       diversion-counter / diversion-limit /
                       diversion-privacy / diversion-screen /
                       diversion-extension))
 diversion-reason    = "reason" EQUAL ("unknown" / "user-busy" /
                       "no-answer" / "unavailable" / "unconditional"
                       / "time-of-day" / "do-not-disturb" /
                       "deflection" / "follow-me" / "out-of-service"
                       / "away" / token / quoted-string)
 diversion-counter   = "counter" EQUAL 1*2DIGIT
 diversion-limit     = "limit" EQUAL 1*2DIGIT
 diversion-privacy   = "privacy" EQUAL ("full" / "name" / "uri" /
                       "off" / token / quoted-string)
 diversion-screen    = "screen" EQUAL ("yes" / "no" / token /
                       quoted-string)
 diversion-extension = token [EQUAL (token / quoted-string)]
```

Note: The Diversion header field could be used in the comma-separated format as described below and in a header-separated format. Both formats could be combined in a received INVITE as recommended in [RFC3261].

Example:

```
Diversion:
<sip:diverting_user2_addr>;reason=user-busy;counter=1;privacy=full,
<sip:diverting_user1_addr>;reason=unconditional;counter=1;privacy=off
```

5. Diversion Header Field to History-Info Header Field

The following text is valid only if no History-Info header field is present in the INVITE request. If at least one History-Info header field is present, the interworking function must adapt its behavior to respect the chronological order. For more information, see Section 3.

Concerning the privacy information in the Diversion header field, the following mapping only applies within a trusted domain; for other domains, see the privacy considerations in Section 3.2.

For N Diversion entries, N+1 History-Info entries must be created. To create the History-Info entries in the same order as during a session establishment, the Diversion entries must be mapped from the bottom-most to the top-most. Each Diversion entry shall be mapped into a History-Info entry. An additional History-Info entry (the last one) must be created with the diverted-to party address present in the Request-URI of the received INVITE. The mapping is described in the table below.

The first entry created in the History-Info header field contains:

- a hi-targeted-to-uri with the name-addr parameter of the bottom-most Diversion header field.
- if a privacy parameter is present in the bottom-most Diversion entry, then a Privacy header field must be escaped in the History-Info header field as described in the table below.
- a hi-index set to 1.

For each of the following Diversion entries (from bottom to top), the History-Info entries are created as follows (from top to bottom):

Source Diversion header component:	Destination History-Info header component:
name-addr	hi-targeted-to-uri
reason of the previous Diversion entry	cause URI parameter A cause-param "cause" is added in each hi-entry (except the first one)
"unknown"	404 (default 'cause' value)
"unconditional"	302
"user-busy"	486
"no-answer"	408
"deflection "	480 or 487
"unavailable"	503
"time-of-day"	404 (default)
"do-not-disturb"	404 (default)
"follow-me"	404 (default)
"out-of-service"	404 (default)
"away"	404 (default)

counter	hi-index
"1" or parameter not present	The previous created index is extended with ".1"
Superior to "1" (i.e., N)	Create N-1 placeholder History entry with the previous index extended with ".1" Then the History-Info header created with the Diversion entry with the previous index extended with ".1"
privacy	Privacy header escaped in the hi-targeted-to-uri
"full"	"history"
"Off"	Privacy header field absent or "none"
"name"	"history"
"uri"	"history"
	hi-target-param An mp-param "mp" is added in each created hi-entry (except the first one) The "mp" parameter is set to the index value of the preceding hi-entry.

A last History-Info entry is created and contains:

- a hi-targeted-to-uri with the Request-URI of the INVITE request.
- a cause-param from the top-most Diversion entry, mapped from the diversion-reason as described above.
- an index set to the previous created index extended with a new level ".1" added at the end.
- a hi-target-param set to "mp" equals to the index value of the previous hi-entry.

Notes:

1. For other optional Diversion parameters, there is no recommendation as the History-Info header field does not provide equivalent parameters.

2. For values of the diversion-reason that are mapped with a recommended default value, it could also be possible to choose another value. The cause-param URI parameter offers fewer possible values than the diversion-reason parameter. However, it has been considered that the cause-param values list was sufficient to implement CDIV service as defined in 3GPP [TS_24.604] as it covers a large portion of cases.

3. The Diversion header field can contain a "tel" URI as defined in [RFC3966] in the name-addr parameter. The History-Info header field can also contain an address that is a "tel" URI, but if this hi-entry has to be completed with either a SIP header field (e.g., Reason or Privacy) or a SIP URI parameter (e.g., 'cause' or 'target'), the "tel" URI must be converted into a SIP URI. [RFC3261] gives an indication as to the mapping between sip: and tel: URIs, but in this particular case, it is difficult to assign a valid hostport as the diversion occurred in a previous network and a valid hostport is difficult to determine. So, it is suggested that in case of "tel" URI in the Diversion header field, the History-Info header field should be created with a SIP URI with user=phone and a domain set to "unknown.invalid".

4. The Diversion header field allows carrying of a counter that retains the information about the number of successive redirections. History-Info does not have an equivalent because to trace and count the number of diversions, it is necessary to count the cause parameter containing a value associated to a call diversion listed in [RFC4458]. Reading the index value is not enough. With the use of the "placeholder" entry the History-Info header field, entries can reflect the real number of diversions that occurred, thanks to the cause-param.

Example of placeholder entry in the History-Info header field:

```
<sip:unknown@unknown.invalid;cause=xxx>;index=1.1

<sip:bob_addr;cause=404>;index=1.1.1;mp=1.1
```

"cause=xxx" reflects the diverting reason of a previous diverting user. For a placeholder hi-entry, the value "404" must be taken for the cause-param and so, located in the next hi-entry.

For recommendations for local policies regarding the coexistence of header fields in the INVITE request, see Sections 3 and 7.4.

6. History-Info Header Field to Diversion Header Field

Concerning the privacy information for the History-Info header field, the following mapping only applies within a trusted domain; for other domains, see the privacy considerations in Section 3.2.

To create the Diversion entries in the same order as during a session establishment, the History-Info entries must be mapped from the top-most to the bottom-most. The first History-Info header field entry selected will be mapped into the last Diversion header field entry and so on. One Diversion header field entry must be created for each History-Info entry that has cause-param with a value listed in [RFC4458].

Diversion information:

The definitions of "Target_entry" and "Diverting_entry" are included below to help readers understand the mapping of the History-Info header field.

The diversion information can be identified by finding the following hi-entries:

- Target_entry: hi-entries containing a cause-param URI parameter with a value listed in [RFC4458] will contain the diversion reason and the address of the target of the concerned call forwarding. Per [RFC7044], these hi-entries may also contain a hi-target-param set to "mp".

- Diverting_entry: For each previously identified hi-entry:

  * If there is an "mp" header field parameter, the hi-entry whose hi-index matches the value of the hi-target-param "mp" will contain the diverting party address, its possible privacy, and/or SIP reason when the retargeting has been caused by a received SIP response.

  * If there is no "mp" header field parameter, the information of the diverting party address, privacy and/or SIP reason will be found in the hi-entry that precede this identified hi-entry.

Note: Per [RFC7044], all retargeting entries must point to a hi-entry that contains an "mp" parameter, but for backward-compatibility reasons, it may be absent from some of the received hi-entries. See Section 8 for more information on backward compatibility.

The History-Info header field must be mapped into the Diversion header field as follows:

Source History-Info header component:	Destination Diversion header component:
hi-targeted-to-uri of the Diverting_entry.	name-addr
cause-param of the Target_entry	reason
404	"unknown" (default value)
302	"unconditional"
486	"user-busy"
408	"no-answer"
480 or 487	"deflection "
503	"unavailable"
hi-index Mandatory parameter for History-Info reflecting the chronological order of the information.	counter The counter is set to "1".
Privacy header field escaped in the hi-targeted-to-uri of the Diverting_entry "history"	privacy "full"
Privacy header field Absent or "none"	"Off"

Note: For other optional History-Info parameters, there is no recommendation as the Diversion header field does not provide equivalent parameters.

For recommendations for local policies regarding the coexistence of header fields in the INVITE request, see Section 3.

7. Examples

7.1. Example with Diversion Header Field Changed into History-Info Header Field

```
INVITE sip:last_diverting_target
Diversion:
<sip:diverting_user3_address>;reason=unconditional;counter=1;
privacy=off,
<sip:diverting_user2_address>;reason=user-busy;counter=1;
privacy=full,
<sip:diverting_user1_address>;reason=no-answer;counter=1;
privacy=off

Mapped into:

History-Info:
<sip:diverting_user1_address?Privacy=none>;index=1,
<sip:diverting_user2_address;
cause=408?Privacy=history>;index=1.1;mp=1,
<sip:diverting_user3_address;
cause=486?Privacy=none>;index=1.1.1;mp=1.1,
<sip:last_diverting_target;cause=302>;index=1.1.1.1;mp=1.1.1
```

7.2. Example with History-Info Header Field Changed into Diversion Header Field

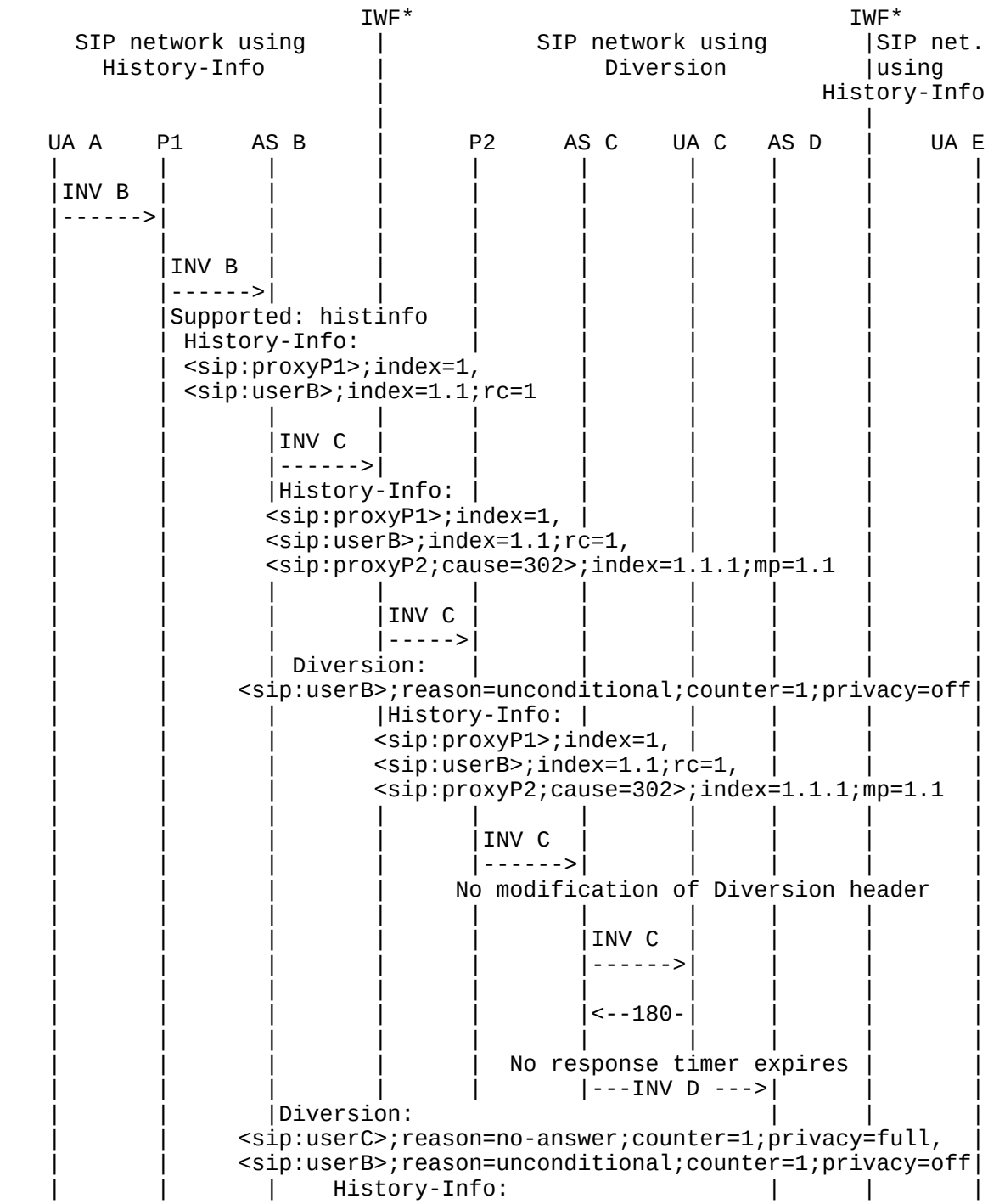
```
INVITE sip:last_diverting_target; cause=486
History-Info:
<sip:diverting_user1_address?Privacy=history>;index=1,
<sip:diverting_user2_address;cause=302?Privacy=none>;index=1.1;mp=1,
<sip:last_diverting_target;cause=486>;index=1.1.1;mp=1.1

Mapped into:

Diversion:
<sip:diverting_user2_address>;reason=user-busy;counter=1;privacy=off,
<sip:diverting_user1_address>;reason=unconditional;counter=1;privacy=
full
```

7.3. Example with Two SIP Networks Using History-Info Header Field Interworking with a SIP Network Using Diversion Header Field

```
A -> P1 -> B -> C -> P2 -> D-> E
A, B, C, D and E are users.
B, C and D have call forwarding service invoked.
P1 and P2 are proxies.
Only relevant information is shown on the following call flow.
```


IWF*
IWF*
SIP network using History-Info
SIP network using Diversion
SIP net. using History-Info
UA A
P1
AS B
P2
AS C
UA C
AS D
UA E
INV B
INV B
Supported: histinfo
History-Info:
<sip:proxyP1>;index=1,
<sip:userB>;index=1.1;rc=1
INV C
History-Info:
<sip:proxyP1>;index=1,
<sip:userB>;index=1.1;rc=1,
<sip:proxyP2;cause=302>;index=1.1.1;mp=1.1
INV C
Diversion:
<sip:userB>;reason=unconditional;counter=1;privacy=off
History-Info:
<sip:proxyP1>;index=1,
<sip:userB>;index=1.1;rc=1,
<sip:proxyP2;cause=302>;index=1.1.1;mp=1.1
INV C
No modification of Diversion header
INV C
<--180-
No response timer expires
---INV D --->
Diversion:
<sip:userC>;reason=no-answer;counter=1;privacy=full,
<sip:userB>;reason=unconditional;counter=1;privacy=off
History-Info:

Note: The IWF is an interworking function that could be a stand-alone equipment not defined in this document (it could be a proxy).

7.4. Additional Interworking Cases

Even for particular cases in which both header fields could coexist, it should be the responsibility of the network local policy to make it work together. This section describes some situations and some recommendations on behavior.

In the case where there is one network that includes different nodes, some of them supporting the Diversion header field and other ones supporting the History-Info header field, there is a problem when any node handling a message does not know the next node that will handle the message. This case can occur when the network has new and old nodes, the older ones using the Diversion header field and the most recent using the History-Info header field.

While a network replacement may be occurring, there will be a time when both nodes coexist in the network. If the different nodes are being used to support different subscriber types due to different

node capabilities, then the problem is more important. In this case, there is a need to pass both the History-Info header field and the Diversion header field within the core network.

These header fields need to be equivalent to ensure that, whatever the node receiving the message, the correct diversion information is received. This requires that, whatever the received header field, there is a requirement to be able to compare the header fields and to convert the header fields. Depending upon the node capability, it may be possible to make assumptions as to how this is handled.

- If it is known that the older Diversion header field supporting nodes does not pass on any received History-Info header field, then the interworking becomes easier. If a message is received with only Diversion header fields, then it has originated from an old node. The equivalent History-Info entries can be created, and these can then be passed as well as the Diversion header field.

- If the node creates a new History-Info header field for a call diversion, then an additional Diversion header field must be created.

- If the next node is an old node, then the Diversion header field will be used by that node, and the History-Info entries will be removed from the message when it is passed on.

- If the next node is a new node, then the presence of both the Diversion header field and History-Info header field means that interworking has already occurred and the Diversion and History-Info entries must be considered equivalent.

- If both nodes pass on both the History-Info header field and Diversion header field but only actively use one, then both types of nodes need to perform the interworking and must maintain equivalence between the header fields. This will eventually result in the use of the Diversion header field being deprecated when all nodes in the network support the History-Info header field.

- If a gap is identified in the History-Info header field by a node that would create a new entry, it shall add a single index with a value of "0" prior to adding the appropriate index for the action to be taken.

8. Backward Compatibility

Issues with backward compatibility are due to the evolution of the History-Info header field from [RFC4244] to [RFC7044], as described in Section 1.3 of this document. Backward compatibility is taken into account throughout this document for the interworking with the Diversion header field. More details are provided in the "Backwards Compatibility" section of [RFC7044].

9. Security Considerations

The security considerations in [RFC7044] and [RFC5806] apply.

The privacy considerations described in Section 3.2 apply.

The use of the Diversion header field or History-Info header field requires application of the requested privacy and integrity requested by each diverting user or entity. Without integrity, the requested privacy functions could be downgraded or eliminated, potentially exposing identity information. Without confidentiality, eavesdroppers on the network (or any intermediaries between the user and the Privacy Service) could see the very personal information that the user has asked the Privacy Service to obscure. Unauthorized insertion and deletion/modification of those header fields can provide misleading information to users and applications. A SIP entity that can provide a redirection reason in a History-Info header field or Diversion header field should be able to suppress this in accordance with privacy requirements of the user concerned.

10. References

10.1. Normative References

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10.2. Informative References

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[TS_29.163]
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Appendix A. Interworking between Diversion Header Field and Voicemail URI

Voicemail URI is a mechanism described in [RFC4458] to provide a simple way to transport only one redirecting user address and the reason why the diversion occurred in the Request-URI of the INVITE request. This mechanism is mainly used for call diversion to a voicemail.

A.1. Diversion Header Field to Voicemail URI

Received:
Diversion: userA-address;reason=user-busy;counter=1;privacy=full

Sent (Voicemail URI created in the R-URI line of the INVITE):
sip: voicemail@example.com;target=userA-address;cause=486 SIP/2.0

Mapping of the Redirection Reason is the same as for History-Info header field with a default value set to 404.

If the Diversion header field contains more than one Diversion entry, the choice of the redirecting user information inserted in the URI is in charge of the network local policy. For example, the choice criterion of the redirecting information inserted in the URI could be the destination of forwarded INVITE request (whether or note the voicemail serves this user).

Note: This interworking could be done in addition to the interworking of the Diversion header field into the History-Info header field.

A.2. Voicemail URI to Diversion Header Field

In case of real voicemail, this way of interworking should not happen. However, if for any reason it occurs, it is recommended to do it as follows:

Received:
INVITE sip: voicemail@example.com;\
target=sip:+33145454500%40example.com;user=phone;\
cause=302 SIP/2.0

Sent in the forwarded INVITE:
Diversion: sip:+33145454500%40example.com;user=phone;
reason=unconditional;counter=1

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