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A P-Served-User Header Field Parameter for Originating CDIV session case in Session Initiation Protocol (SIP)

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Abstract

The P-Served-User header field is used to convey the identity of the served user and the session case that applies to this particular communication session and application invocation. This document updates RFC5502 by defining a new P-Served-User header field parameter, "orig-cdiv". The parameter conveys the session case used by a proxy when handling an originating session after Call Diversion (CDIV) services have been invoked for the served user. This document also fixes the ABNF in RFC 5502 and provides more guidance for using the P-Served-User header field in IP networks.

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1. Introduction

1.1. General

The P-Served-User header field [RFC5502] was defined based on a requirement from 3rd Generation Partnership Project (3GPP) IMS (IP Multimedia Subsystem) in order to convey the identity of the served user, his/her registration state and the session case between an Serving Call Session Control Function (S-CSCF) and an Application Server (AS) on the IMS Service Control (ISC) interface. A session case is metadata that captures the status of the session of a served user: whether the served user is registered or not, and whether the session originates or terminates with the served user. For more information on session cases and the IMS, a detailed description can be found in [TS.3GPP.24.229].

[RFC5502] defines the originating and terminating session cases for a registered or unregistered user. This document extends the P-Served-User header field to include the session case for a forwarded leg when a call diversion service (CDIV) has been invoked and if an originating service of the diverting user has to be triggered.

The sessioncase-param parameter of the P-Served-User header field is extended with the "orig-cdiv" parameter for this "originating after CDIV" session case.

The following section defines usage of the "orig-cdiv" parameter of P-Served-User header field, Section 3 discusses the applicability and scope of this new header field parameter, and Section 4 specifies the proxy behavior for handling the new header field parameter. Section 5 clarifies some of the [RFC5502] procedures, Section 6 describes the extended syntax and corrects the syntax of [RFC5502], Section 8 registers the P-Served-User header field parameters with IANA, Section 7 gives some examples, and Section 9 discusses the security properties of the environment where this new header field parameter is intended to be used.

1.2. Basic Use Case

In the 3GPP IMS (IP Multimedia Subsystem), the S-CSCF (Serving CSCF) is a SIP proxy that serves as a registrar and handles originating and terminating session states for users assigned to it. This means that any call that is originated by a specific user or any call that is terminated to that specific user will pass through the S-CSCF that is assigned to that user.

At the moment that an S-CSCF is assigned to a specific user, the user profile is downloaded from the Home Subscriber Server (HSS) to this S-CSCF, see [TS.3GPP.29.228]. The user profile contains the list of actions to be taken by the S-CSCF for the served user depending on

the session direction (originating or terminating) and the user state (registered or not) in the IMS network. With this user profile, the S-CSCF determines the current case and applies the corresponding actions such as forwarding the request to an AS. The AS then goes through a similar process of determining who is the current served user, what is his/her "registration state", and what is the "session case" of the session. [RFC5502] defines all those parameters and in particular the originating and terminating session cases.

In basic call scenarios, there is no particular issue for the S-CSCF and AS to know which scenario needs to be realized, but in case of call diversion services for which the session is re-targeted, the session cases defined in [RFC5502] pose some limitations as described in the following section.

1.3. Problem Statement

In the case of a call diversion service, the received request is first treated as a terminating session case, and the terminating filter criteria configured in the S-CSCF are performed. A filter criteria is information in the user profile that determines whether an initial request is sent to a particular AS. When the AS receives the call initiation request, the AS is able to determine the served user and the session case (here "term") from the received P-Served-User header field content and to execute terminating services. When the call diversion service is executed (as a terminating service), the AS changes the target (Request-URI) of the session and a new call leg is created. This new call leg could be considered as an originating call leg from the diverting user but this is not the case. Indeed, the originating user remains the same, and some of the diverting user's originating services should not be triggered as if it was an originating call. For instance, the originating user identity should not be restricted because the diverting user has a privacy service for his/her own identity. The privacy of the diverting user should apply to information related to this user (eg. in the History-Info header field). In the same manner, some specific services will need to be triggered on the outgoing leg after a call diversion. Without a dedicated session case for originating after CDIV, the S-CSCF cannot trigger an originating service for the diverting user, nor can an AS execute the procedures for this particular session case.

For this use case, this document creates a new parameter for the originating after CDIV session case to be embedded in the P-Served-User header field.

2. Conventions and Terminology

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.

3. Applicability

The use of the P-Served-User header field extensions is only applicable inside a Trust Domain [RFC3324] for the P-Served-User header field. Nodes in such a Trust Domain explicitly trust each other to convey the served user and to be responsible for withholding that information outside of the Trust Domain. The means by which the network determines the served user and the policies that are executed for a specific served user is outside the scope of this document.

4. Proxy behavior and parameter handling

The following section illustrates how this header field parameter can be used in a 3GPP network.

For a terminating call, the following steps will be followed:

1. The S-CSCF receives the initial INVITE request for a terminating call and determines that the session case is for a terminating user as described in [RFC5502];

2. The S-CSCF determines who is the served user by looking at the Request-URI and saves the current Request-URI;

3. The S-CSCF analyzes the filter criteria. It then sends the request to the AS of the served user an INVITE that includes the P-Served-User header field with the "sescase" parameter set to "term" and the "regstate" set to the corresponding value in order to trigger execution of terminating services;

4. Based on some criteria, the AS concludes that the request has to be diverted to another target user or application. The AS replaces the received Request-URI with the new diverted-to address and the AS stores the successive Request-URI(s) values by adding one or two History-Info header field entry(ies) [RFC7044] in the outgoing INVITE. In the History-Info header field, the served user address is tagged using the mp-param header field parameter added in entry associated to the diverted-to address created. The AS forwards the INVITE request back to the S-CSCF;

5. When receiving back the INVITE request, the S-CSCF can see that the topmost Route header field contains its own hostname but the Request-URI does not match the saved Request-URI. In this case, the S-CSCF updates the P-Served-User header field content by replacing the "sescase" parameter with the "orig-cdiv" parameter. The P-Served-User header field value remains unchanged;

6. The S-CSCF forwards the INVITE request to an AS that hosts the originating services of the served user (diverting user) that need to be executed on the forwarded leg after a call diversion service;

7. When the AS receives the INVITE request, it determines that the session case is for "orig-cdiv" session case and performs the originating services to be executed after retargeting for the diverting user (i.e. served user).

5. Clarification of RFC5502 procedures

This document provides the following guidance for the handling of the P-Served-User header field that are missing in [RFC5502]:

- The P-Served-User header field MUST NOT be repeated within a request for a particular session at a particular time for the reason that session cases are mutually exclusive. This document updates [RFC5502] to clearly state that the P-Served-User header field MUST NOT contain multiple values either comma-separated or header-separated. This documents also updates the syntax of the header from [RFC5502] to reflect this uniqueness of parameters values.

- [RFC5502] does not clearly state what to do with the received P-Served-User header field when a call is diverted to another destination. This document highlights that there are several ways of handling the P-Served-User header field: the S-CSCF could store the previous "regstate" value and decide that the same value applies; or the "regstate" may no longer be relevant after a diverting service so the S-CSCF removes it; or the regstate could be combined with the orig-cdiv session case to provide different services depending on whether the served user is registered or unregistered. These choices are implementation dependent.

6. Syntax

6.1. General

[RFC5502] defines the P-Served-User header field with the sessioncase-param parameter "sescase" which is specified as having "orig" and "term" predefined values. This document defines an additional parameter for the sessioncase-param: "orig-cdiv".

Because this document extends the existing sessioncase-param parameter, and because errors have been identified in the syntax, this document corrects and extends the P-Served-User header field.

The extension of the sessioncase-param parameter to add the "orig-cdiv" session case is done in a way to fit the parameter format introduced in Release 11 of the 3GPP [TS.3GPP.24.229] and to maintain a backward compatibility.

"EQUAL", "HCOLON", "SEMI", "name-addr", "addr-spec", and "generic-param" are defined in [RFC3261].

6.2. ABNF

The augmented Backus-Naur Form (ABNF) [RFC5234] syntax of the P-Served-User header field is described in [RFC5502].

This document updates [RFC5502] to correct the P-Served-User header field ABNF syntax and extend it as following:

```
P-Served-User            = "P-Served-User" HCOLON PServedUser-value
                           *(SEMI served-user-param)
served-user-param        = sessioncase-param
                           / registration-state-param
                           / generic-param
PServedUser-value        = name-addr / addr-spec
sessioncase-param        = "sescase" EQUAL ("orig"/"term")/ orig-cdiv
registration-state-param = "regstate" EQUAL ("unreg" / "reg")
orig-cdiv                = "orig-cdiv"
```

Examples of possible P-Served-User header field:

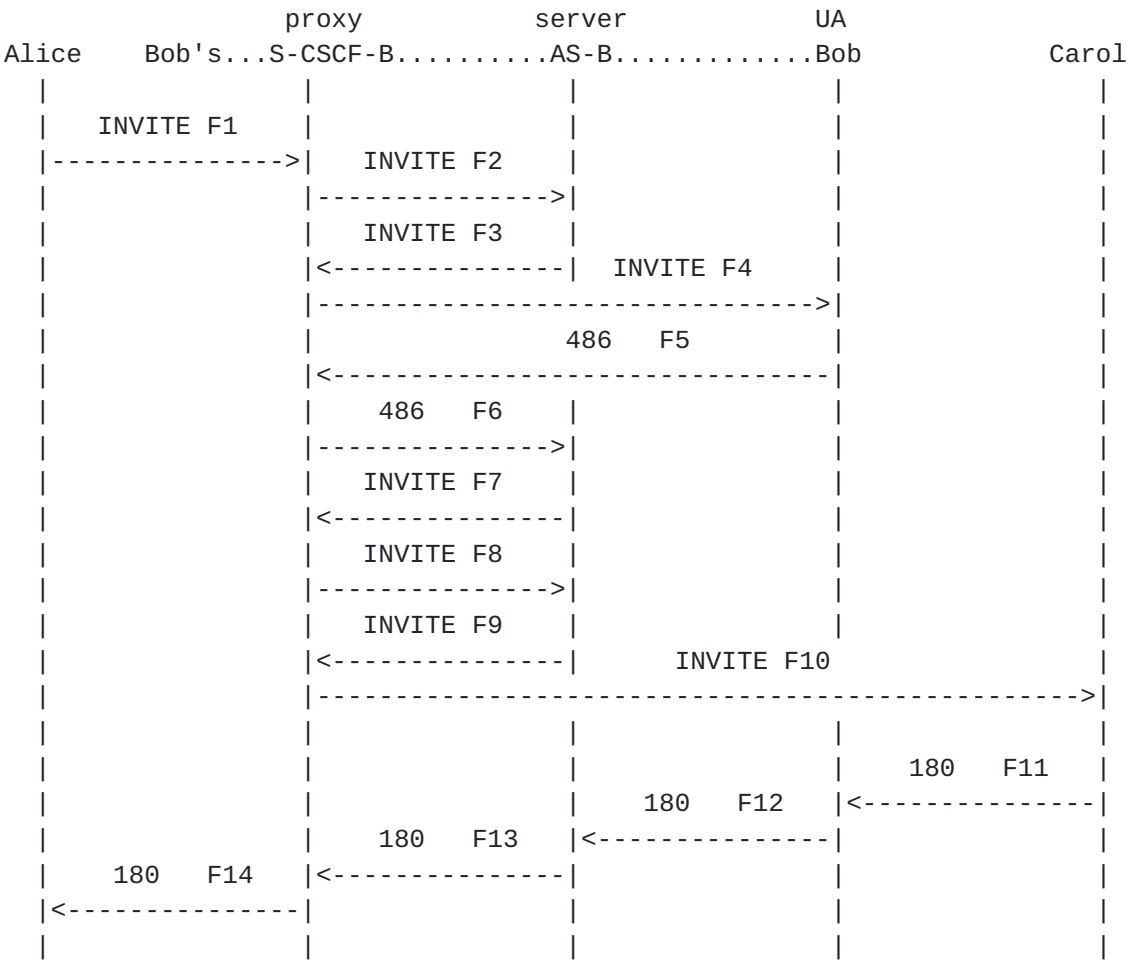
```
P-Served-User: <sip:user@example.com>; orig-cdiv; regstate=reg
or
P-Served-User: <sip:user@example.com>; orig-cdiv
or
P-Served-User: <sip:user@example.com>; sescase=term; regstate=unreg
```

This document allows choosing between addr-spec and name-addr when constructing the header field value. As specified in RFC 8217, the "addr-spec" form MUST NOT be used if its value would contain a comma, semicolon, or question mark [RFC8217].

7. Call Flow Examples

7.1. Call diversion case

The following call flow shows a session establishment when Alice calls Bob, who has a call diversion service that diverts to Carol when Bob is busy.



[Alice calls Bob]

F1 INVITE Alice -> S-CSCF-B
INVITE sip:bob@example.com SIP/2.0
From: Alice <sip:alice@domaina.com>;tag=1928301774
To: Bob <sip:bob@example.com>

```
   F2 INVITE S-CSCF-B -> AS-B
   INVITE sip:bob@example.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
        P-Served-User: <sip:bob@example.com>; term; regstate=reg

   F3 INVITE AS-B -> S-CSCF-B
   INVITE sip:bob@example.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
        P-Served-User: <sip:bob@example.com>; term; regstate=reg

   F4 INVITE S-CSCF-B -> Bob
   INVITE sip:bob@192.0.2.4 SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
        P-Served-User: <sip:bob@example.com>; term; regstate=reg

[Bob is busy. His call diversion when busy is invoked towards Carol]

   F5-F6 486 BUSY Bob -> S-CSCF-B  -> AS-B
   486 BUSY
    From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>;tag=es43sd

[Alice's call is diverted to Carol]

   F7 INVITE AS-B -> S-CSCF-B
   INVITE sip:carol@domainc.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
        P-Served-User: <sip:bob@example.com>; term; regstate=reg

[Forwarded leg to Carol is identified as an originating call after
diversion that should not trigger all Bob's originating services]

   F8 INVITE S-CSCF-B -> AS-B
   INVITE sip:carol@domainc.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
        P-Served-User: <sip:bob@example.com>; orig-cdiv; regstate=reg

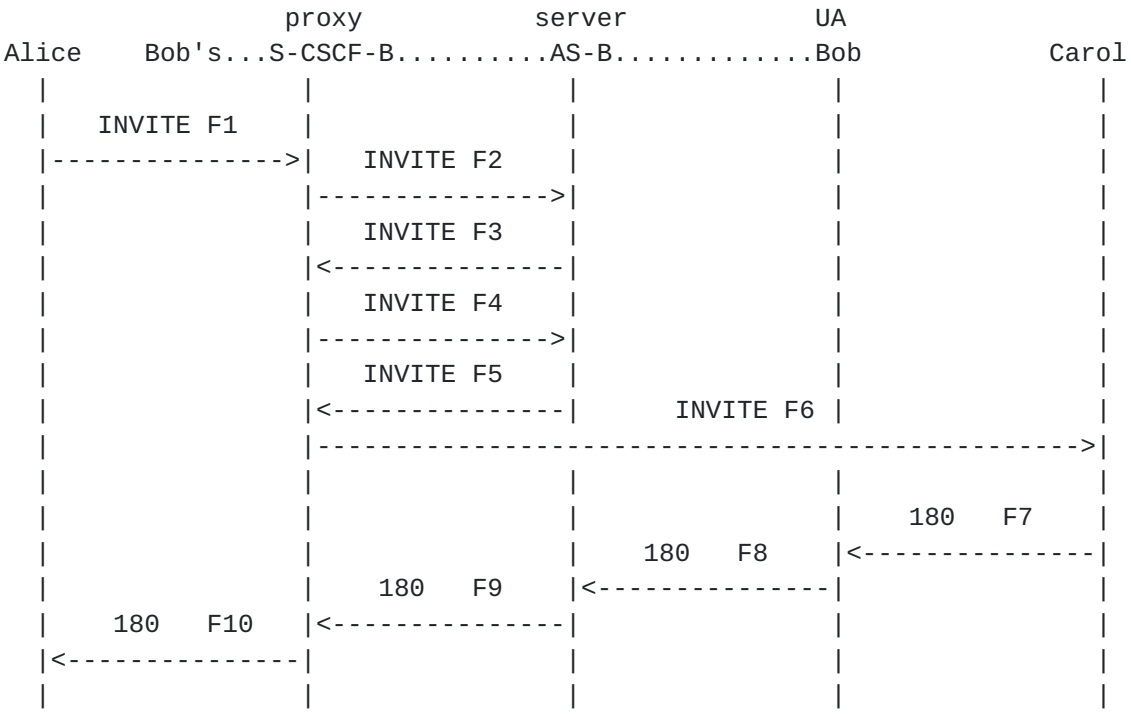
   F9 INVITE AS-B -> S-CSCF-B
   INVITE sip:carol@domainc.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
        P-Served-User: <sip:bob@example.com>; orig-cdiv; regstate=reg
```

```
   F10 INVITE S-CSCF-B -> Carol
   INVITE sip:carol@192.0.2.7 SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
```

Figure 1: P-Served-User during call diversion service

7.2. Call diversion and privacy

The following call flow shows a call diversion use case for which Alice has no identity restriction service and Bob has an unconditional call diversion service towards Carol and an identity presentation restriction service.



[Alice calls Bob]

```
   F1 INVITE Alice -> S-CSCF-B
   INVITE sip:bob@example.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
        Supported: histinfo

   F2 INVITE S-CSCF-B -> AS-B
   INVITE sip:bob@example.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Bob <sip:bob@example.com>
```

```
        P-Served-User: <sip:bob@example.com>; term; regstate=reg

[Bob's unconditional call diversion to Carol is triggered]

   F3 INVITE AS-B -> S-CSCF-B
   INVITE sip:carol@domainc.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Carol <sip:carol@domainc.com>
        P-Served-User: <sip:bob@example.com>; term; regstate=reg
        History-Info:
                <sip:bob@example.com>;index=1,
                <sip:carol@domainc.com;cause=302>;index=1.1;mp=1

[Alice's call is diverted to Carol]

   F4 INVITE S-CSCF-B -> AS-B
   INVITE sip:carol@domainc.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Carol <sip:carol@domainc.com>
        P-Served-User: <sip:bob@example.com>; orig-cdiv; regstate=reg
        History-Info:
                <sip:bob@example.com>;index=1,
                <sip:carol@domainc.com;cause=302>;index=1.1;mp=1

   F5 INVITE AS-B -> S-CSCF-B
   INVITE sip:carol@domainc.com SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Carol <sip:carol@domainc.com>
        P-Served-User: <sip:bob@example.com>; orig-cdiv; regstate=reg
        History-Info:
                <sip:bob@example.com?privacy=history>;index=1,
                <sip:carol@domainc.com;cause=302>;index=1.1;mp=1

[Forwarded leg to Carol is identified as an originating call after
diversion that allows to apply Bob's privacy request to his identity
within the Histroy-Info header field]

   F6 INVITE S-CSCF-B -> Carol
   INVITE sip:carol@192.0.2.7 SIP/2.0
        From: Alice <sip:alice@domaina.com>;tag=1928301774
        To: Carol <sip:carol@domainc.com>
        History-Info:
                <sip:bob@example.com?privacy=history>;index=1,
                <sip:carol@domainc.com;cause=302>;index=1.1;mp=1
                <sip:carol@192.0.2.7>;index=1.1.1;rc=1.1
```

Figure 2: P-Served-User when privacy requested

8. IANA Considerations

The syntax of the P-Served-User header field [RFC5502] is updated in Section 4 of this document.

This document requests IANA to update the existing row for the P-Served-User header field in the "Header Fields" sub-registry within the "Session Initiation Protocol (SIP) Parameters" registry:

Header Name	Compact Form	Reference
P-Served-User	none	[RFC5502][RFCXXXX]

Note to RFC Editor: Please replace XXXX with the RFC number of this document.

This document requests IANA to add new rows for the P-Served-User header field parameters in the "Header Field Parameters and Parameter Values" sub-registry within the "Session Initiation Protocol (SIP) Parameters" registry: as per the registry created by [RFC3968]:

Header Field	Parameter Name	Predefined Values	Reference
P-Served-User	sescase	Yes	[RFC5502]
P-Served-User	regstate	Yes	[RFC5502]
P-Served-User	orig-cdiv	No	[RFCXXXX]

Note to RFC Editor: Please replace XXXX with the RFC number of this document.

9. Security Considerations

The security considerations in [RFC5502] apply.

As the "orig-cdiv" parameter of P-Served-User header field can be used to trigger applications when a call is diverted , it is important to ensure that the parameter has not been added to the SIP message by an unauthorized SIP entity. Thus, the P-Served-User header field is to be used in a trusted environment and proxies MUST NOT insert the header unless they have sufficient knowledge that the route set includes another trusted proxy.

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