draft-penar-ietf-sipcore-00
SIPCORE
Internet-Draft
Expires: January, 2021

R. Penar
Microsoft

June 02, 2020

A Session Initiation Protocol (SIP) Response Code for Call Rating

Abstract

This document defines the 184 (Rated) Session Initiation Protocol (SIP) response code. This response code enables calling parties to learn an intermediary rated their call attempt. Depending on rating (e.g. Likely Scam), the call may be rejected or go unanswered. Through a 1xx code, the caller?s network may become aware future attempts to contact the same User Agent Server will likely go unanswered. The initial use case driving the need for a 184 response code is when the intermediary is an analytics engine. In this case, the rating is constructed via machine or other process. This contrasts with 607 (Unwanted) & 608 (Rejected) SIP response codes in which a human at target User Agent Server, or terminating network analytics,indicate the call may not completed. This document also defines use of a Call-Info header field in 184 responses to enable negatively rated callers to contact entities that rated their calls in error. This provides a remediation mechanism for legal callers who find their calls going unanswered (not necessarily blocked).

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on July 4, 2021.

Copyright Notice

Table of Contents

1. Introduction

The IETF has been addressing numerous issues surrounding how to handle unwanted and, depending on the jurisdiction, illegal calls [RFC5039]. Secure Telephone Identity Revisited (STIR) [RFC7340] and Signature-based Handling of Asserted information using toKENs (SHAKEN) [SHAKEN] address the cryptographic signing and attestation, respectively, of signaling to ensure the integrity and authenticity of the asserted caller identity.

This document describes a new Session Initiation Protocol (SIP) [RFC3261] response code, 184, which allows calling parties to learn that an intermediary rated their call. As described below, we

need a distinct indicator to signal how a call?s rating is being presented to the called party.

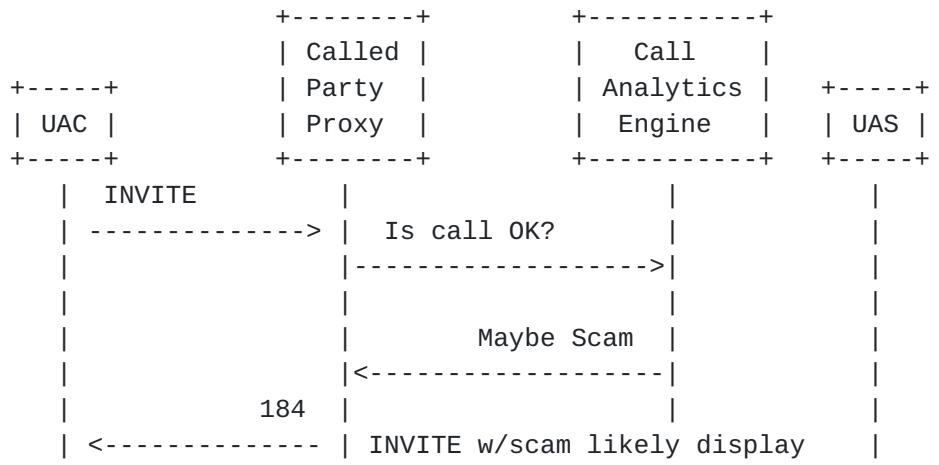
For example, a legitimate caller may call a user who observes the call is rated poorly, ?Likely Scam?. Thus, instead of answering the call, the called party simply does not answer the call.

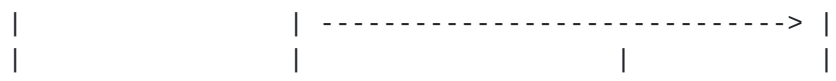
The 184 response code addresses this need of remediating incorrectly rated calls. Specifically, this code informs the SIP User Agent Client (UAC) an intermediary rated the call and provides a redress mechanism allowing callers (or their operator) to contact the operator of the intermediary.

For calls rated poorly from a legitimate caller, receiving a 184 response code can inform the caller to evaluate their calling procedures & patterns. Moreover, if a legitimate caller believes the user is ignoring their calls in error, they can use redress channels to contact the intermediary. For example, a pharmacy calls a user to alert them a prescription is available for pickup and the user mistakenly thinks the call is a scam, the pharmacy has a means of communicating with the intermediary to update the rating to increase chances of the specific pharmacy calls being answered in the future.

Many systems allow the user to mark the call unwanted (e.g., with the 607 response code) also allow the user to change their mind and unmark such calls. This mechanism is relatively easy to implement as the user usually has a direct relationship with the service provider that is blocking calls.

However, things become more complicated if an intermediary, such as a third-party provider of call management services that classifies calls based on the relative likelihood that the call is unwanted, misidentifies the call as unwanted. Figure 1 shows this case. Note that the UAS typically does receive an INVITE as the called party proxy rates the call on behalf of the user or network. In this situation, it would be beneficial for the caller to learn who rejected the call so they can correct the misidentification.





Caller either cancels request or leaves voicemail.

Figure 1: Rated (184) Ladder Diagram

It is useful for rated callers to have a redress mechanism. One can imagine some jurisdictions will require it. However, we must be mindful most of the calls intermediaries rate will, in fact, be illegal and should not be answered.

Why do we not use the same mechanism an analytics service provider offers their customers? Specifically, why not have the analytics service provider allow a calling party to correct calls rated in error? The reason is while there is an existing relationship between the customer (called party) and the analytics service provider, it is unlikely there is a relationship between the caller and the analytics service provider. Moreover, there are numerous call rating providers in the ecosystem. Therefore, we need a mechanism for indicating an intermediary rated a call that also provides contact information for the operator of that intermediary without exposing the target user's contact information.

The protocol described in this document uses existing SIP protocol mechanisms for specifying the rating and redress mechanism. In the Call-Info header field passed back to the UAC, we send additional information specifying rating and redress address. We choose to encode redress address using jCard [RFC7095]. As we will see later in this document, this information needs to have its own application-layer integrity protection. Thus, we use jCard rather than vCard [RFC6350], as we have a marshaling mechanism for creating a JavaScript Object Notation (JSON) [RFC8259] object, such as a jCard ,and a standard integrity format for such an object, namely, JSON Web Signature (JWS) [RFC7515]. The SIP community is familiar with this concept as it is the mechanism used by STIR [RFC8224].

Integrity protecting the jCard with a cryptographic signature might seem unnecessary at first, but it is essential to preventing potential network attacks. Section 6 describes the attack and why we sign the jCard in more detail.

2. 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. Protocol Operation

This section uses the term "intermediary" to mean the entity that acts as a SIP UAS on behalf of the user in the network as opposed to the user's UAS (usually, but not necessarily, their phone). The intermediary could be a back-to-back user agent (B2BUA) or a SIP Proxy.

Figure 4 shows an overview of the call flow for a rated call.

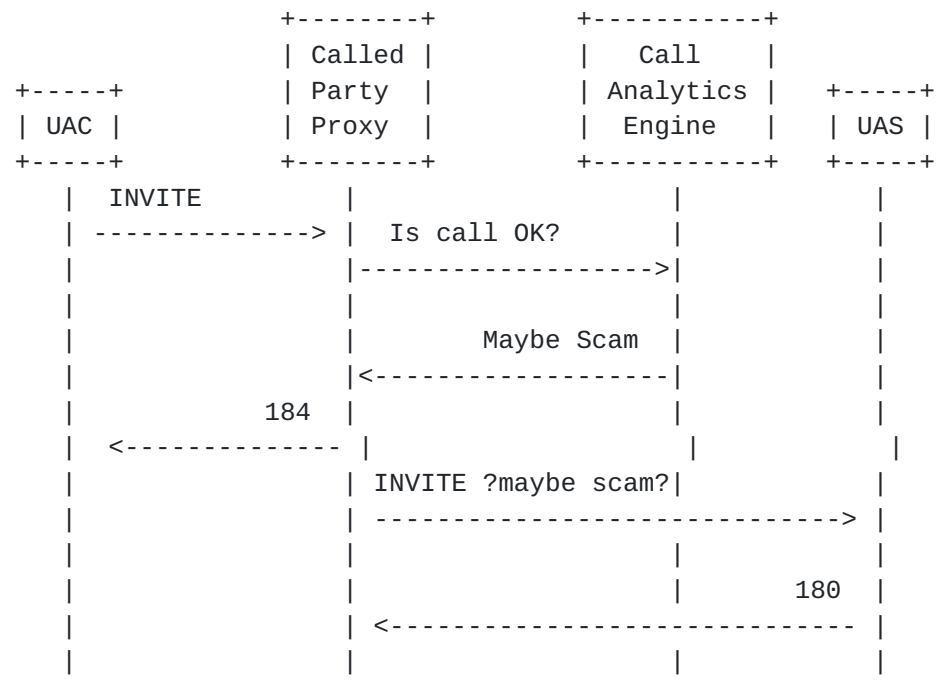


Figure 2: Rated (184) Ladder Diagram

3.1. Intermediary Operation

An intermediary MAY issue the 184 response code in a failure response for an INVITE request to indicate an intermediary rated the offered communication negatively (e.g. likely scam) or positively (e.g. verified caller or Calling Name). An intermediary MAY issue the 184 as the value of the "cause" parameter of a SIP reason-value in a Reason header field [RFC3326].

If an intermediary issues a 184 code and there are no indicators the calling party will use the contents of the Call-Info header field for malicious purposes (see Section 6), the intermediary MUST include a Call-Info header field in the response.

If there is a Call-Info header field, it MUST have the "purpose" parameter of "jwscard". The value of the Call-Info header field MUST refer to a valid JSON Web Signature (JWS) [RFC7515] encoding of a jCard [RFC7095] object. The following section describes the construction of the JWS.

3.2. JWS Construction

The intermediary constructs the JWS of the jCard as follows.

3.2.1. JOSE Header

The Javascript Object Signing and Encryption (JOSE) header MUST include the typ, alg, and x5u parameters from JWS [RFC7515]. The typ parameter MUST have the value "vcard+json". Implementations MUST support ES256 as JSON Web Algorithms (JWA) [RFC7518] defines it and MAY support other registered signature algorithms. Finally, the x5u parameter MUST be a URI that resolves to the public key certificate corresponding to the key used to digitally sign the JWS.

3.2.2. JWT Payload

The payload contains two JSON values. The first JSON Web Token (JWT) claim which MUST be present is the "iat" (issued at) claim [RFC7519]. The "iat" MUST be set to the date and time of the issuance of the 184 response. This mandatory component protects the response from replay attacks.

The second JWT claim which MUST be present is the "jcard" claim. The value of the jcard [RFC7095] claim is a JSON array conforming to the JSON jCard data format defined in [RFC7095]. Section 5.3 describes the registration. In the construction of the jcard claim, the "jcard" MUST include at least one of the URL, EMAIL, TEL, or ADR Properties. The Integer Property, specifically used to signal rating class, MUST also be included. Integer values are defined as; ?1?(negative rating) and ?2?(positive rating). UACs supporting this specification MUST be prepared to receive a full jCard. Call originators (at the UAC) can use the information returned by the jCard to contact the intermediary which rejected the call and appeal the intermediary's rating of the call attempt. What the intermediary does if the rated caller contacts the intermediary is outside the scope of this document.

3.2.3. JWS Signature

JWS [RFC7515] specifies the procedure for calculating the signature over the jCard JWT. Section 4 of this document has a detailed example on constructing the JWS, including the signature.

3.3. UAC Operation

A UAC conforming to this specification MUST include the sip.184 feature-capability indicator in the Feature-Caps header field of the INVITE request.

Upon receiving a 184 response, UACs perform normal SIP processing for 1xx responses.

As for the disposition of the jCard itself, the UAC MUST check the "iat" claim in the JWT. As noted in Section 3.2.2, we are concerned about replay attacks. Therefore, the UAC MUST reject jCards that come with an expired "iat". The definition of "expired" is a matter of local policy. A reasonable value would be on the order of one minute due to account for clock drift.

3.4. Legacy Interoperation

If the UAC indicates support for 184 and the intermediary issues a 184, life is good, as the UAC will receive all the information it needs to remediate an erroneous rating by an intermediary. However, what if the UAC does not understand 184? For example, how can we support callers from a legacy, non-SIP, public-switched network connecting to the SIP network via a media gateway?

We address this situation by having the first network element that conforms with this specification play an announcement for negatively rated call attempts. See Section 3.5 for requirements on the announcement. The simple rule is a network element that inserts the sip.184 feature capability MUST be able to convey at a minimum the call was rated negatively and how to contact the operator of the intermediary that rated the call attempt.

The degenerate case is the intermediary is the only element that understands the semantics of the 184 response code. Obviously, any SIP device will understand that a 184 response code is a 1xx response. However, there are no other elements in the call path that understand the meaning of the value of the Call-Info header field. The intermediary knows this is the case as the INVITE request will not have the sip.184 feature capability. In this case, one can consider the intermediary to be the element "inserting" a virtual sip.184 feature capability. If the caveats described in Sections 3.5 and 6 do not hold, the intermediary MUST play the announcement.

Now we take the case where a network element that understands the 184 response code receives an INVITE for further processing. A network element conforming with this specification MUST insert the sip.184 feature capability per the behaviors described in Section 4.2 of [RFC6809].

Note even if a network element plays an announcement describing the contents of the 184 response message, the network element MUST forward the 184 response code message as a progress response to the INVITE.

One aspect of using a feature capability is that only the network elements that will either consume (UAC) or play an announcement (media gateway, session border controller (SBC) [RFC7092], or proxy) need to understand the sip.184 feature capability. If the other network elements conform to Section 16.6 of [RFC3261], they will

pass header fields such as "Feature-Caps: *;+sip.184" unmodified and without need for upgrade.

Because the ultimate disposition of the call attempt MAY be a 100-class response (assuming call goes unanswered due to negative rating), the network element conveying the announcement in the legacy direction MUST use the 183 Session Progress response to establish the media session. The 183 to provide the announcement SHOULD be performed prior to forwarding 180 ringing. While playing the announcement, the intermediary MUST suppress additional 180 and 183 progress messages. Because of the small chance the UAC is an extremely old legacy device and is using UDP, the UAC MUST include support for 100rel [RFC3262] in its INVITE, the network element conveying the announcement MUST Require 100rel in the 183, and the UAC MUST issue a Provisional Response ACKnowledgement(PRACK) to which the network element MUST respond 200 OK PRACK.

3.5. Announcement Requirements

There are a few requirements on the element handling the announcement for legacy interoperation.

As noted above, the element inserting the sip.184 feature capability is responsible for conveying the information referenced by the Call-Info header field in the 184 response message. However, this specification does not mandate how to convey that information.

Let us take the case where a telecommunications service provider controls the element inserting the sip.184 feature capability. It would be reasonable to expect the service provider would play an announcement in the media path towards the UAC (caller). It is important to note the network element should be mindful of the media type requested by the UAC as it formulates the announcement. For example, it would make sense for an INVITE that only indicated audio codecs in the Session Description Protocol (SDP) [RFC4566] to result in an audio announcement. Likewise, if the INVITE only indicated real-time text [RFC4103] and the network element can render the information in the requested media format, the network element should send the information in a text format.

It is also possible for the network element inserting the sip.184 feature capability to be under the control of the same entity that controls the UAC. For example, a call center might have legacy UACs, but have a modern outbound calling proxy that understands the full semantics of the 184 response code. In this case, it is enough for the outbound calling proxy to digest the Call-Info information and handle the information digitally rather than "transcoding" the Call-Info information for presentation to the caller.

4. Examples

These examples are not normative, do not include all protocol elements, and may have errors. Review the protocol documents for actual syntax and semantics of the protocol elements.

4.1. Full Exchange

Given an INVITE, shamelessly taken from [SHAKEN], with the line breaks in the Identity header field for display purposes only:

```
INVITE sip:+12155550113@tel.one.example.net SIP/2.0
Max-Forwards: 69
Contact: <sip:+12155550112@[2001:db8::12]:50207;rinstance=9da3088f3>
To: <sip:+12155550113@tel.one.example.net>
From: "Alice" <sip:+12155550112@tel.two.example.net>;tag=614bdb40
Call-ID: 79048YzkxNDA5NTI1MzA0OWFjOTFkMmFlODhiNTI2OWQ1ZTI
P-Asserted-Identity: "Alice"<sip:+12155550112@tel.two.example.net>,
    <tel:+12155550112>
CSeq: 2 INVITE
Allow: SUBSCRIBE, NOTIFY, INVITE, ACK, CANCEL, BYE, REFER, INFO,
    MESSAGE, OPTIONS
Content-Type: application/sdp
Date: Tue, 16 Aug 2016 19:23:38 GMT
Feature-Caps: *;+sip.184
Identity: eyJhbGciOiJFUzI1NiIsInR5cCI6InBhc3Nwb3J0IiwicHB0Ijoic2hha2V
uIiwieDV1IjoiaHR0cDovL2NlcnQuZXhhbXBsZTIubmV0L2V4YW1wbGUuY2VydCJ9.eyJ
hdHRlc3QiOiJBIiwiZGVzdCI6eyJ0biI6IisxMjE1NTU1MDExMyJ9LCJpYXQiOiIxNDcx
Mzc1NDE4Iiwib3JpZyI6eyJ0biI6IisxMjE1NTU1MDExMiJ9LCJvcmlnaWQiOiIxMjNlN
DU2Ny1lODliLTEyZDMtYTQ1Ni00MjY2NTU0NDAwMCJ9.QAht_eFqQlaoVrnEV56Qly-OU
tsDGifyCcpYjWcaR661Cz1hutFH2BzIlDswTahO7ujjqsWjeoOb4h97whTQJg;info=
<http://cert.example2.net/example.cert>;alg=ES256
Content-Length: 153

v=0
o=- 13103070023943130 1 IN IP6 2001:db8::177
c=IN IP6 2001:db8::177
t=0 0
m=audio 54242 RTP/AVP 0
a=sendrecv
```

An intermediary could reply:

```
SIP/2.0 184 Rated
Via: SIP/2.0/UDP [2001:db8::177]:60012;branch=z9hG4bK-524287-1
From: "Alice" <sip:+12155550112@tel.two.example.net>;tag=614bdb40
To: <sip:+12155550113@tel.one.example.net>
Call-ID: 79048YzkxNDA5NTI1MzA0OWFjOTFkMmFlODhiNTI2OWQ1ZTI
CSeq: 2 INVITE
Call-Info: <https://rated.example.net/complaint-jws>;purpose=jwscard
```

The location https://rated.example.net/complaint-jws resolves to a JWS. One would construct the JWS as follows.

The JWS header of this example jCard could be:

```
{ "alg":"ES256",
  "typ":"vcard+json",
  "x5u":"https://certs.example.net/rated_key.cer"
}
```

Now, let us construct a minimal jCard. For this example, the jCard refers the caller to an email address, remediation@rated.example.net:

```
["vcard",
  [
    ["version", {}, "text", "4.0"],
    ["fn", {}, "text", "Call Rating Adjudication"],
    ["email", {"type":"work"}, "text",
     "remediation@rated.example.net"]
  ]
]
```

With this jCard, we can now construct the JWT:

```
{
  "iat":1546008698,
  "jcard":["vcard",
    [
      ["version", {}, "text", "4.0"],
      ["fn", {}, "text", "Call Rating Adjudication"],
      ["email", {"type":"work"},
       "text", "remediation@rated.example.net"],
      ["rating-class",{},"integer", 1]
    ]
  ]
}
```

To calculate the signature, we need to encode the JSON Object Signing and Encryption (JOSE) header and JWT using base64url encoding. As an implementation note, one can trim whitespace in the JSON objects to save a few bytes. UACs MUST be prepared to receive pretty-printed,compact, or bizarrely formatted JSON. For the purposes of this example, we leave the objects with pretty whitespace. Speaking of pretty vs. machine formatting, these examples have line breaks in the base64url encodings for ease of publication in the RFC format. The specification of base64url allows for these line breaks, and the decoded text works just fine. However, those extra line-break octets would affect the calculation of the signature. Implementations MUST NOT insert line breaks into the base64url encodings of the JOSE header or JWT. This also means UACs MUST be prepared to receive arbitrarily long octet streams from the URI referenced by the Call-Info header field.

base64encoding of JOSE header:

```
eyAiYWxnIjoiRVMyNTYiLAogICAgICJ0eXAiOiJ2Y2FyZCtqc29uIiwKICAgICAieDV1
IjoiaHR0cHM6Ly9jZXJ0cy5leGFtcGxlLm5ldC9yYXRlZF9rZXkuY2VyIgogICB9Cg==
```

base64encoding of JWT:

```
ewogICAgICJpYXQiOjE1NDYwMDg2OTgsCiAgICAgImpjYXJkIjpbInZjYXJkIiwKICAg
ICAgIFsKICAgICAgICAgWyJ2ZXJzaW9uIiwge30sICJ0ZXh0IiwgIjQuMCJdLAogICAg
ICAgICBbImZuIiwge30sICJ0ZXh0IiwgIkNhbGwgUmF0aW5nIEFkanVkaWNhdGlvbiJd
LAogICAgICAgICBbImVtYWlsIiwgeyJ0eXBlIjoid29yayJ9LAogICAgICAgICAgInRl
eHQiLCAicmVtZWRpYXRpb25AcmF0ZWQuZXhhbXBsZS5uZXQiXSwKCSAgW+KAnHJhdGlu
Zy1jbGFzc+KAnSx7fSzigJxpbnRlZ2Vy4oCdLCAxXQogICAgICAgXQogICAgIF0KICAg
fQ==
```

Note the object to sign is a single long line. Above line breaks are for ease of review and do not appear in actual object to sign.

We use the X.509 PKCS #8-encoded Elliptic Curve Digital Signature Algorithm (ECDSA) key, also shamelessly taken from [SHAKEN], as an example key for signing the hash of the above text.

Please do NOT use this key in real life! It is for example purposes only. We strongly recommend encrypting your key at rest.

-----Example object to sign / Base 64 Jose + JWT-----

```
 eyAiYWxnIjoiRVMyNTYiLAogICAgICJ0eXAiOiJ2Y2FyZCtqc29uIiwKICAgICAieDV
 1IjoiaHR0cHM6Ly9jZXJ0cy5leGFtcGxlLm5ldC9yYXRlZF9rZXkuY2VyIgp9CnsKIC
 AgICAiaWF0IjoxNTQ2MDA4Njk4LAogICAgICJqY2FyZCI6WyJ2Y2FyZCIsCiAgICAgI
 CBbCiAgICAgICAgIFsidmVyc2lvbiIsIHt9LCAidGV4dCIsICI0LjAiXSwKICAgICAg
 ICAgWyJmbiIsIHt9LCAidGV4dCIsICJDYWxsIFJhdGluZyBBZGp1ZGljYXRpb24iXSw
 KICAgICAgICAgWyJlbWFpbCIsIHsidHlwZSI6IndvcmsifSwKICAgICAgICAgICJ0ZX
 h0IiwgInJlbWVkaWF0aW9uQHJhdGVkLmV4YW1wbGUubmV0Il0sCgkgIFvigJxyYXRpb
 mctY2xhc3PigJ0se30s4oCcaW50ZWdlcuKAnSwgMV0KICAgICAgIF0KICAgICBdCiAg
 IH0=
```

```
-----BEGIN PRIVATE KEY-----
MIGHAgEAMBMGByqGSM49AgEGCCqGSM49AwEHBG0wawIBAQQgi7q2TZvN9VDFg8Vy
qCP06bETrR2v8MRvr89rn4i+UAahRANCAAQWfaj1HUETpoNCrOtp9KA8o0V79IuW
ARKt9C1cFPkyd3FBP4SeiNZxQhDrD0tdBHls3/wFe8++K2FrPyQF9vuh
-----END PRIVATE KEY-----
```

```
-----BEGIN PUBLIC KEY-----
MFkwEwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAE8HNbQd/TmvCKwPKHkMF9fScavGeH
78YTU8qLS8I5HLHSSmlATLcslQMhNC/OhlWBYC626nIlo7XeebYS7Sb37g==
-----END PUBLIC KEY-----
```

The resulting JWS, using the above key on the above object, renders the following ECDSA P-256 SHA-256 digital signature.

```
 3045022100d6ac15779808d4d6c99082a85fd129ff5faac25ba96dbef5d615f3586
```

```
 a7c5060022077e450ebd83cf04a9e74a4858b592fe92cf682d487ead8e74c8d624a
 f8f2c5a4
```

The JWS would be stored at https://rated.example.net/complaint-jws

4.2. Web Site jCard

For an intermediary that provides a Web site for adjudication, the jCard could contain the following. Note that we do not show the calculation of the JWS; the URI reference in the Call-Info header field would be to the JWS of the signed jCard.

```
["vcard",
  [
    ["version", {}, "text", "4.0"],
    ["fn", {}, "text", "Rated Call Adjudication"],
    ["url", {"type":"work"},
     "text", "https://rated.example.net/adjudication-form"],
    [?rating-class?,{},?integer?, 1]
  ]
]
```

4.3. Multi-modal jCard

For an intermediary that provides a telephone number and a postal address, the jCard could contain the following. Note that we do not show the calculation of the JWS; the URI reference in the Call-Info header field would be to the JWS of the signed jCard.

```
["vcard",
  [
    ["version", {}, "text", "4.0"],
    ["fn", {}, "text", "Rated Call Adjudication"],
    ["adr", {"type":"work"}, "text",
      ["Argument Clinic",
       "12 Main St","Anytown","AP","000000","Somecountry"]
    ]
    ["tel", {"type":"work"}, "uri", "tel:+1-555-555-0112"],
  [?rating-class?,{},?integer?, 1]
  ]
]
```

Note that it is up to the UAC to decide which jCard contact modality, if any, it will use.

4.4. Legacy Interoperability

Figure 5 depicts a call flow illustrating legacy interoperability. In this non-normative example, we see a UAC that does not support the full semantics for 184. However, there is an SBC that does support 184. Per [RFC6809], the SBC can insert "*;+sip.184" into the Feature-Caps header field for the INVITE. When the

intermediary, labeled "Called Party Proxy" in the figure, rates the call, it knows it can simply perform the processing described in this document. Since the intermediary saw the sip.184 feature capability, it knows it does not need to send any media describing whom to contact in the event of an erroneous rating. The SBC in this case does not proxy additional progress messages to allow for full announcement playback, unless/until a final response is received and announcment is interupted if not complete.
For illustrative purposes, the figure shows generic SIP Proxies in the flow. Their presence or absence or the number of proxies is not relevant to the operation of the protocol. They are in the figure to show that proxies that do not understand the sip.184 feature capability can still participate in a network offering 184 services.

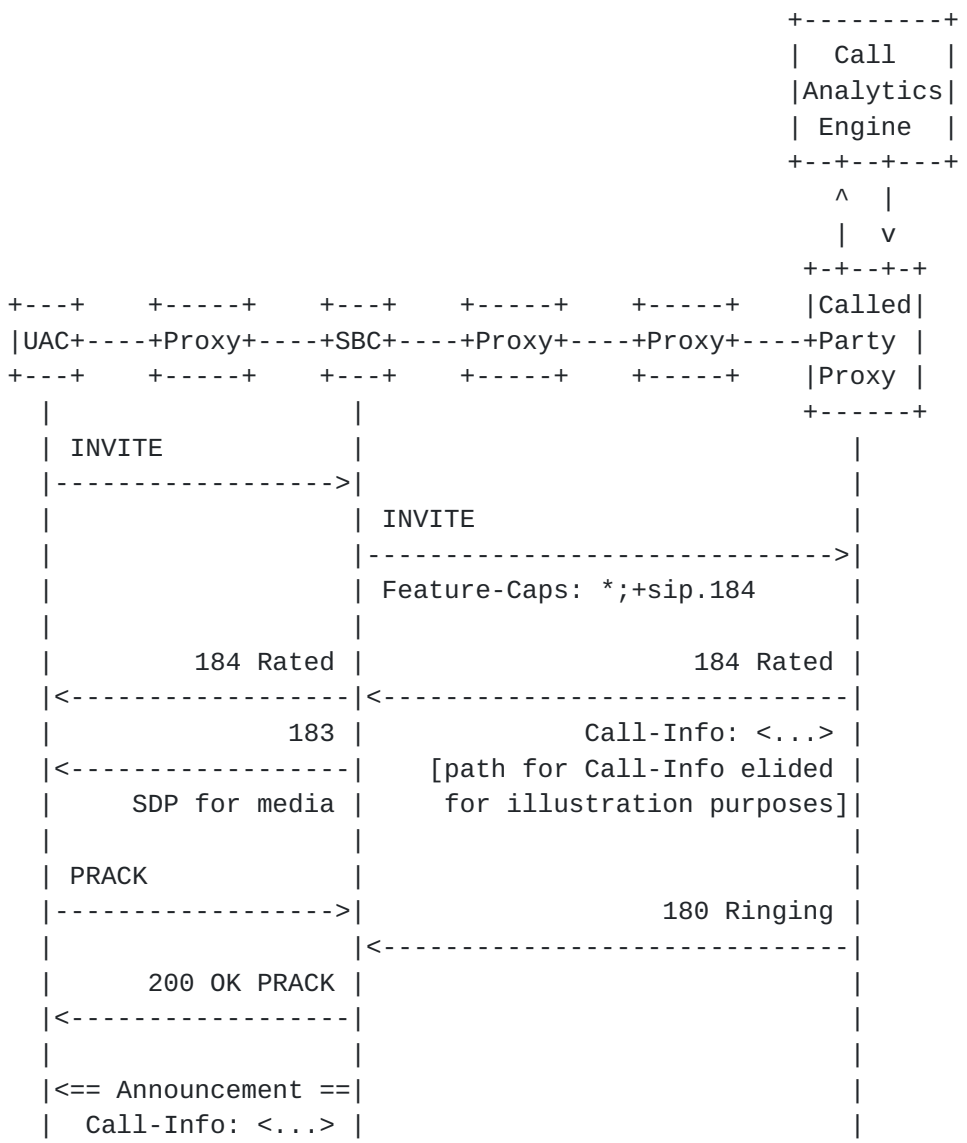


Figure 3: Legacy Operation

When the SBC receives the 184 response code, it correlates that with the original INVITE from the UAC. The SBC remembers it inserted

the sip.184 feature capability, which means it is responsible for somehow alerting the UAC the call is rated and disclosing whom to contact. At this point, the SBC can play a prompt, either natively or through a mechanism such as NETANN [RFC4240], that sends the relevant information in the appropriate media to the UAC. Since this is a potentially long transaction and there is a chance the UAC is using an unreliable transport protocol, the UAC will have indicated support for provisional responses, the SBC will indicate it requires a PRACK from the UAC in the 183 response, the UAC will provide the PRACK, and the SBC will acknowledge receipt of the PRACK before playing the announcement.

As an example, the SBC could extract the FN and TEL jCard fields and play something like a special information tone (see Section 6.21.2.1 of Telcordia [SR-2275] or Section 7 of ITU-T E.180 [ITU.E.180.1998]), followed by "Your call has been rated as spam by...", followed by a text-to-speech translation of the FN text, followed by "You can reach them on...", followed by a text-to-speech translation of the telephone number in the TEL field.

Note that the SBC also still sends the full 184 response code, including the Call-Info header field, towards the UAC.

5. IANA Considerations

5.1. SIP Response Code

This document defines a new SIP response code, 184, in the "Response Codes" subregistry of the "Session Initiation Protocol (SIP) Parameters" registry defined in [RFC3261].

Response code:	184
Description:	Rated
Reference:	TBD

5.2. SIP Feature-Capability Indicator

This document defines the feature capability, sip.184, in the "SIP Feature-Capability Indicator Registration Tree" registry defined in [RFC6809].

Name:	sip.184
Description:	This feature-capability indicator, when included in a Feature-Caps header field of an INVITE request, indicates the entity associated with the indicator will be responsible for indicating to the caller any information contained in the 184 SIP response code, specifically, the value referenced by the Call-Info header field.
Reference:	TBD

5.3. JSON Web Token Claim

This document defines the new JSON Web Token claim in the "JSON Web Token Claims" subregistry created by [RFC7519]. Section 3.2.2 defines the syntax. The required information is:

Claim Name:	jcard
Claim Description:	jCard data
Change Controller:	IESG
Reference:	RFC 8688, [RFC7095]

5.4. Call-Info Purpose

This document defines the new predefined value "jwscard" for the "purpose" header field parameter of the Call-Info header field. This modifies the "Header Field Parameters and Parameter Values" subregistry of the "Session Initiation Protocol (SIP) Parameters" registry by adding this RFC as reference to the line for the header field "Call-Info" and parameter name "purpose":

Header Field:	Call-Info
Parameter Name:	purpose
Predefined Values:	Yes
Reference:	TBD

6. Security Considerations

Intermediary operators need to be mindful to whom they are sending the 184 response. The intermediary could be rating a truly malicious caller. This raises two issues. The first is the caller, now alerted that an intermediary is poorly rating their call attempts, may change their call behavior to defeat call-rating systems. The second, and more significant risk, is by providing a contact in the Call-Info header field, the intermediary may be giving the malicious caller a vector for attack. In other words, intermediary will be publishing an address which a malicious actor may use to launch an attack on the intermediary. Because of this, we recommend intermediary operators configure their response to only include a Call-Info header field for signed INVITE passing validation by STIR [RFC8224].

Another risk is as follows. Consider an attacker that floods a proxy supporting sip.184 feature. However, the SDP in the INVITE request refers to a victim device. Moreover, the attacker somehow knows there is a 184-aware gateway connecting to the victim who is on a segment that lacks the sip.184 feature capability. Because the mechanism described here can result in sending an audio file to the target of the SDP, an attacker could use the mechanism described by this document as an amplification attack, given a SIP INVITE can be under 1 kilobyte and an audio file can be hundreds of kilobytes. One remediation for this is for devices inserting a sip.184 feature capability to only transmit media to what is highly likely to be the

actual source of the call attempt. A method for this is to only play media in response to a STIR-signed INVITE which passes validation. Beyond requiring a valid STIR signature on the INVITE, the intermediary can also use remediation procedures such as performing connectivity checks specified by Interactive Connectivity Establishment [RFC8445]. If the target did not request the media, the checks will fail.

Yet another risk is a malicious intermediary generating a malicious 184 response with a jCard referring to a malicious agent. For example, the recipient of a 184 may receive a TEL URI in the vCard. When the recipient calls that address, the malicious agent could ask for personally identifying information. Instead of using that information to verify the recipient's identity, they are phishing information for nefarious ends. A similar scenario can unfold if the malicious agent inserts a URI which points to a phishing or other mal-intent site. As such, we strongly recommend the recipient validates to whom they are communicating with if asking to adjudicate an erroneously rated call attempt. Since we may also be concerned about intermediate nodes modifying contact information, we can address both issues with a single solution. The remediation is to require the intermediary to sign the jCard. Signing the jCard provides integrity protection. In addition, one can imagine mechanisms such as used by [SHAKEN].

Similarly, one can imagine an adverse agent maliciously spoofs a 184 response with a victim's contact address to many active callers who may then all send redress requests to the specified address (the basis for a denial-of-service attack). The process would occur as follows: (1) a malicious agent senses INVITE requests from a variety of UACs and (2) spoofs 184 responses with an unsigned redress address before the intended receivers can respond, causing (3) the UACs to all contact the redress address at once. The jCard encoding allows the UAC to verify the blocking intermediary's identity before contacting the redress address. Specifically, because the sender signs the jCard, we can cryptographically trace the sender of the jCard. Given the protocol machinery of having a signature, one can apply local policy to decide whether to believe that the sender of the jCard represents the owner of the contact information found in the jCard. This guards against a malicious agent spoofing 184 responses.

Specifically, one could use policies around signing certificate issuance as a mechanism for traceback to the entity issuing the jCard. One check could be verifying that the identity of the subject of the certificate relates to the To header field of the initial SIP request, similar to validating that the intermediary was vouching for the From header field of a SIP request with that identity. Note that we are only protecting against a malicious intermediary and not a hidden intermediary attack (formerly known as a "man-in-the-middle attack"). Thus, we only need to ensure the signature is fresh, which

is why we include "iat". For most implementations, we assume that the intermediary has a single set of contact points and will generate the jCard on demand. As such, there is no need to directly correlate HTTPS fetches to specific calls. However, since the intermediary is in control of the jCard and Call-Info response, an intermediary may choose to encode per-call information in the URI returned in a given 184 response. However, if the intermediary does go that route, the intermediary MUST use a non-deterministic URI reference mechanism and be prepared to return dummy responses to URI requests referencing calls that do not exist so that attackers attempting to glean call metadata by guessing URIs (and thus calls) will not get any actionable information from the HTTPS GET.

Since the decision of whether to include Call-Info in the 184 response is a matter of policy, one thing to consider is whether a legitimate caller can ascertain whom to contact without including such information in the 184. For example, in some jurisdictions, if only the terminating service provider can be the intermediary, the caller can look up who the terminating service provider is based on the routing information for the dialed number. Thus, the Call-Info jCard could be redundant information. However, the factors going into a particular service provider's or jurisdiction's choice of whether to include Call-Info is outside the scope of this document.

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

[RFC3261] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., and E. Schooler, "SIP: Session Initiation Protocol", RFC 3261, DOI 10.17487/RFC3261, June 2002, <https://www.rfc-editor.org/info/rfc3261>.

[RFC3262] Rosenberg, J. and H. Schulzrinne, "Reliability of Provisional Responses in Session Initiation Protocol (SIP)", RFC 3262, DOI 10.17487/RFC3262, June 2002, <https://www.rfc-editor.org/info/rfc3262>.

[RFC3326] Schulzrinne, H., Oran, D., and G. Camarillo, "The Reason Header Field for the Session Initiation Protocol (SIP)", RFC 3326, DOI 10.17487/RFC3326, December 2002, <https://www.rfc-editor.org/info/rfc3326>.

[RFC6809] Holmberg, C., Sedlacek, I., and H. Kaplan, "Mechanism to Indicate Support of Features and Capabilities in the

Session Initiation Protocol (SIP)", RFC 6809,
DOI 10.17487/RFC6809, November 2012,
<https://www.rfc-editor.org/info/rfc6809>.

[RFC7095] Kewisch, P., "jCard: The JSON Format for vCard", RFC 7095,
DOI 10.17487/RFC7095, January 2014,
<https://www.rfc-editor.org/info/rfc7095>.

[RFC7515] Jones, M., Bradley, J., and N. Sakimura, "JSON Web
Signature (JWS)", RFC 7515, DOI 10.17487/RFC7515, May
2015, <https://www.rfc-editor.org/info/rfc7515>.

[RFC7518] Jones, M., "JSON Web Algorithms (JWA)", RFC 7518,
DOI 10.17487/RFC7518, May 2015,
<https://www.rfc-editor.org/info/rfc7518>.

[RFC7519] Jones, M., Bradley, J., and N. Sakimura, "JSON Web Token
(JWT)", RFC 7519, DOI 10.17487/RFC7519, May 2015,
<https://www.rfc-editor.org/info/rfc7519>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC
2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174,
May 2017, <https://www.rfc-editor.org/info/rfc8174>.

7.2. Informative References

[ITU.E.180.1998]
ITU-T, "Technical characteristics of tones for the
telephone service", ITU-T Recommendation E.180/Q.35, March
1998.

[RFC4103] Hellstrom, G. and P. Jones, "RTP Payload for Text
Conversation", RFC 4103, DOI 10.17487/RFC4103, June 2005,
<https://www.rfc-editor.org/info/rfc4103>.

[RFC4240] Burger, E., Ed., Van Dyke, J., and A. Spitzer, "Basic
Network Media Services with SIP", RFC 4240,
DOI 10.17487/RFC4240, December 2005,
<https://www.rfc-editor.org/info/rfc4240>.

[RFC4566] Handley, M., Jacobson, V., and C. Perkins, "SDP: Session
Description Protocol", RFC 4566, DOI 10.17487/RFC4566,
July 2006, <https://www.rfc-editor.org/info/rfc4566>.

[RFC5039] Rosenberg, J. and C. Jennings, "The Session Initiation
Protocol (SIP) and Spam", RFC 5039, DOI 10.17487/RFC5039,
January 2008, <https://www.rfc-editor.org/info/rfc5039>.

[RFC6350] Perreault, S., "vCard Format Specification", RFC 6350,
DOI 10.17487/RFC6350, August 2011,
<https://www.rfc-editor.org/info/rfc6350>.

[RFC7092] Kaplan, H. and V. Pascual, "A Taxonomy of Session Initiation Protocol (SIP) Back-to-Back User Agents", RFC 7092, DOI 10.17487/RFC7092, December 2013, <https://www.rfc-editor.org/info/rfc7092>.

[RFC7340] Peterson, J., Schulzrinne, H., and H. Tschofenig, "Secure Telephone Identity Problem Statement and Requirements", RFC 7340, DOI 10.17487/RFC7340, September 2014, <https://www.rfc-editor.org/info/rfc7340>.

[RFC8197] Schulzrinne, H., "A SIP Response Code for Unwanted Calls", RFC 8197, DOI 10.17487/RFC8197, July 2017, <https://www.rfc-editor.org/info/rfc8197>.

[RFC8688] Burger, E.W.,and Nagda, B. "A SIP Response Code for Rejected Calls", RFC 8688, DOI 10.17487/RFC8688, December 2019, <https://www.rfc-editor.org/info/rfc8688>.

[RFC8224] Peterson, J., Jennings, C., Rescorla, E., and C. Wendt, "Authenticated Identity Management in the Session Initiation Protocol (SIP)", RFC 8224, DOI 10.17487/RFC8224, February 2018, <https://www.rfc-editor.org/info/rfc8224>.

[RFC8259] Bray, T., Ed., "The JavaScript Object Notation (JSON) Data Interchange Format", STD 90, RFC 8259, DOI 10.17487/RFC8259, December 2017, <https://www.rfc-editor.org/info/rfc8259>.

[RFC8445] Keranen, A., Holmberg, C., and J. Rosenberg, "Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal", RFC 8445, DOI 10.17487/RFC8445, July 2018, <https://www.rfc-editor.org/info/rfc8445>.

[SHAKEN] ATIS/SIP Forum IP-INNI Task Group, "Signature-based Handling of Asserted information using toKENs (SHAKEN)", ATIS 1000074, January 2017, <https://www.sipforum.org/download/sip-forum-twg-10-signature-based-handling-of-asserted-information-using-tokens-shaken-pdf/?wpdmdl=2813>.

[SR-2275] Telcordia, "Telcordia Notes on the Networks", Telcordia SR-2275, October 2000.

Acknowledgements

This document liberally lifts from [RFC8197] and [RFC8688] in its text and structure. However, the mechanism and purpose of 184 is quite different than either 607 or 608. Any errors are the current

editor's and not the editors of RFC 8197 or RFC 8688.

Authors Addresses:

Russ A. Penar
Microsoft
1 Microsoft Way
Redmond, WA 98052
United States of America

Email: russp@microsoft.com

Expires: January, 2021
draft-penar-ietf-sipcore-00