Abstract

SIP already provides the ability to perform hop-by-hop traceroute for SIP messages using the Max-Forwards header field to determine the reachability path of requests to a target. A mechanism for media-loopback calls has also been defined separately, which enables test calls to be generated that result in media being looped back to the originator. This document describes a means of performing hop-by-hop traceroute-style test calls using the media-loopback mechanism to test the media path when SIP sessions go through media-relaying B2BUAs.

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1. Introduction

In many deployments, the media for SIP-created sessions does not flow directly from the originating user’s UAC to the answering user’s UAS. Often, SIP B2BUAs in the SIP signaling path also insert themselves in the media plane path by manipulating SDP, either for injecting media such as rich ringtones or music-on-hold, or for relaying media in order to provide functions such as transcoding, IPv4-IPv6 conversion, NAT traversal, SRTP termination, media steering, etc.

As more SIP domains get deployed and interconnected, the odds of a SIP session crossing such media-plane B2BUAs increases, as well as the number of such B2BUAs any given SIP session may go through. In other words, any given SIP session may cross any number of B2BUA’s both in the SIP signaling plane as well as media plane.

When a failure or degradation occurs in the media plane, it is difficult to determine where in the media path they occurred. In
order to aid managing and troubleshooting SIP-based sessions and media traversing such B2BUAs, it would be useful to progressively test the media path as it reaches successive B2BUAs with a test controlled in a single-ended way from the source UA. A mechanism to perform media-loopback test sessions has been defined in [RFC6849], but it cannot be used directly to test B2BUAs because typically the B2BUAs do not have an Address of Record (AoR) to be targeted, nor is it known a priori which B2BUAs will be traversed for any given session.

For example, suppose calls from Alice to Bob have media problems. Alice would like to test the media path to each B2BUA in the path to Bob separately, to determine which segment has the issues. Alice cannot target the B2BUAs directly for each test call, because she doesn’t know which URIs to use to target them; nor would using such URIs guarantee the same media path be used as a call to Bob. A better solution would be to make a test call targeted to Bob, but with a SIP traceroute-type mechanism that makes the call terminate at the B2BUAs, such that she can perform test sessions to test the media path to each downstream B2BUA.

This document defines how such a mechanism can be employed, using the [RFC6849] mechanism along with the Max-Forwards SIP header field such that a SIP User Agent can make multiple test calls, each reaching a B2BUA further downstream. Each B2BUA in the path that supports the mechanism in [RFC6849] would answer the media-loopback call, and thus the originating SIP UA can test the media path up to that B2BUA.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

B2BUA: a SIP Back-to-Back User Agent, which is the logical combination of a User Agent Server (UAS) and User Agent Client (UAC).

UAS: a SIP User Agent Server.

UAC: a SIP User Agent Client.

Traceroute: a mechanism to trace a path of hops from an originator to a destination. For IP, this is typically done using the TTL field of the IP header, starting at the value 1 and incrementing by 1 as each IP hop responds with an ICMP error. For SIP this can be done using Max-Forwards header field starting with the value 0, in a similar fashion to the TTL field.
It is assumed the reader is already familiar with media-loopback
[RFC6849].

3. The SIP Traceroute Mechanism

The Max-Forwards header field can already be used to perform a
simple SIP-request traceroute mechanism by generating a SIP request
initially using a Max-Forwards value of 0, receiving a 483 Too Many
Hops response from the next-hop, and then incrementing the value for
subsequent SIP requests, thereby reaching SIP devices further and
further downstream and receiving 483 from each of them.

The mechanism described in this document uses such a Max-Forwards
style traceroute to perform media-loopback testing. To perform a
SIP media-plane traceroute, the originating UAC (Alice) generates a
SIP INVITE to a target AoR (Bob), with a Max-Forwards header field
value of 0 and with SDP based on [RFC6849]. The SIP next-hop will
either reject the request with a 483 Too Many Hops response, or if
the next-hop is a B2BUA that supports this mechanism, and if the
B2BUA allows such testing from the requesting UAC, then the B2BUA
will answer the INVITE to establish the dialog and create a media-
loopback session.

The originating UAC can then end the media-loopback session,
generate another INVITE to the same target AoR with a Max-Forwards
header field value of 1, which will reach the second SIP next hop,
and so on.

A defined [RFC3326] SIP Reason header field cause value of ‘483’
will be in the 200 answer from each B2BUA answering the INVITE,
until the INVITE reaches the final UAS (Bob), which does not use the
Reason cause value. (see Section 3.2 for details)

Using this mechanism a SIP UAC can test the path from itself to each
successive B2BUA on the path to a target. Such a mechanism could
also be useful for establishing a permanent test call between an
Enterprise and a Service Provider across a SIP Trunk, for example,
or for automated measurement systems to test the media path between
domains, etc.

3.1. Processing a Received Max-Forwards Header Field

As currently defined in [RFC3261], the UAS half of a B2BUA does not
technically need to inspect the Max-Forwards header field value for
received requests - only Proxies do. This behavior was updated by
[draft-loop-detection], such that a compliant B2BUA needs to both
inspect the value in order to prevent loops, as well as copy and
decrement the value as if it were a Proxy. This document also
requires such behavior in order for the mechanism to succeed; therefore a B2BUA supporting the traceroute mechanism defined in this document MUST also comply with [draft-loop-detection].

3.2. Answering the INVITE

If a SIP B2BUA receives a dialog-creating INVITE request with a Max-Forwards header value of 0, with SDP for media-loopback based on [RFC6849], and the policies of the B2BUA allow it to answer such a request, then it is answered as if the original target of the request were the local SIP B2BUA. The normal procedures of SIP apply, as well as [RFC6849], as if the request had been targeted at the local B2BUA device as the intended destination all along.

In the 200 response for the INVITE, the B2BUA MUST also add a Reason header, per [RFC3326], with a protocol field value of "SIP", a cause field value of "483", and a reason-text value of "Traceroute Response". The purpose of the Reason header is to indicate to the UAC that the request is being answered due to reaching a Max-Forwards of 0, rather than being answered due to reaching the final UAS. When the ultimate target UAS answers a loopback-based INVITE with a Max-Forwards greater than or equal to 0, the Reason header would not be added to the response and the UAC will know the traceroute is complete.

If a B2BUA receives an INVITE with media-loopback SDP and a Max-Forwards header field value of 0 as defined in this document, and it does not accept the session (e.g., due to local policy), then it SHOULD respond with a 483 Too Many Hops response, per normal [RFC3261] rules as it would previously. In other words, in such a case it behaves no differently than it would have if it did not support this document’s new behavior.

4. Security Considerations

There are security implications for the mechanism defined in this document. Answering media-loopback calls in a B2BUA consumes resources on the B2BUA, and network bandwidth in between, and thus exposes a vector for denial of service attacks; therefore, B2BUAs should provide configuration options to control who can make such test calls, how many concurrent calls can be established and maintained, and for how long. Entities that deploy B2BUAs should set these options to values that reduce the denial-of-service risk to an acceptable level. A B2BUA might perform digest-challenge authentication with specific credentials for such calls, for example; or it might only allow specific sources to make such calls, at a specific time. Such policies are typically vendor-specific based on local policies and deployment usage scenarios, and cannot to be explicitly defined in this document.
The security considerations of [RFC6849] also apply to this document. Since B2BUAs are not end user devices, there is no human user to monitor the loopback session activity on the B2BUA as recommended in [RFC6849]; instead, B2BUAs should log such events, or provide some form of administrative notification.

5. IANA Considerations

This document makes no request of IANA.

6. Acknowledgments

The general concept of performing media-loopback on a hop-by-hop basis using a decrementing header traceroute style approach came out of discussions several years ago, between the author, Kaynam Hedayat, Nagarjuna Venna, and Patrick Melampy. Other people that have contributed to the topic over the years since then: Brett Tate, Paul Kyzivat, Peter Dawes, Zaid Ally, Dianna Stiller, Jon Boone, and several others whom I have lost the names of since.

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7. References

7.1. Normative References


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