       Locating Session Initiation Protocol (SIP) Servers in a Dual-Stack IP
                                Network
                  draft-johansson-sip-dual-stack-01

Abstract

   RFC 3263 defines how a Session Initiation Protocol (SIP)
   implementation, given a SIP Uniform Resource Identifier (URI), should
   locate the next hop SIP server using Domain Name System (DNS)
   procedures. The specification repeatedly states that the
   implementation should look up IPv4 or IPv6 addresses. This is not a
   suitable solution and one that can cause severely degraded user
   experience dual-stack clients, as detailed in the Happy Eyeballs
   specification. This document specifies amended procedures for dual-
   stack SIP implementations so that they look up both IPv4 and IPv6
   addresses. This way, the SIP implementation can find the preferred
   network path and protocol with an improved chance of successfully
   reaching the desired service. This document also clarifies DNS SRV
   usage for single-stack clients.

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1. Introduction

The core SIP [RFC3261] RFCs were written with support for both IPv4
and IPv6 in mind, but they were not fully equipped to handle highly
hybridized environments during this transitional phase of migration
from IPv4 to IPv6 networks, where many server and client
implementations run on dual stack hosts. In such environments, a
dual-stack host will likely suffer greater connection delay, and by
extension an inferior user experience, than an IPv4-only host. The
need to remedy this diminished performance of dual-stack hosts led to
the development of the Happy Eyeballs [RFC6555] algorithm, that has
since been implemented in many applications.

RFC 6157[RFC6157] focuses on handling media in a dual-stack network
path between two SIP user agents (UAs). This doesn't solve the
signalling issues that can occur when trying to find the best network
path to the next hop SIP server.

This document updates RFC 3263[RFC3263] procedures so that a dual-
stack client SHOULD look up both A and AAAA records in DNS and then
select the best way to set up a network flow. The details of how the
latter is done is considered out of scope for this document. See the
Happy Eyeballs algorithm and implementation and design considerations

in RFC 6555[RFC6555] for more information about issues with setting
up dual-stack network flows.

2. Terminology and Conventions Used in This Document

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 RFC 2119 [RFC2119].

RFC 3261 [RFC3261] defines additional terms used in this document
that are specific to the SIP domain such as "proxy"; "registrar";
"redirect server"; "user agent server" or "UAS"; "user agent client"
or "UAC"; "back-to-back user agent" or "B2BUA"; "dialog";
"transaction"; "server transaction".

This document uses the term "SIP Server" that is defined to include
the following SIP entities: user agent server, registrar, redirect
server, a SIP proxy in the role of user agent server, and a B2BUA in
the role of a user agent server.

This document also uses the following terminology to make clear
distinction between SIP entities supporting only IPv4, only IPv6 or
supporting both IPv4 and IPv6.

IPv4-only UA/UAC/UAS: An IPv4-only UA/UAC/UAS supports SIP signaling
   and media only on the IPv4 network. It does not understand IPv6
   addresses.

IPv6-only UA/UAC/UAS: An IPv6-only UA/UAC/UAS supports SIP signaling
   and media only on the IPv6 network. It does not understand IPv4
   addresses.

IPv4/IPv6 UA/UAC/UAS: A UA/UAC/UAS that supports SIP signaling and
   media on both IPv4 and IPv6 networks; such a UA/UAC/UAS is known
   (and will be referred to in this document) as a "dual-stack"
   [RFC4213] UA/UAC/UAS.

3. DNS Procedures in a Dual-Stack Network

This specification introduces two normative DNS lookup procedures.
These are designed to improve the performace of dual-stack clients in
IPv4/IPv6 networks.

3.1. **Dual-Stack SIP UA DNS Record Lookup Procedure**

   Once the transport protocol has been determined, the procedure for
   discovering an ip address if the TARGET is not a numeric IP address
   but the port is explicitly stated in the URI, is detailed in
   Section 4.2 of RFC 3263[RFC3263]. The piece relevant to to this
   discussion is:

      "If the TARGET was not a numeric IP address, but a port is present
      in the URI, the client performs an A or AAAA record lookup of the
      domain name. The result will be a list of IP addresses, each of
      which can be contacted at the specific port from the URI and
      transport protocol determined previously."

   Section 4.2 of RFC 3263 [RFC3263] also goes on to describe the
   complete procedure for discovering an ip address if the TARGET is not
   a numeric IP address, and no port is present in the URI. The piece
   relevant to to this discussion is:

      "If no SRV records were found, the client performs an A or AAAA
      record lookup of the domain name. The result will be a list of IP
      addresses, each of which can be contacted using the transport
      protocol determined previously, at the default port for that
      transport. Processing then proceeds as described above for an
      explicit port once the A or AAAA records have been looked up."

   Happy Eyeballs [RFC6555] has proven that looking up the "A or AAAA
   record" is not an effective practice for dual-stack clients that can
   add significant connection delay and greatly degrade user experience.
   A dual-stack client SHOULD perform an A and AAAA record lookup of the
   domain name and add the respective IPv4/IPv6 addresses to the list of
   IP addresses to be contacted. This is a normative update to the
   procedures described in Section 4.2 of RFC 3263 [RFC3263].

3.2. **Indicating Address Family Preference in DNS SRV Records**

   The Happy Eyeballs algorithm is particularly effective when dual-
   stack client applications have have significant performance
   differences in their IPv4 or IPv6 network paths. In this common
   scenario it is often necessary for a dual-stack client to indicate a
   preference for either IPv4 or IPv6. A service may use DNS SRV
   records to indicate such a preference for an address family. This
   way, a server with a high-latency and/or low-capacity IPv4 tunnel may
   indicate a preference for being contacted using IPv6. A server that
   wishes to do this can use the lowest SRV priority to publish
   hostnames that only resolve in IPv6 and the next priority with host
   names that resolve in both address families.

When indicating address family preference through SRV, a single
stack-clients should be prepared to handle SRV record sets that don't
resolve into an ip address in the address family used by the client.
In such a case, the client should simply proceed to the next priority
and try those hostnames.

4. Security Considerations

This document makes two normative changes to the existing DNS
procedures used to locate SIP servers in a dual-stack network. One
change updates the procedure described in RFC 3263 for dual-stack
clients and recommends both A and AAAA record lookups of the domain
name. The other update is simply the ability to indicate preference
for a particular address family in SRV records. While both of these
changes to current procedures are optimizations designed to improve
the performance of dual-stack clients, neither introduces any new
security considerations. The specific security vulnerabilities,
attacks and threat models of the various protocols discussed in this
document (SIP, DNS, SRV records, etc.) are well documented in their
respective specifications.

5. IANA Considerations

This document does not require any actions by IANA.

6. Acknowledgements

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7. References

7.1. Normative References

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