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Locating Session Initiation Protocol (SIP) Servers in a Dual-Stack IP Network
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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. As SIP networks increasingly transition from IPv4-only to dual-stack, a quality user experience must be ensured for dual-stack SIP implementations. This document supplements the DNS procedures described in RFC 3263 for dual-stack SIP implementations and ensures that they properly align to the optimizations detailed by Happy Eyeballs.

Status of This Memo

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

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This Internet-Draft will expire on October 27, 2014.

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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, which 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.

[[TODO: Sync with Vijay Gurbani on impacts of this draft to RFC 6157, especially relative to the additional requirement that DNS be populated such that a certain address family is preferred.]]

This document aims to provide a more holistic design solution by clarifying the DNS lookup procedures of RFC 3263[RFC3263] to ensure enhanced performance, and consequently user experience, in highly

hybridized dual-stack SIP networks. The procedures described herein are such 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. Notational Conventions

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].

3. Terminology

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.

4. 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.

4.1. 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 and that it can add significant connection delay and greatly degrade user experience. Therefore, this document makes the following normative addendum to the DNS lookup procedures of Section 4.2 of RFC 3263 [RFC3263] for IPv4/IPv6 hybrid SIP networks and recommends it as a best practice for such dual-stack networks:

> The 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.

4.2. Indicating Address Family Preference in DNS SRV Records

The Happy Eyeballs algorithm [RFC6555] is particularly effective when dual-stack client applications 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, IPv4-only and/or IPv6-only clients should be prepared to handle SRV record sets that don't resolve into an ip address in the address family used by that client. In such a case, the client should simply proceed to the next priority and try the hostnames in the alternate address family.

5. Security Considerations

This document introduces two new normative procedures to the existing DNS procedures used to locate SIP servers. While both of these 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, Happy Eyeballs requirements and algorithm, etc.) are well documented in their respective specifications.

6. IANA Considerations

This document does not require any actions by IANA.

7. Acknowledgments

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8. References

8.1. Normative References

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8.2. Informative References

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