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The IPv6 Segment Routing (SRv6) Domain Name System (DNS) Resource Record
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Abstract

A Domain Name System (DNS) Resource Record (RR) Type is specified for storing IPv6 Segment Routing (SRv6) Information in the DNS.

Status of This Memo

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1. Introduction

The Domain Name System (DNS) is a hierarchical, distributed, highly available database with a variety of security features [RFC4034] [RFC4035] used for bi-directional mapping between domain names and addresses, for email routing, and for other information [RFC1034] [RFC1035]. This data is formatted into resource records (RRs) whose content type and structure are indicated by the RR Type field. General familiarity with the DNS and its terminology [RFC9499] is assumed in this document.

1.1. IPv6 Segment Routing

Internet Protocol versions 4 (IPv4, [RFC0791]) and 6 (IPv6, [RFC8200]) have long provided header options that support including an ordered sequence of addresses in a packet header so the packet travels in order through the nodes specified by that sequence of addresses. This is sometimes referred to as "source routing" because the route or path the packet follows is set, at least in part, when the sequence of addresses is added to the packet, usually at the packet's source, rather than being dynamically determined as the packet proceeds through the network.

IPv6 Segment Routing (SRv6, [RFC8402]) extends "source routing" by generalizing the IPv6 sized "address" quantities in a source "routing" sequence to be "instructions". [RFC8754] specifies a particular Segment Routing Header (SRH) that may be use used as part of the headers of an IPv6 packet to indicate an IPv6 Segment Routing sequence of addresses / instructions. [RFC8986] further specifies the structuring of an IPv6 address size quantity such that it may be composed of addressing information followed by a function designation which is optionally further followed by arguments to that function. Thus, segment routing might encode a series of operations to be performed on a packet.

Furthermore, because a sequence of SRv6 instructions may all start with the same constant addressing prefix, methods of compression have been specified [Compress] to represent this addressing prefix less often and pack an increased number of quantities into a Segment Routing Header where each quantity may consist optionally of additional address information and/or function designation and/or function arguments.

1.2. The SRV6 RR Type

This document specifies a SRV6 RR Type to return a sequence of IPv6 Segment Routing addresses / instructions and optionally other data.

In many ways, the data returned for an SRV6 DNS RR is like an address. This RR supports a DNS client querying for SRV6 RRs at a name, inserting returned SRv6 information into the header of an IPv6 packet, and transmitting that packet so addressed. It would also be reasonable for an application using SRv6 to do a type SRV DNS query [RFC2782] followed by an SRV6 query at the resulting domain name if it was in a domain where SRv6 was in use. Furthermore, as a fall back, if no SRV6 RR is present in the DNS at a domain name, a client application whose SRV6 query has failed could query for the AAAA IPv6 address RR type.

Segment Routing is intended to be used in a limited domain compared with the global Internet. Furthermore, the DNS is commonly thought of as the source for global Internet addressing. However, most DNS servers can be easily configured in a network so that some names are only visible locally and some RRs are only delivered locally.

1.3. 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.

The following acronyms are used in this document:

DNS - Domain Name System

IANA - Internet Assigned Number Authority

IPv6 - Internet Protocol Version 6 [RFC8200]

RR - DNS Resource Record

SID - Segment Identifier [RFC8402]

SRH - Segment Routing (IPv6) Header [RFC8754]

SRv6 - IPv6 Segment Routing [RFC8402]

SRV6 - Mnemonic for the SRv6 RR Type

TLV - Type, Length, Value

2. SRV6 RR Type RDATA

The SRV6 RR type enables the storage and retrieval of an ordered sequence of SRv6 quantities each of which is 16-bytes, the size of an IPv6 [RFC8200] address. The RDATA for this type of RR is a set of fields followed by a sequence of such quantities followed by optional data (see Figure 1) and will be (4 + N*16 + Opt) bytes long, where N is the number of such quantities present and Opt is the length of the optional data.

The RR Type Code for the SRV6 RR is TBD1.

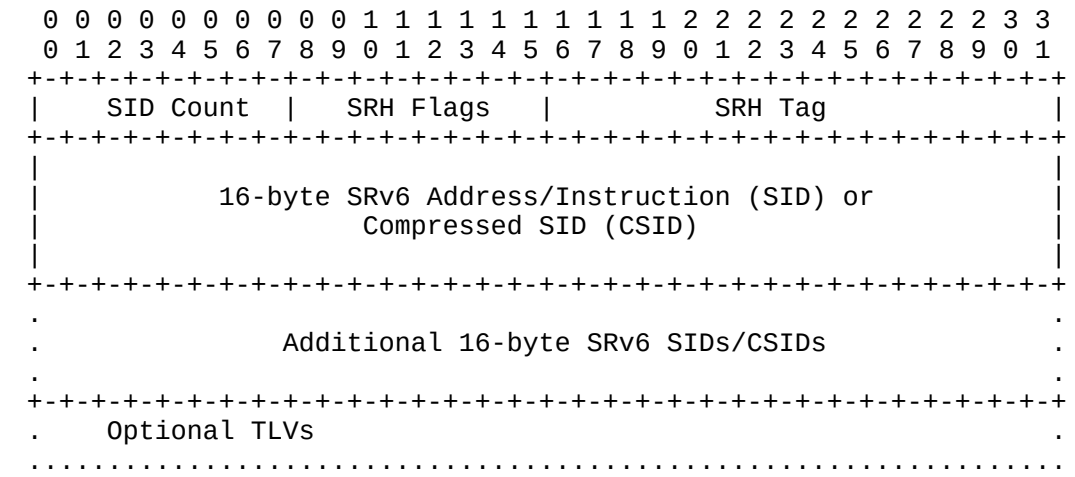

Figure 1: SRV6 RRTYPE Data

The RDATA consists of a segment count followed by a flags byte, a 2 byte tag, and then one or more 128-bit SRv6 SIDs followed by optional TLV data, all as further detailed as follows:

SID Count - As unsigned one byte integer giving the number of 16-byte SRv6 SIDs in the RDATA.

SRH Flags - This byte gives a initial value for the Flags field of the Segment Routing Header (SRH, [RFC8754]).

SRH Tag - This field is a suggested value for the Tag field of the SRH [RFC8754].

SIDs/CSIDs - 16-byte SRv6 segment identifiers (SIDs, [RFC8402]) or compressed SIDs (CSIDs, [Compress]).

Optional TLVs - Suggested TLVs for inclusion in a Segment Routing Header (SRH, [RFC8754]) created using this RDATA.

If the RDATA length is less than (4 + (SID Count)*16) or if the Optional TLVs do not parse as SRH TLVs, then the RR is malformed and MUST be ignored.

Circumstances and/or future definition of flags and TLV types may require, when an IPv6 packet header is contructed based on an SRV6 RR, that some SRH FLags be set or clear regardless of the SRH Flags RR field and/or that some SRH TLVs be included or excluded regardless of the Optional TLV in the SRH RR.

3. Acknowledgements

The suggestions and comments of the following persons are gratefully acknowledged:

tbd

4. IANA Considerations

IANA is requested to assign an SRV6 RR Type (TBD1) as in the template in Appendix A.

5. Security Considerations

For information on DNS features that improve the authentication of retrieved RRs, see [RFC4034] and [RFC4035].

For SRv6 Security Considerations, see [RFC8402] and Section 5 of [RFC8754]. For Security Considerations of SRv6 Network Programming, see [RFC8986].

6. Normative References

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[RFC4035] Arends, R., Austein, R., Larson, M., Massey, D., and S. Rose, "Protocol Modifications for the DNS Security Extensions", RFC 4035, DOI 10.17487/RFC4035, March 2005, <https://www.rfc-editor.org/info/rfc4035>.

[RFC8754] Filsfils, C., Ed., Dukes, D., Ed., Previdi, S., Leddy, J., Matsushima, S., and D. Voyer, "IPv6 Segment Routing Header (SRH)", RFC 8754, DOI 10.17487/RFC8754, March 2020, <https://www.rfc-editor.org/info/rfc8754>.

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Appendix A. SRV6 RR Type Template

A. Submission Date: tbd

B.1 Submission Type: [X] New RRTYPE [ ] Modification to RRTYPE
B.2 Kind of RR: [X] Data RR [ ] Meta-RR

C. Contact Information for submitter (will be publicly posted):
Name: Donald Eastlake
Email Address: d3e3e3@gmail.com
International telephone number: +1-508-333-2270
Other contact handles:

D. Motivation for the new RRTYPE application.

Enable storeage of IPv6 Segment Routing sequences in the DNS.

E. Description of the proposed RR type.
See draft-eastlake-dnsop-rrtype-srv6

F. What existing RRTYPE or RRTYPEs come closest to filling that need and why are they unsatisfactory?

Perhaps AAAA but that only returns a single IPv6 address, not an ordered sequence of IPv6 sized SRv6 instructions or any additional information.

G. What mnemonic is requested for the new RRTYPE (optional)?

SRV6

H. Does the requested RRTYPE make use of any existing IANA registry or require the creation of a new IANA subregistry in DNS Parameters? If so, please indicate which registry is to be used or created. If a new subregistry is needed, specify the allocation policy for it and its initial contents.

Does not use any existing registry and does not create a new registry.

I. Does the proposal require/expect any changes in DNS servers/resolvers that prevent the new type from being processed as an unknown RRTYPE (see [RFC3597])?

No.

J. Comments: None.

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