             Dynamic Host Configuration Protocol (DHCPv6) Options
                 for Session Initiation Protocol (SIP) Servers

Status of this Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

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Abstract

   This document defines a Dynamic Host Configuration Protocol version 6
   (DHCPv6) option that contains a list of domain names or IPv6
   addresses that can be mapped to one or more Session Initiation
   Protocol (SIP) outbound proxy servers. This is one of the many
   methods that a SIP client can use to obtain the addresses of such a
   local SIP server.

1. Terminology

   This document uses the DHCP terminology defined in [1].

   A SIP server is defined in RFC 3261 [2]. This server MUST be an
   outbound proxy server, as defined in [3]. In the context of this
   document, a SIP server refers to the host the outbound SIP proxy
   server is running on.

   A SIP client is defined in RFC 3261 [2]. The client can be a user
   agent client or the client portion of a proxy server. In the context
   of this document, a SIP client refers to the host the SIP client is
   running on.

In this document, the key words "MUST", "MUST NOT", "REQUIRED",
"SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY",
and "OPTIONAL" are to be interpreted as described in BCP 14, RFC 2119
[4].

2. Introduction

The Session Initiation Protocol (SIP) [2] is an application-layer
control protocol that can establish, modify and terminate multimedia
sessions or calls. A SIP system has a number of logical components:
user agents, proxy servers, redirect servers and registrars. User
agents MAY contain SIP clients, proxy servers always do.

This document specifies two DHCPv6 options [1] that allow SIP clients
to locate a local SIP server that is to be used for all outbound SIP
requests, a so-called outbound proxy server. (SIP clients MAY
contact the address identified in the SIP URL directly, without
involving a local SIP server. However in some circumstances, such as
when firewalls are present, or local dialing plans, local emergency
and other services need to be provided, SIP clients need to use a
local server for outbound requests.) This is one of many possible
solutions for locating the outbound SIP server; manual configuration
is an example of another.

3. SIP Server DHCPv6 Option

This document defines two DHCPv6 options that describe a local
outbound SIP proxy: one carries a list of domain names (Section 3.1),
the other a list of 128-bit (binary) IPv6 addresses (Section 3.2).

   Since DHCPv6 does not suffer from a shortage of option codes, we
   avoid the encoding byte found in the IPv4 DHCP option for SIP
   servers [6]. This makes the option shorter, easier to parse,
   simplifies appropriate word alignment for the numeric addresses
   and allows the client to request either numeric or domain name
   options using the "option request option".

An implementation implementing this specification MUST support both
options.

3.1 SIP Servers Domain Name List

The option length is followed by a sequence of labels, encoded
according to Section 3.1 of RFC 1035 [5], quoted below:

   "Domain names in messages are expressed in terms of a sequence of
   labels. Each label is represented as a one octet length field
   followed by that number of octets. Since every domain name ends

with the null label of the root, a domain name is terminated by a
length byte of zero. The high order two bits of every length
octet must be zero, and the remaining six bits of the length field
limit the label to 63 octets or less. To simplify
implementations, the total length of a domain name (i.e., label
octets and label length octets) is restricted to 255 octets or
less."

RFC 1035 encoding was chosen to accommodate future
internationalized domain name mechanisms.

The option MAY contain multiple domain names, but these SHOULD refer
to different NAPTR records, rather than different A records. The
client MUST try the records in the order listed, applying the
mechanism described in Section 4.1 of RFC 3263 [3] for each. The
client only resolves the subsequent domain names if attempts to
contact the first one failed or yielded no common transport protocols
between client and server or denote a domain administratively
prohibited by client policy. Domain names MUST be listed in order of
preference.

Use of multiple domain names is not meant to replace NAPTR or SRV
records, but rather to allow a single DHCP server to indicate
outbound proxy servers operated by multiple providers.

The DHCPv6 option has the format shown in Fig. 1.

option-code: OPTION_SIP_SERVER_D (21)

option-length: Length of the 'SIP Server Domain Name List' field
in octets; variable.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      OPTION_SIP_SERVER_D       |         option-length         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   SIP Server Domain Name List                 |
|                              ...                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
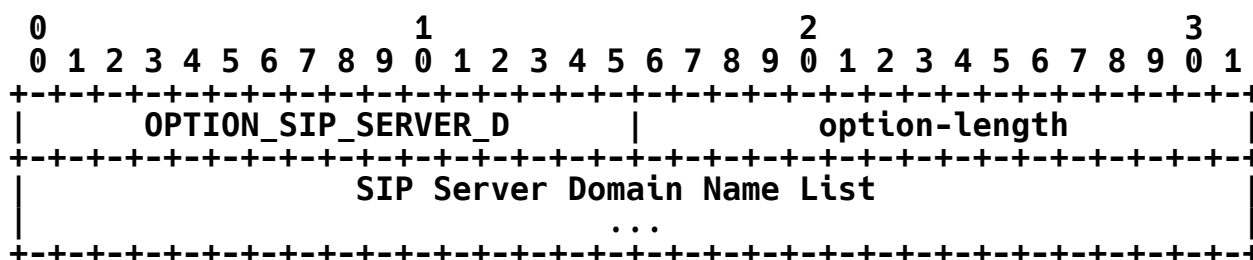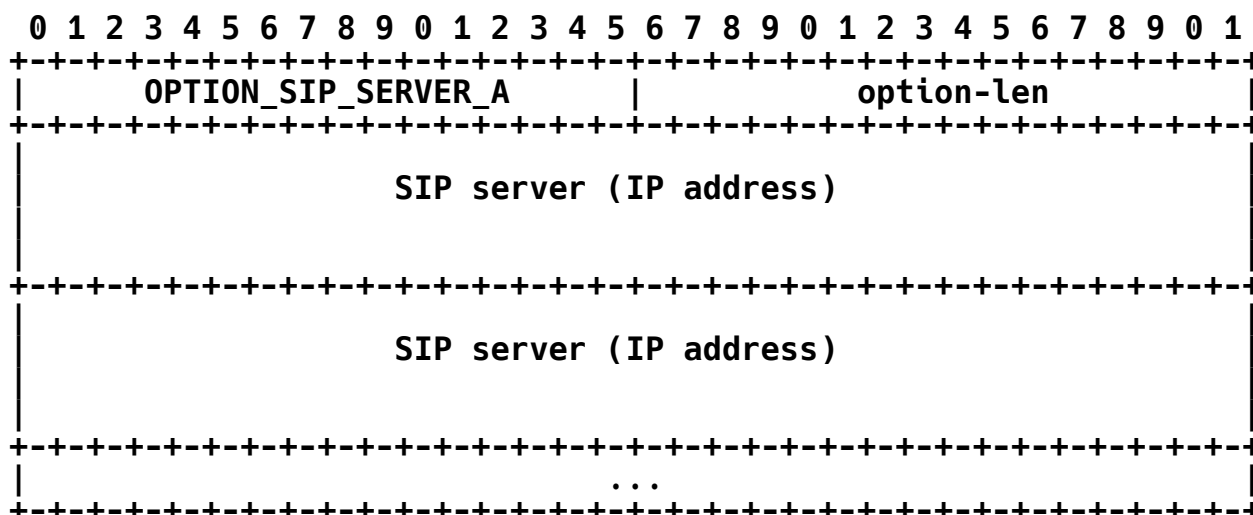
Figure 1: DHCPv6 option for SIP Server Domain Name List

SIP Server Domain Name List: The domain names of the SIP outbound
proxy servers for the client to use. The domain names are encoded
as specified in Section 8 ("Representation and use of domain
names") of the DHCPv6 specification [1].

3.2 SIP Servers IPv6 Address List

   This option specifies a list of IPv6 addresses indicating SIP
   outbound proxy servers available to the client. Servers MUST be
   listed in order of preference.

```
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |       OPTION_SIP_SERVER_A      |           option-len          |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                                                               |
   |                      SIP server (IP address)                  |
   |                                                               |
   |                                                               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                                                               |
   |                      SIP server (IP address)                  |
   |                                                               |
   |                                                               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                              ...                              |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

      option-code: OPTION_SIP_SERVER_A (22)

      option-length: Length of the 'options' field in octets; must be a
      multiple of 16.

      SIP server: IPv6 address of a SIP server for the client to use.
                  The servers are listed in the order of preference for
                  use by the client.

4. Client Operation

   A client may request either or both of the SIP Servers Domain Name
   List and SIP Servers IPv6 Address List options in an Options Request
   Option (ORO) as described in [1],

   If a client receives both the SIP Servers Domain Name List and SIP
   Servers IPv6 Address List options, it SHOULD use the SIP Servers
   Domain Name List option. Only if no server in the SIP Servers Domain
   Name List can be resolved or reached, the client MAY use the SIP
   Servers IPv6 Address List option.

5. Server Operation

   A server MAY send a client one or both of the SIP Servers Domain Name
   List and SIP Servers IPv6 Address List options.

   If a client requests both options and the server is configured for
   both, the server MAY send a client only one of these options and
   SHOULD send the SIP Servers Domain Name List.

   A server configured with the SIP Servers IPv6 Address List option
   MUST send a client the SIP Servers IPv6 Address List option if that
   client requested the SIP Servers IPv6 Address List option and not the
   SIP Servers Domain Name List option in an ORO (see [1]).

   The following table summarizes the server's response:

Client sends in ORO	Domain Name List	IPv6 Address List
Neither option	SHOULD	MAY
SIP Servers Domain Name List	SHOULD	MAY
SIP Servers IPv6 Address List	MAY	MUST
Both options	SHOULD	MAY

6. Security Consideration

   The security considerations in RFC 3315 [1], RFC 3261 [2] and RFC
   3263 [3] apply. If an adversary manages to modify the response from
   a DHCP server or insert its own response, a SIP user agent could be
   led to contact a rogue SIP server, possibly one that then intercepts
   call requests or denies service. A modified DHCP answer could also
   omit host names that translated to TLS-based SIP servers, thus
   facilitating intercept.

7. IANA Considerations

   The IANA has assigned a DHCPv6 option number of 21 for the "SIP
   Servers Domain Name List" and the DHCPv6 option number of 22 for the
   "SIP Servers IPv6 Address List" defined in this document.

8. Acknowledgements

   Erik Nordmark and Alex Zinin provided helpful comments.

9. Normative References

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       (SIP): Locating SIP Servers", RFC 3263, June 2002.

   [4] Bradner, S., "Key words for use in RFCs to indicate requirement
       levels", BCP 14, RFC 2119, March 1997.

   [5] Mockapetris, P., "Domain names - implementation and
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10. Informative References

   [6] Schulzrinne, H., "Dynamic Host Configuration Protocol (DHCP-for-
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11. Authors' Addresses

   Henning Schulzrinne
   Department of Computer Science
   Columbia University
   1214 Amsterdam Avenue, MC 0401
   New York, NY 10027
   USA

   EMail: schulzrinne@cs.columbia.edu

   Bernie Volz
   116 Hawkins Pond Road
   Center Harbor, NH 03226-3103
   USA

   EMail: volz@metrocast.net

12. Full Copyright Statement

Acknowledgement