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DHCP and Router Advertisement Options for the Discovery of Network-designated Resolvers (DNR)

Abstract

   The document specifies new DHCP and IPv6 Router Advertisement
   options to discover encrypted DNS servers (e.g., DNS-over-HTTPS,
   DNS-over-TLS, DNS-over-QUIC). Particularly, it allows to learn an
   authentication domain name together with a list of IP addresses and
   a set of service parameters to reach such encrypted DNS servers.

Status of This Memo

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1. Introduction

This document focuses on the support of encrypted DNS such as DNS-
over-HTTPS (DoH) [RFC8484], DNS-over-TLS (DoT) [RFC7858], or DNS-
over-QUIC (DoQ) [I-D.ietf-dprive-dnsoquic] in local networks.

In particular, the document specifies how a local encrypted DNS
server can be discovered by connected hosts by means of DHCPv4
[RFC2132], DHCPv6 [RFC8415], and IPv6 Router Advertisement (RA)
[RFC4861] options. These options are designed to convey the
following information: the DNS Authentication Domain Name (ADN), a
list of IP addresses, and a set of service parameters.

The options defined in this document can be deployed in a variety of
deployments (e.g., local networks with Customer Premises Equipment
(CPEs) that may or may not be managed by an Internet Service
Provider (ISP), local networks with or without DNS forwarders). It
is out of the scope of this document to provide an inventory of such
deployments.

2. 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.

This document makes use of the terms defined in [RFC8499]. The
following additional terms are used:

Do53: refers to unencrypted DNS.

Encrypted DNS: refers to a scheme where DNS exchanges are
   transported over an encrypted channel. Examples of encrypted DNS
   are DoT, DoH, or DoQ.

Encrypted DNS options: refers to the options defined in Sections 4,
   5, and 6.

DHCP: refers to both DHCPv4 and DHCPv6.

3. Overview

This document describes how a DNS client can discover local
encrypted DNS servers using DHCP (Sections 4 and 5) and Neighbor
Discovery protocol (Section 6): Encrypted DNS options.

These options configure an authentication domain name, a list of
IPv6 addresses, and a set of service parameters of the encrypted DNS
server. More information about the design of these options is
provided in the following subsections.

3.1. Configuration Data for Encrypted DNS

In order to allow for PKIX-based authentication between a DNS client
and an encrypted DNS server, the Encrypted DNS options are designed
to include an authentication domain name. This ADN is presented as a
reference identifier for DNS authentication purposes. This design
accommodates the current best practices for issuing certificates as
per Section 1.7.2 of [RFC6125]:

| Some certification authorities issue server certificates based on
| IP addresses, but preliminary evidence indicates that such
| certificates are a very small percentage (less than 1%) of issued
| certificates.

To avoid adding a dependency on another server to resolve the ADN,
the Encrypted DNS options return the IP address(es) to locate the
encrypted DNS server. These encrypted DNS servers may be hosted on
the same or distinct IP addresses. Such a decision is deployment
specific.

In order to optimize the size of discovery messages when all DNS
servers terminate on the same IP address, early versions of this
document considered relying upon the discovery mechanisms specified
in [RFC2132][RFC3646][RFC8106] to retrieve a list of IP addresses to
reach their DNS servers. Nevertheless, this approach requires a
client that supports more than one encrypted DNS protocol (e.g., DoH
and DoT) to probe that list of IP addresses. To avoid such a
probing, the options defined in Sections 4, 5, and 6 associate an IP
address with an encrypted DNS protocol. No probing is required in
such a design.

A list of IP addresses to reach an encrypted DNS server may be
returned in an Encrypted DNS option to accommodate current
deployments relying upon primary and backup servers. Whether one or
more IP addresses are returned in an Encrypted DNS option is
deployment specific. For example, a router embedding a recursive
server or a forwarder has to include one single IP address pointing
to one of its LAN-facing interfaces. This IP address can be a
private IPv4 address, a link-local address, a Unique Local IPv6
unicast Address (ULA), or a Global Unicast Address (GUA).

If more than one IP address are to be returned in an Encrypted DNS
option, these addresses are ordered in the preference for use by the
client.

Because distinct encrypted DNS protocols may be provisioned by a
network (e.g., DoT, DoH, and DoQ) and that some of these protocols
may make use of customized port numbers instead of default ones, the
Encrypted DNS options are designed to return a set of service
parameters. These parameters are encoded following the same rules
for encoding SvcParams in Section 2.1 of [I-D.ietf-dnsop-svcb-
https]. This encoding approach may increase the size of the options
but it has the merit to rely upon an existing IANA registry and,
thus, to accommodate new encrypted DNS protocols and service
parameters that may be defined in the future. For example, "dohpath"
service parameter (Section 5.1 of [I-D.ietf-add-svcb-dns]) supplies
a relative DoH URI Template.

A single option is used to convey both the ADN and IP addresses because otherwise means to correlate an IP address with an ADN will be required if, for example, more than one ADN is supported by the network.

The DHCP options defined in Sections 4 and 5 follow the option ordering guidelines in Section 17 of [RFC7227].

3.2. Handling Configuration Data Conflicts

If the encrypted DNS is discovered by a host using both RA and DHCP, the rules discussed in Section 5.3.1 of [RFC8106] MUST be followed.

DHCP/RA options to discover encrypted DNS servers (including, DoH URI Templates) takes precedence over DDR [I-D.ietf-add-ddr] since DDR uses unencrypted DNS to an external DNS resolver, which is susceptible to both internal and external attacks whereas DHCP/RA is typically protected using the mechanisms discussed in Section 7.1.

3.3. Connection Establishment

If the local DNS client supports one of the discovered Encrypted DNS protocols identified by Application Layer Protocol Negotiation (ALPN) protocol identifiers, the DNS client establishes an encrypted DNS session following the order of the discovered servers. The client follows the mechanism discussed in Section 8 of [RFC8310] to authenticate the DNS server certificate using the authentication domain name conveyed in the Encrypted DNS options. ALPN-related considerations can be found in Section 6.1 of [I-D.ietf-dnsop-svcb-https].

3.4. Multihoming Considerations

Devices may be connected to multiple networks; each providing their own DNS configuration using the discovery mechanisms specified in this document. Nevertheless, it is out of the scope of this specification to discuss DNS selection of multi-interface devices. The reader may refer to [RFC6731] for a discussion of issues and an example of DNS server selection for multi-interfaced devices.

4. DHCPv6 Encrypted DNS Option

4.1. Option Format

The format of the DHCPv6 Encrypted DNS option is shown in Figure 1.

```
 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_V6_DNR          |            Option-length       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Service Priority      |           ADN Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                    authentication-domain-name                 ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Addr Length          |                                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                                |
~                    ipv6-address(es)                           ~
|                               +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                               |                                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                                |
~                Service Parameters (SvcParams)                 ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
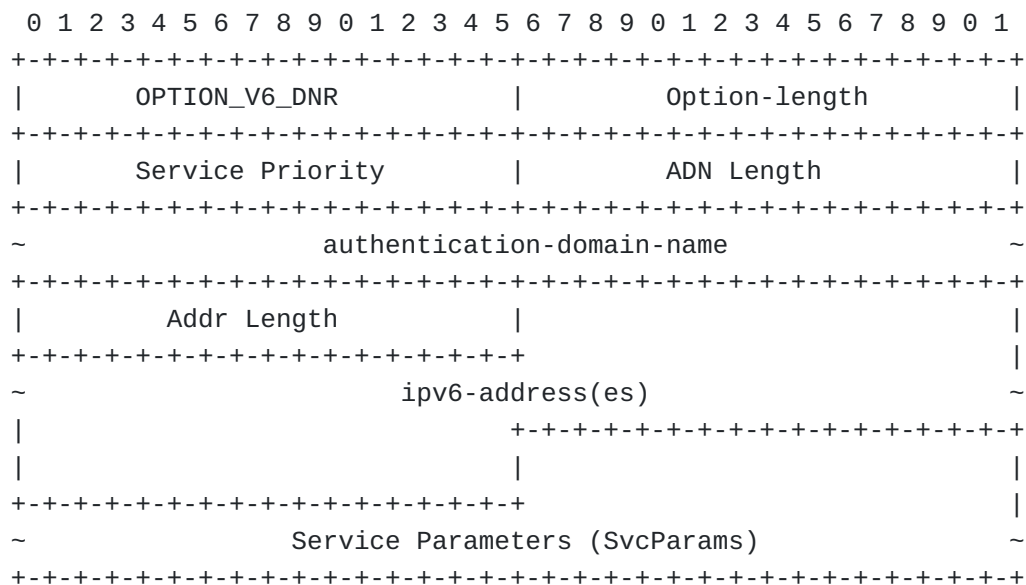
Figure 1: DHCPv6 Encrypted DNS Option

The fields of the option shown in Figure 1 are as follows:

Option-code: OPTION_V6_DNR (TBA1, see Section 8.1)

Option-length: Length of the enclosed data in octets.

Service Priority: The priority of this OPTION_V6_DNR instance
   compared to other instances. This field is encoded following the
   rules specified in Section 2.4.1 of [I-D.ietf-dnsop-svcb-https].

ADN Length: Length of the authentication-domain-name field in
   octets.

authentication-domain-name (variable length): A fully qualified
   domain name of the encrypted DNS server. This field is formatted
   as specified in Section 10 of [RFC8415].

   An example of the authentication-domain-name encoding is shown in
   Figure 2. This example conveys the FQDN "doh1.example.com.", and
   the resulting Option-length field is 18.

```
   +------+------+------+------+------+------+------+------+------+
   | 0x04 |  d   |  o   |  h   |  1   | 0x07 |  e   |  x   |  a   |
   +------+------+------+------+------+------+------+------+------+
   |  m   |  p   |  l   |  e   | 0x03 |  c   |  o   |  m   | 0x00 |
   +------+------+------+------+------+------+------+------+------+
```

Figure 2: An Example of the DNS authentication-domain-name
                            Encoding

Addr Length:
          Length of enclosed IPv6 addresses in octets. It MUST
    be a multiple of 16.

ipv6-address(es) (variable length): Indicates one or more IPv6
    addresses to reach the encrypted DNS server. An address can be
    link-local, ULA, or GUA. The format of this field is shown in
    Figure 3.

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
|                         ipv6-address                          |
|                                                               |
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                             ...                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
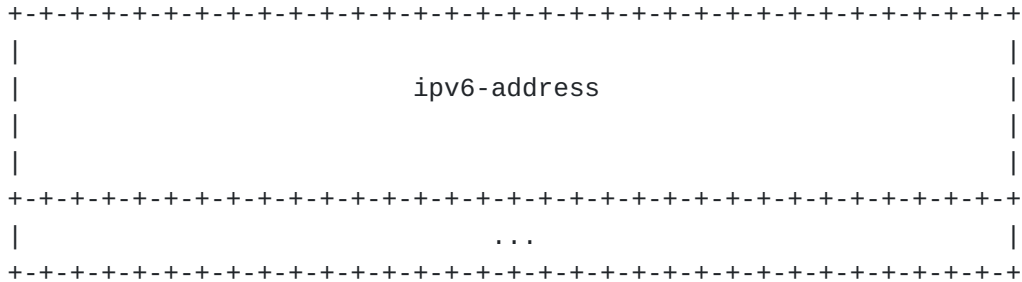
Figure 3: Format of the IPv6 Addresses Field

Service Parameters (SvcParams) (variable length): Specifies a set
    of service parameters that are encoded following the rules in
    Section 2.1 of [I-D.ietf-dnsop-svcb-https]. Service parameters
    may include, for example, a list of ALPN protocol identifiers or
    alternate port numbers. The service parameters MUST NOT include
    "ipv4hint" or "ipv6hint" SvcParams as they are superseded by the
    included IP addresses.

    If no port service parameter is included, this indicates that
    default port numbers should be used. As a reminder, the default
    port number is 853 for DoT, 443 for DoH, and 853 for DoQ.

    The length of this field is ('Option-length' - 6 - 'ADN Length' -
    'Addr Length').

4.2. DHCPv6 Client Behavior

To discover an encrypted DNS server, the DHCPv6 client MUST include
OPTION_V6_DNR in an Option Request Option (ORO), as in Sections
18.2.1, 18.2.2, 18.2.4, 18.2.5, 18.2.6, and 21.7 of [RFC8415].

The DHCP client MUST be prepared to receive multiple instances of
the OPTION_V6_DNR option; each option is to be treated as a separate
encrypted DNS server. These instances SHOULD be processed following
their service priority (i.e., smaller service priority indicates a
higher preference).

The DHCPv6 client MUST silently discard multicast and host loopback
addresses conveyed in OPTION_V6_DNR.

5. DHCPv4 Encrypted DNS Option

5.1. Option Format

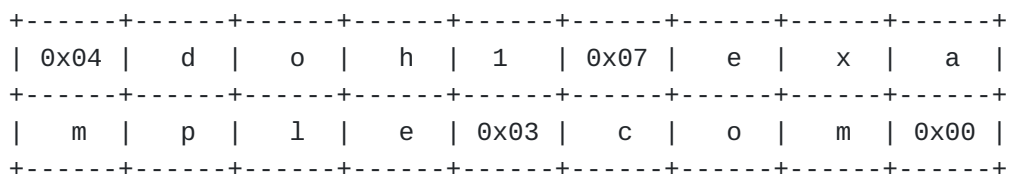The format of the DHCPv4 Encrypted DNS option is illustrated in
Figure 4.

```
                 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                |      TBA2      |     Length    |
                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                |        Service Priority        |
                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                |  ADN Length   |                |
                +-+-+-+-+-+-+-+-+                +
                ~  authentication-domain-name   ~
                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                | Addr Length   |                |
                +-+-+-+-+-+-+-+-+                +
                ~         IPv4 Address(es)       ~
                |               +-+-+-+-+-+-+-+-+
                |               |                |
                +-+-+-+-+-+-+-+-+                |
                ~Service Parameters (SvcParams) ~
                |                               |
                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
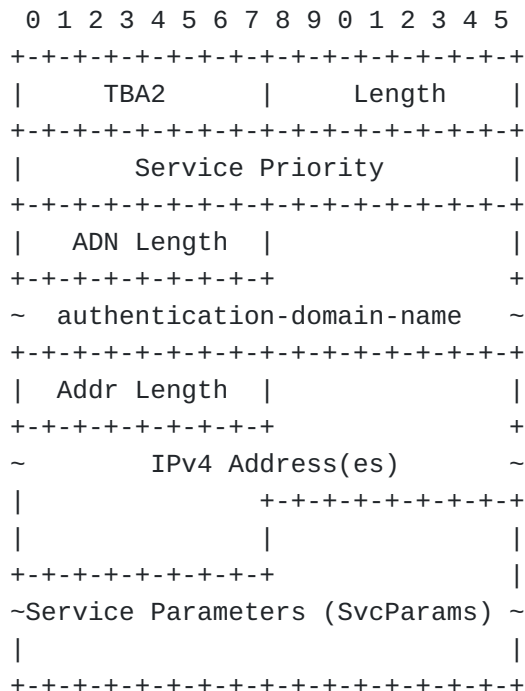
Figure 4: DHCPv4 Encrypted DNS Option

The fields of the option shown in Figure 4 are as follows:

Code: OPTION_V4_DNR (TBA2, see Section 8.2).

Length: Indicates the length of the enclosed data in octets.

Service Priority: The priority of this OPTION_V4_DNR instance
   compared to other instances. This field is encoded following the
   rules specified in Section 2.4.1 of [I-D.ietf-dnsop-svcb-https].

ADN Length: Indicates the length of the authentication-domain-name
   in octets.

authentication-domain-name (variable length): Includes the
   authentication domain name of the encrypted DNS server. This
   field is formatted as specified in Section 10 of [RFC8415]. The
   format of this field is shown in Figure 5. The values s1, s2, s3,
   etc. represent the domain name labels in the domain name
   encoding.

```
                    +-----+-----+-----+-----+-----+--
                    |  s1 |  s2 |  s3 |  s4 | s5  |  ...
                    +-----+-----+-----+-----+-----+--
                       authentication-domain-name
```

Figure 5: Format of the Authentication Domain Name Field

Addr Length: Indicates the length of included IPv4 addresses in
    octets. It MUST be a multiple of 4.

IPv4 Address(es) (variable length): Indicates one or more IPv4
    addresses to reach the encrypted DNS server. Both private and
    public IPv4 addresses can be included in this field. The format
    of this field is shown in [Figure 6](). This format assumes that an
    IPv4 address is encoded as a1.a2.a3.a4.

```
          0     8     16    24    32    40    48
          +-----+-----+-----+-----+-----+-----+--
          | a1  | a2  | a3  | a4  | a1  | a2  | ...
          +-----+-----+-----+-----+-----+-----+--
            IPv4 Address 1          IPv4 Address 2 ...
```

Figure 6: Format of the IPv4 Addresses Field

Service Paramters (SvcParams) (variable length): Specifies a set of
    service parameters that are encoded following the rules in
    Section 2.1 of [[I-D.ietf-dnsop-svcb-https]()]. Service parameters
    may include, for example, a list of ALPN protocol identifiers or
    alternate port numbers. The service parameters MUST NOT include
    "ipv4hint" or "ipv6hint" SvcParams as they are superseded by the
    included IP addresses.

    If no port service parameter is included, this indicates that
    default port numbers should be used.

    The length of this field is ('Option-length' - 4 - 'ADN Length' -
    'Addr Length').

OPTION_V4_DNR is a concatenation-requiring option. As such, the
mechanism specified in [[RFC3396]()] MUST be used if OPTION_V4_DNR
exceeds the maximum DHCPv4 option size of 255 octets.

5.2. DHCPv4 Client Behavior

To discover an encrypted DNS server, the DHCPv4 client requests the
Encrypted DNS server by including OPTION_V4_DNR in a Parameter
Request List option [[RFC2132]()].

The DHCPv4 client MUST be prepared to receive multiple instances of
the OPTION_V4_DNR option; each option is to be treated as a separate

encrypted DNS server. These instances SHOULD be processed following
their service priority (i.e., smaller service priority indicates a
higher preference).

The DHCPv4 client MUST silently discard multicast and host loopback
addresses conveyed in OPTION_V4_DNR.

6. IPv6 RA Encrypted DNS Option

6.1. Option Format

This section defines a new Neighbor Discovery option [RFC4861]: IPv6
RA Encrypted DNS option. This option is useful in contexts similar
to those discussed in Section 1.1 of [RFC8106].

The format of the IPv6 RA Encrypted DNS option is illustrated in
Figure 7.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     TBA3      |     Length     |          ADN Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Lifetime                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                  authentication-domain-name                   ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|        Addr Length         |                                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                                  |
~                        ipv6-address(es)                       ~
|                            +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            |       SvcParams Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                   Service Parameters (SvcParams)              ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
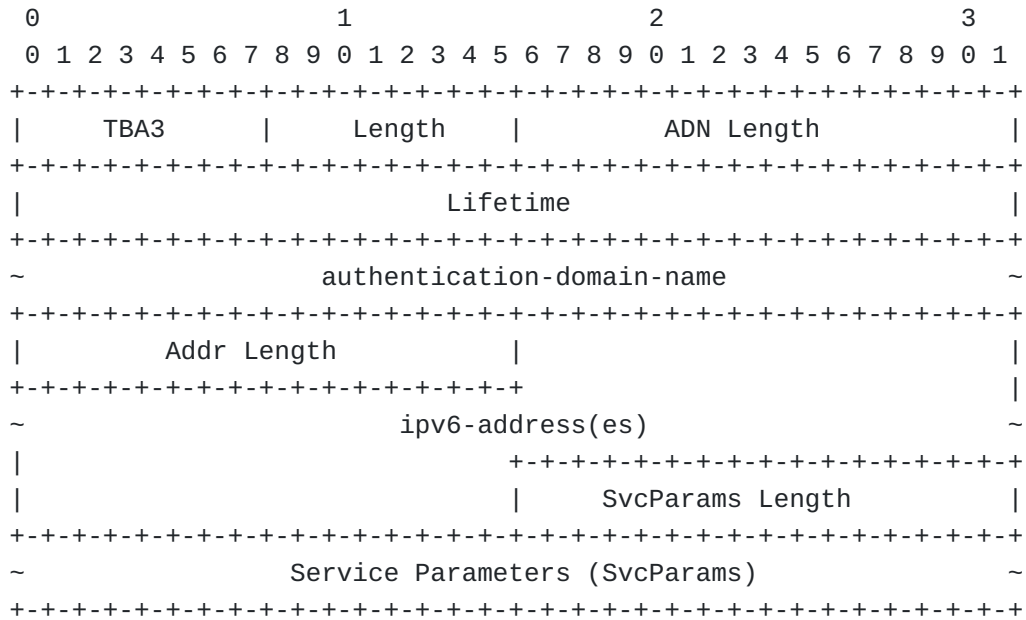
Figure 7: RA Encrypted DNS Option

The fields of the option shown in Figure 7 are as follows:

Type: 8-bit identifier of the Encrypted DNS Option as assigned by
   IANA (TBA3, see Section 8.3).

Length: 8-bit unsigned integer. The length of the option (including
   the Type and Length fields) is in units of 8 octets.

Lifetime: 32-bit unsigned integer. The maximum time in seconds
   (relative to the time the packet is received) over which the
   discovered Authentication Domain Name is valid.

The value of Lifetime SHOULD by default be at least 3 *
MaxRtrAdvInterval, where MaxRtrAdvInterval is the maximum RA
interval as defined in [RFC4861].

A value of all one bits (0xffffffff) represents infinity.

A value of zero means that this Authentication Domain Name MUST
no longer be used.

ADN Length: 16-bit unsigned integer. This field indicates the
length of the authentication-domain-name field in octets.

authentication-domain-name (variable length): The domain name of
the encrypted DNS server. This field is formatted as specified in
Section 10 of [RFC8415].

Addr Length: 16-bit unsigned integer. This field indicates the
length of enclosed IPv6 addresses in octets. It MUST be a
multiple of 16.

ipv6-address(es) (variable length): One or more IPv6 addresses of
the encrypted DNS server. An address can be link-local, ULA, or
GUA.

All of the addresses share the same Lifetime value. Similar to
[RFC8106], if it is desirable to have different Lifetime values
per IP address, multiple Encrypted DNS options may be used.

The format of this field is shown in Figure 3.

SvcParams Length: 16-bit unsigned integer. This field indicates the
length of the Service Parameters field in octets.

Service Paramters (SvcParams) (variable length): Specifies a set of
service parameters that are encoded following the rules in
Section 2.1 of [I-D.ietf-dnsop-svcb-https]. Service parameters
may include, for example, a list of ALPN protocol identifiers or
alternate port numbers. The service parameters MUST NOT include
"ipv4hint" or "ipv6hint" SvcParams as they are superseded by the
included IP addresses.

If no port service parameter is included, this indicates that
default port numbers should be used.

The option MUST be padded with zeros so that the full enclosed data
is a multiple of 8 octets (Section 4.6 of [RFC4861]).

Multiple Encrypted DNS options may be returned to an IPv6 host.
Similar to [RFC8106], these options are ordered in the preference
for use by the IPv6 host.

6.2. IPv6 Host Behavior

The procedure for DNS configuration is the same as it is with any
other Neighbor Discovery option [RFC4861]. In addition, the host
follows the procedure described in Section 5.3.1 of [RFC8106].

The host MUST silently discard multicast and host loopback addresses
conveyed in the Encrypted DNS options.

7. Security Considerations

7.1. Spoofing Attacks

DHCP/RA messages are not encrypted or protected against modification
within the LAN. Unless mitigated (described below), the content of
DHCP and RA messages can be spoofed or modified by active attackers,
such as compromised devices within the local network. An active
attacker (Section 3.3 of [RFC3552]) can spoof the DHCP/RA response
to provide the attacker's Encrypted DNS server. Note that such an
attacker can launch other attacks as discussed in Section 22 of
[RFC8415]. The attacker can get a domain name with a domain-
validated public certificate from a CA and host an Encrypted DNS
server.

Attacks of spoofed or modified DHCP responses and RA messages by
attackers within the local network may be mitigated by making use of
the following mechanisms:

  *DHCPv6-Shield described in [RFC7610], the CPE discards DHCP
   response messages received from any local endpoint.

  *RA-Guard described in [RFC7113], the CPE discards RAs messages
   received from any local endpoint.

  *Source Address Validation Improvement (SAVI) solution for DHCP
   described in [RFC7513], the CPE filters packets with forged
   source IP addresses.

The above mechanisms would ensure that the endpoint receives the
correct configuration information of the encrypted DNS servers
selected by the DHCP server (or RA sender), but cannot provide any
information about the DHCP server or the entity hosting the DHCP
server (or RA sender) .

Encrypted DNS sessions with rogue servers that spoof the IP address
of a DNS server will fail because the DNS client will fail to
authenticate that rogue server based upon PKIX authentication
[RFC6125], particularly the authentication domain name in the
Encrypted DNS Option. DNS clients that ignore authentication

failures and accept spoofed certificates will be subject to attacks
(e.g., redirect to malicious servers, intercept sensitive data).

Encrypted DNS connections received from outside the local network
MUST be discarded by the encrypted DNS forwarder in the CPE. This
behavior adheres to REQ#8 in [RFC6092]; it MUST apply for both IPv4
and IPv6.

7.2. Deletion Attacks

If the DHCP responses or RAs are dropped by the attacker, the client
can fallback to use a preconfigured encrypted DNS server. However,
the use of policies to select servers is out of the scope of this
document.

Note that deletion attack is not specific to DHCP/RA.

7.3. Passive Attacks

A passive attacker (Section 3.2 of [RFC3552]) can identify a host is
using DHCP/RA to discover an encrypted DNS server and can infer that
host is capable of using DoH/DoT/DoQ to encrypt DNS messages.
However, a passive attacker cannot spoof or modify DHCP/RA messages.

7.4. Wireless Security - Authentication Attacks

Wireless LAN (WLAN) as frequently deployed in local networks (e.g.,
home networks) is vulnerable to various attacks (e.g., [Evil-Twin],
[Krack], [Dragonblood]). Because of these attacks, only
cryptographically authenticated communications are trusted on WLANs.
This means that an information (e.g., NTP server, DNS server,
default domain) provided by such networks via DHCP, DHCPv6, or RA
are untrusted because DHCP and RA messages are not authenticated.

If the pre-shared key is the same for all clients that connect to
the same WLAN, the shared key will be available to all nodes,
including attackers. As such, it is possible to mount an active on-
path attack. Man-in-the-middle attacks are possible within local
networks because such WLAN authentication lacks peer entity
authentication.

This leads to the need for provisioning unique credentials for
different clients. Endpoints can be provisioned with unique
credentials (username and password, typically) provided by the local
network administrator to mutually authenticate to the local WLAN
Access Point (e.g., 802.1x Wireless User Authentication on OpenWRT
[dot1x], EAP-pwd [RFC8146]). Not all endpoint devices (e.g., IoT
devices) support 802.1x supplicant and need an alternate mechanism
to connect to the local network. To address this limitation, unique

pre-shared keys can be created for each such device and WPA-PSK is
used (e.g., [PSK]).

8. IANA Considerations

8.1. DHCPv6 Option

IANA is requested to assign the following new DHCPv6 Option Code in
the registry maintained in [DHCPV6].

Value	Description	Client ORO	Singleton Option	Reference
TBA1	OPTION_V6_DNR	Yes	No	[ThisDocument]

Table 1

8.2. DHCPv4 Option

IANA is requested to assign the following new DHCP Option Code in
the registry maintained in [BOOTP].

```
+------+------------------+-------+---------------+----------------+
| Tag  | Name             | Data  | Meaning       | Reference      |
|      |                  | Length|               |                |
+------+------------------+-------+---------------+----------------+
| TBA2 | OPTION_V4_DNR    | N     | Encrypted DNS | [ThisDocument] |
|      |                  |       | Server        |                |
+------+------------------+-------+---------------+----------------+
```

8.3. Neighbor Discovery Option

IANA is requested to assign the following new IPv6 Neighbor
Discovery Option type in the "IPv6 Neighbor Discovery Option
Formats" sub-registry under the "Internet Control Message Protocol
version 6 (ICMPv6) Parameters" registry maintained in [ND].

Type	Description	Reference
TBA3	DNS Encrypted DNS Option	[ThisDocument]

Table 2

9. Acknowledgements

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Stephane Bortzmeyer, Ben Schwartz, and Iain Sharp for the comments.

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The use of DHCP to retrieve an authentication domain name was discussed in Section 7.3.1 of [RFC8310] and [I-D.pusateri-dhc-dns-driu].

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11.1. Normative References

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