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Authors: B. Schwartz
Google LLC
Service Binding Mapping for DNS Servers

Abstract

The SVCB DNS record type expresses a bound collection of endpoint metadata, for use when establishing a connection to a named service. DNS itself can be such a service, when the server is identified by a domain name. This document provides the SVCB mapping for named DNS servers, allowing them to indicate support for new transport protocols.

Discussion Venues

This note is to be removed before publishing as an RFC.

Discussion of this document takes place on the ADD Working Group mailing list (add@ietf.org), which is archived at <https://mailarchive.ietf.org/arch/browse/add/>.

Source for this draft and an issue tracker can be found at <https://github.com/bemasc/svcb-dns>.

Status of This Memo

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Table of Contents

- [1. Introduction](#)
- [2. Conventions and Definitions](#)
- [3. Name form](#)
 - [3.1. Special case: non-default ports](#)
- [4. Applicable existing SvcParamKeys](#)
 - [4.1. alpn](#)
 - [4.2. port](#)
 - [4.3. Other applicable SvcParamKeys](#)
- [5. New SvcParamKeys](#)
 - [5.1. dohpath](#)
- [6. Limitations](#)
- [7. Examples](#)
- [8. Security Considerations](#)
 - [8.1. Adversary on the query path](#)
 - [8.2. Adversary on the transport path](#)
- [9. IANA Considerations](#)
- [10. References](#)
 - [10.1. Normative References](#)
 - [10.2. Informative References](#)
- [Appendix A. Mapping Summary](#)
- [Acknowledgments](#)
- [Author's Address](#)

1. Introduction

The SVCB record type [[SVCB](#)] provides clients with information about how to reach alternative endpoints for a service, which may have improved performance or privacy properties. The service is identified by a "scheme" indicating the service type, a hostname, and optionally other information such as a port number. A DNS server is often identified only by its IP address (e.g. in DHCP), but in some contexts it can also be identified by a hostname (e.g. "NS")

records, manual resolver configuration) and sometimes also a non-default port number.

Use of the SVCB record type requires a mapping document for each service type, indicating how a client for that service can interpret the contents of the SVCB SvcParams. This document provides the mapping for the "dns" service type, allowing DNS servers to offer alternative endpoints and transports, including encrypted transports like DNS over TLS and DNS over HTTPS.

2. Conventions and Definitions

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.

3. Name form

Names are formed using Port-Prefix Naming ([[SVCB](#)] Section 2.3), with a scheme of "dns". For example, SVCB records for a DNS service identified as dns1.example.com would be located at _dns.dns1.example.com.

3.1. Special case: non-default ports

Normally, a DNS service is identified by an IP address or a domain name. When connecting to the service using unencrypted DNS over UDP or TCP, clients use the default port number for DNS (53). However, in rare cases, a DNS service might be identified by both a name and a port number. For example, the dns: URI scheme [[DNSURI](#)] optionally includes an authority, comprised of a host and a port number (with a default of 53). DNS URIs normally omit the authority, or specify an IP address, but a hostname and non-default port number are allowed.

When a non-default port number is part of a service identifier, Port-Prefix Naming places the port number in an additional a prefix on the name. For example, SVCB records for a DNS service identified as dns1.example.com:9953 would be located at _9953._dns.dns1.example.com. If two DNS services operating on different port numbers provide different behaviors, this arrangement allows them to preserve the distinction when specifying alternative endpoints.

4. Applicable existing SvcParamKeys

4.1. alpn

This key indicates the set of supported protocols ([\[SVCB\]](#) Section 6.1). There is no default protocol, so the no-default-alpn key does not apply, and the alpn key MUST be present.

If the protocol set contains any HTTP versions (e.g. "h2", "h3"), then the record indicates support for DNS over HTTPS [\[DOH\]](#), and the "dohpath" key MUST be present ([Section 5.1](#)). All keys specified for use with the HTTPS record are also permissible, and apply to the resulting HTTP connection.

If the protocol set contains protocols with different default ports, and no port key is specified, then protocols are contacted separately on their default ports. Note that in this configuration, ALPN negotiation does not defend against cross-protocol downgrade attacks.

4.2. port

This key is used to indicate the target port for connection ([\(\[SVCB\]](#) Section 6.2)). If omitted, the client SHALL use the default port for each transport protocol (853 for DNS over TLS [\[DOT\]](#), 443 for DNS over HTTPS).

This key is automatically mandatory if present. (See Section 7 of [\[SVCB\]](#) for the definition of "automatically mandatory".)

4.3. Other applicable SvcParamKeys

These SvcParamKeys from [\[SVCB\]](#) apply to the "dns" scheme without modification:

*ech

*ipv4hint

*ipv6hint

Future SvcParamKeys may also be applicable.

5. New SvcParamKeys

5.1. dohpath

"dohpath" is a single-valued SvcParamKey whose value (both in presentation and wire format) is a relative URI Template [\[RFC6570\]](#), normally starting with "/". If the "alpn" SvcParamKey indicates

support for HTTP, clients MAY construct a DNS over HTTPS URI Template by combining the prefix "https://", the service name, the port from the "port" key if present, and the "dohpath" value. (The DNS service's original port number MUST NOT be used.)

Clients SHOULD NOT query for any "HTTPS" RRs when using the constructed URI Template. Instead, the SvcParams and address records associated with this SVCB record SHOULD be used for the HTTPS connection, with the same semantics as an HTTPS RR. However, for consistency, service operators SHOULD publish an equivalent HTTPS RR, especially if clients might learn this URI Template through a different channel.

6. Limitations

This document is concerned exclusively with the DNS transport, and does not affect or inform the construction or interpretation of DNS messages. For example, nothing in this document indicates whether the service is intended for use as a recursive or authoritative DNS server. Clients must know the intended use in their context.

7. Examples

*A resolver at simple.example that supports DNS over TLS on port 853 (implicitly, as this is its default port):

```
_dns.simple.example. 7200 IN SVCB 1 simple.example. alpn=dot
```

*A resolver at doh.example that supports only DNS over HTTPS (DNS over TLS is not supported):

```
_dns.doh.example. 7200 IN SVCB 1 doh.example. (  
    alpn=h2 dohpath=/dns-query{?dns} )
```

*A resolver at resolver.example that supports

- DNS over TLS on resolver.example ports 853 (implicit in record 1) and 8530 (explicit in record 2), with resolver.example as the Authentication Domain Name,

- DNS over HTTPS at https://resolver.example/dns-query{?dns} (record 1), and

- an experimental protocol on fooexp.resolver.example:5353 (record 3):

```
$ORIGIN resolver.example.  
_dns 7200 IN SVCB 1 @ alpn=dot,h2,h3 dohpath=/dns-query{?dns}  
SVCB 2 @ alpn=dot port=8530  
SVCB 3 fooexp port=5353 alpn=foo foo-info=...
```

*A nameserver at ns.example whose service configuration is published on a different domain:

```
$ORIGIN example.  
_dns.ns 7200 IN SVCB 0 _dns.ns.nic
```

8. Security Considerations

8.1. Adversary on the query path

This section considers an adversary who can add or remove responses to the SVCB query.

Clients **MUST** authenticate the server to its name during secure transport establishment. This name is the hostname used to construct the original SVCB query, and cannot be influenced by the SVCB record contents. Accordingly, this draft does not mandate the use of DNSSEC. This draft also does not specify how clients authenticate the name (e.g. selection of roots of trust), which might vary according to the context.

Although this adversary cannot alter the authentication name of the service, it does have control of the port number and "dohpath" value. As a result, the adversary can direct DNS queries for \$HOSTNAME to any port on \$HOSTNAME, and any path on "https://\$HOSTNAME", even if \$HOSTNAME is not actually a DNS server. If the DNS client uses shared TLS or HTTP state, the client could be correctly authenticated (e.g. using a TLS client certificate or HTTP cookie).

This behavior creates a number of possible attacks for certain server configurations. For example, if "https://\$HOSTNAME/upload" accepts any POST request as a public file upload, the adversary could forge a SVCB record containing dohpath=/upload. This would cause the client to upload and publish every query, resulting in unexpected storage costs for the server and privacy loss for the client.

To mitigate this attack, a client of this SVCB mapping **MUST NOT** provide client authentication for DNS queries, except to servers that it specifically knows are not vulnerable to such attacks, and a DoH service operator **MUST** ensure that all unauthenticated DoH requests to its origin maintain the DoH service's privacy guarantees, regardless of the path. Also, if an alternative service endpoint sends an invalid response to a DNS query, the client **SHOULD NOT** send more queries to that endpoint.

8.2. Adversary on the transport path

This section considers an adversary who can modify network traffic between the client and the alternative service (identified by the TargetName).

For a SVCB-reliant client ([SVCB] Section 3), this adversary can only cause a denial of service. However, because DNS is unencrypted by default, this adversary can execute a downgrade attack against SVCB-optional clients. Accordingly, when use of this specification is optional, clients SHOULD switch to SVCB-reliant behavior if SVCB resolution succeeds. Specifications making use of this mapping MAY adjust this fallback behavior to suit their requirements.

9. IANA Considerations

Per [SVCB] IANA would be directed to add the following entry to the SVCB Service Parameters registry.

Number	Name	Meaning	Reference
TBD	dohpath	DNS over HTTPS path template	(This document)

Table 1

Per [Attrleaf], IANA would be directed to add the following entry to the DNS Underscore Global Scoped Entry Registry:

RR TYPE	_NODE NAME	Meaning	Reference
SVCB	_dns	DNS SVCB info	(This document)

Table 2

10. References

10.1. Normative References

- [DOH] Hoffman, P. and P. McManus, "DNS Queries over HTTPS (DoH)", RFC 8484, DOI 10.17487/RFC8484, October 2018, <<https://www.rfc-editor.org/rfc/rfc8484>>.
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10.2. Informative References

[Attrleaf] Crocker, D., "Scoped Interpretation of DNS Resource Records through "Underscored" Naming of Attribute Leaves", BCP 222, RFC 8552, DOI 10.17487/RFC8552, March 2019, <<https://www.rfc-editor.org/rfc/rfc8552>>.

[DNSURI] Josefsson, S., "Domain Name System Uniform Resource Identifiers", RFC 4501, DOI 10.17487/RFC4501, May 2006, <<https://www.rfc-editor.org/rfc/rfc4501>>.

Appendix A. Mapping Summary

This table serves as a non-normative summary of the DNS mapping for SVCB.

Mapped scheme	"dns"
RR type	SVCB (64)
Name prefix	_dns for port 53, else _\$PORT._dns
Required keys	alpn
Automatically Mandatory Keys	port
Special behaviors	Supports all HTTPS RR SvcParamKeys
	Overrides the HTTPS RR for DoH
	Default port is per-transport
	No encrypted -> cleartext fallback

Table 3

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Author's Address

Benjamin Schwartz
Google LLC

Email: bemasc@google.com