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DoH Preference Hints for HTTP
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Abstract

When using a publicly available DNS-over-HTTPS (DoH) server, some clients may suffer poor performance when the authoritative DNS server is located far from the DoH server. For example, a publicly available DoH server provided by a Content Delivery Network (CDN) should be able to resolve names hosted by that CDN with good performance but might take longer to resolve names provided by other CDNs, or might provide suboptimal results if that CDN is using DNS-based load balancing and returns different address records depending on where the DNS query originated from. This document attempts to lessen these issues by allowing the web server to indicate to the client which DoH server can best resolve its addresses. This document defines an HTTP header field that enables web host operators to inform user agents of the preferred DoH servers to use for subsequent DNS lookups for the host's domain.

Discussion of this work is encouraged to happen on the ADD IETF mailing list add@ietf.org or on the GitHub repository which contains the draft: <https://github.com/DavidSchinazi/draft-httpbis-doh-preference-hints>.

Status of This Memo

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[1.](#) Introduction

When using a publicly available DNS-over-HTTPS (DoH) server, some clients may suffer poor performance when the authoritative DNS server is located far from the DoH server. For example, a publicly available DoH server provided by a Content Delivery Network (CDN) should be able to resolve names hosted by that CDN with good performance but might take longer to resolve names provided by other CDNs, or might provide suboptimal results if that CDN is using DNS-

based load balancing and returns different address records depending on where the DNS query originated from. This document attempts to lessen these issues by allowing the web server to indicate to the client which DoH server can best resolve its addresses. This document defines an HTTP header field that enables web host operators

to inform user agents of the preferred DoH servers to use for subsequent DNS lookups for the host's domain.

When a web server wishes its client to use a specific DoH server to resolve its addresses, it can send the DoH-Preference header to indicate that preference to the user agent. The header is not prescriptive, it only indicates the server's preference to the user. It also only applies to the web server's current hostname.

The header defined in this document is not intended to be used as a discovery mechanism for clients learning about the existence of new DoH servers. Instead, it is intended to be used as an optimization technique for clients with support for multiple DoH servers who wish to choose the most performant DNS server for a given query.

Discussion of this work is encouraged to happen on the ADD IETF mailing list add@ietf.org or on the GitHub repository which contains the draft: <https://github.com/DavidSchinazi/draft-httpbis-doh-preference-hints>.

1.1. 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.

This document uses the Augmented BNF defined in [[RFC5234](#)] and updated by [[RFC7405](#)] along with the "#rule" extension defined in [Section 7 of](#) [[RFC7230](#)]. The rules below are defined in [[RFC5234](#)], [[RFC7230](#)], and [[RFC7234](#)]:

OWS = <OWS, see {{[RFC7230](#)}}, [Section 3.2.3](#)>
delta-seconds = <delta-seconds; see {{[RFC7234](#)}}, [Section 1.2.1](#)>
quoted-string = <quoted-string, see {{[RFC7230](#)}}, [Section 3.2.6](#)>

token = <token, see {{RFC7230}}, [Section 3.2.6](#)>

[2.](#) The DoH-Preference Header Field

An HTTPS origin can indicate its preference regarding DoH servers to the client by adding an DoH-Preference header field to responses.

```
DoH-Preference = doh-uri *( OWS ";" OWS parameter )
doh-uri         = quoted-string
parameter       = token "=" ( token / quoted-string )
```

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The "doh-uri" component consists of the DoH URI Template as defined in [[RFC8484](#)].

Sending multiple DoH-Preference header fields indicates that the server prefers multiple DoH servers. They are sent in decreasing order of preference.

[2.1.](#) The max-age Directive

The REQUIRED "max-age" directive specifies the number of seconds, after the reception of the DoH-Preference header field, during which the user agent caches the server's DoH preferences.

The syntax of the max-age directive's REQUIRED value (after quoted-string unescaping, if necessary) is defined as:

```
max-age-value = delta-seconds
```

A max-age value of zero (i.e., "max-age=0") signals the user agent to remove the DoH URI template from its cache.

[2.2.](#) Examples

The header below indicates that the user agent should consider querying DNS results for the web server's hostname using "dnsserver.example.net" for approximately six months. (Lines are folded to fit.)

```
DoH-Preference: "https://dnsserver.example.net/dns-query{?dns}";
```

max-age=15768000

[3.](#) Server Behavior

Web servers MAY send a DoH-Preference header to indicate to clients that it would prefer they use that DoH server when resolving addresses for the hostname of the web server. Web servers MAY send multiple DoH-Preference headers. Web servers MUST NOT send the DoH-Preference header in HTTP responses conveyed over a non-secure transport.

[3.1.](#) Considerations For Choosing a Preferred DoH Server

The choice of DoH server can affect overall performance and responsiveness as perceived by the client. Some example considerations in choosing a preferred DoH server are:

- * A DoH host specified as a host name rather than an IP address will require one or more additional DNS resolutions when the cached DNS entries for the resolver or resolvers expire.
- * Support for extension mechanisms (e.g. EDNS(0)) may be desired.
- * Clients, particularly mobile device clients, may frequently move between networks that have different network paths to the DoH server.

[4.](#) Client Behavior

If a client chooses to act on received DoH-Preference headers, it SHOULD cache the server's hostname and the corresponding DoH URI template and lifetime. It SHOULD then send subsequent DNS requests for A and AAAA records for that host name to the provided DoH server, until the cache entry expires after the time specified in the "max-age" directive. Any received DoH-Preference header replaces and overrides any and all information received in a previous DoH-Preference header for the same host name and DoH URI template.

Clients MAY decide to only respect the DoH-Preference header for a

subset of vetted DoH servers.

Clients MUST NOT use the contents of the DoH-Preference header to impact how it resolves other domain names. Clients MUST ignore the DoH-Preference header in HTTP responses conveyed over a non-secure transport.

If the DoH-Preference URI contains a host expressed as a host name rather than as an IP address and that host name is resolved via DoH, the DoH server might also specify a DoH-Preference header. This means that respecting the DoH server recommendation could result in an excessively long chain of DoH queries or a loop of DoH servers. Clients SHOULD be capable of detecting a loop or an excessively long chain of DoH servers and treat these conditions as a query failure.

[4.1.](#) Fallback

If resolution using the recommended DoH server fails, clients MUST fall back and retry their query using another DNS resolution mechanism.

[5.](#) Internationalization Considerations

An internationalized domain name that appears in the header field MUST be expressed using A-labels; see [Section 2.3.2.1 of \[RFC5890\]](#).

[6.](#) Security Considerations

The DoH-Preference header allows a web server to impact how a user agent resolves DNS A and AAAA records for its own host name. Since the web server has proven ownership of the domain name via its TLS certificate and the DNS result that led to the initial connection, impacting future DNS resolutions to the same host name has limited security impact.

The potential exists for the DoH-Preference header to be used as a form of web tracking. Because a DoH URI is chosen by the server, cached by the client, and then subsequently contacted by the client, a uniquely chosen DoH URI could identify a client even after other client-side state has expired or been removed. Clients SHOULD expire cached DoH URIs when other client state expires or is cleared by the

user unless the URIs refer to vetted DoH servers or match common DoH URI patterns that preclude client-unique URIs.

7. IANA Considerations

This document, if approved, requests IANA to register the DoH-Preference header in the "Permanent Message Header Field Names" registry maintained at <https://www.iana.org/assignments/message-headers/> (<https://www.iana.org/assignments/message-headers/>).

| Header Field Name | Protocol | Status | Reference |
|-------------------|----------|----------|---------------------------|
| DoH-Preference | http | standard | Section 2 |

The change controller is: "IETF (iesg@ietf.org) - Internet Engineering Task Force".

8. Normative References

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