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Client-Cert HTTP Header Field: Conveying Client Certificate Information
from TLS Terminating Reverse Proxies to Origin Server Applications
[draft-ietf-httpbis-client-cert-field-00](#)

Abstract

This document defines the HTTP header field "Client-Cert" that allows a TLS terminating reverse proxy to convey the client certificate of a mutually-authenticated TLS connection to the origin server in a common and predictable manner.

Note to Readers

RFC EDITOR: please remove this section before publication

Discussion of this draft takes place on the HTTP working group mailing list (ietf-http-wg@w3.org), which is archived at <https://lists.w3.org/Archives/Public/ietf-http-wg/> (<https://lists.w3.org/Archives/Public/ietf-http-wg/>).

Working Group information can be found at <http://httpwg.github.io/> (<http://httpwg.github.io/>); source code and issues list for this draft can be found at <https://github.com/httpwg/http-extensions/labels/client-cert-header> (<https://github.com/httpwg/http-extensions/labels/client-cert-header>).

Status of This Memo

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Client-Cert Field

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[1.](#) Introduction

A fairly common deployment pattern for HTTPS applications is to have the origin HTTP application servers sit behind a reverse proxy that

terminates TLS connections from clients. The proxy is accessible to the internet and dispatches client requests to the appropriate origin server within a private or protected network. The origin servers are not directly accessible by clients and are only reachable through the reverse proxy. The backend details of this type of deployment are

typically opaque to clients who make requests to the proxy server and see responses as though they originated from the proxy server itself. Although HTTPS is also usually employed between the proxy and the origin server, the TLS connection that the client establishes for HTTPS is only between itself and the reverse proxy server.

The deployment pattern is found in a number of varieties such as n-tier architectures, content delivery networks, application load balancing services, and ingress controllers.

Although not exceedingly prevalent, TLS client certificate authentication is sometimes employed and in such cases the origin server often requires information about the client certificate for its application logic. Such logic might include access control decisions, audit logging, and binding issued tokens or cookies to a certificate, and the respective validation of such bindings. The specific details from the certificate needed also vary with the application requirements. In order for these types of application deployments to work in practice, the reverse proxy needs to convey information about the client certificate to the origin application server. A common way this information is conveyed in practice today is by using non-standard headers to carry the certificate (in some encoding) or individual parts thereof in the HTTP request that is dispatched to the origin server. This solution works but interoperability between independently developed components can be cumbersome or even impossible depending on the implementation choices respectively made (like what header names are used or are configurable, which parts of the certificate are exposed, or how the certificate is encoded). A well-known predictable approach to this commonly occurring functionality could improve and simplify interoperability between independent implementations.

This document aspires to standardize an HTTP header field named "Client-Cert" that a TLS terminating reverse proxy (TTRP) adds to requests that it sends to the backend origin servers. The header value contains the client certificate from the mutually-authenticated

TLS connection between the originating client and the TTRP. This enables the backend origin server to utilize the client certificate information in its application logic. While there may be additional proxies or hops between the TTRP and the origin server (potentially even with mutually-authenticated TLS connections between them), the scope of the "Client-Cert" header is intentionally limited to exposing to the origin server the certificate that was presented by the originating client in its connection to the TTRP.

1.1. Requirements Notation and Conventions

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.

1.2. Terminology

Phrases like TLS client certificate authentication or mutually-authenticated TLS are used throughout this document to refer to the process whereby, in addition to the normal TLS server authentication with a certificate, a client presents its X.509 certificate [[RFC5280](#)] and proves possession of the corresponding private key to a server when negotiating a TLS connection or the resumption of such a connection. In contemporary versions of TLS [[RFC8446](#)] [[RFC5246](#)] this requires that the client send the Certificate and CertificateVerify messages during the handshake and for the server to verify the CertificateVerify and Finished messages.

TODO: HTTP2 forbids TLS renegotiation and post-handshake authentication but it's possible with HTTP1.1 and maybe needs to be discussed explicitly here or somewhere in this document? Naively I'd say that the "Client-Cert" header will be sent with the data of the most recent client cert anytime after renegotiation or post-handshake auth. And only for requests that are fully covered by the cert but that in practice making the determination of where exactly in the application data the cert

messages arrived is hard to impossible so it'll be a best effort kind of thing.

2. HTTP Header Field and Processing Rules

2.1. Encoding

The field-values of the HTTP header defined herein utilize the following encoded form.

A certificate is represented in text as an "EncodedCertificate", which is the base64-encoded ([Section 4 of \[RFC4648\]](#)) DER [\[ITU.X690.1994\]](#) PKIX certificate. The encoded value MUST NOT include any line breaks, whitespace, or other additional characters. ABNF [\[RFC5234\]](#) syntax for "EncodedCertificate" is shown in the figure below.

```
EncodedCertificate = 1*( DIGIT / ALPHA / "+" / "/" ) 0*2"="
```

```
DIGIT = <Defined in Section B.1 of [RFC5234]> ; A-Z / a-z
```

```
ALPHA = <Defined in Section B.1 of [RFC5234]> ; 0-9
```

2.2. Client-Cert HTTP Header Field

In the context of a TLS terminating reverse proxy (TTRP) deployment, the TTRP makes the TLS client certificate available to the backend application with the following header field.

Client-Cert: The end-entity client certificate as an "EncodedCertificate" value.

The "Client-Cert" header field defined herein is only for use in HTTP requests and MUST NOT be used in HTTP responses. It is a single HTTP header field-value as defined in [Section 3.2 of \[RFC7230\]](#), which MUST NOT have a list of values or occur multiple times in a request.

2.3. Processing Rules

This section outlines the applicable processing rules for a TLS

terminating reverse proxy (TTRP) that has negotiated a mutually-authenticated TLS connection to convey the client certificate from that connection to the backend origin servers. Use of the technique is to be a configuration or deployment option and the processing rules described herein are for servers operating with that option enabled.

A TTRP negotiates the use of a mutually-authenticated TLS connection with the client, such as is described in [RFC8446] or [RFC5246], and validates the client certificate per its policy and trusted certificate authorities. Each HTTP request on the underlying TLS connection are dispatched to the origin server with the following modifications:

1. The client certificate is be placed in the "Client-Cert" header field of the dispatched request as defined in [Section 2.2](#).
2. Any occurrence of the "Client-Cert" header in the original incoming request MUST be removed or overwritten before forwarding the request. An incoming request that has a "Client-Cert" header MAY be rejected with an HTTP 400 response.

Requests made over a TLS connection where the use of client certificate authentication was not negotiated MUST be sanitized by removing any and all occurrences "Client-Cert" header field prior to dispatching the request to the backend server.

Backend origin servers may then use the "Client-Cert" header of the request to determine if the connection from the client to the TTRP was mutually-authenticated and, if so, the certificate thereby presented by the client.

Forward proxies and other intermediaries MUST NOT add the "Client-Cert" header to requests, or modify an existing "Client-Cert" header. Similarly, clients MUST NOT employ the "Client-Cert" header in requests.

A server that receives a request with a "Client-Cert" header value that it considers to be too large can respond with an HTTP 431 status code per [Section 5 of \[RFC6585\]](#).

[3.](#) Security Considerations

The header described herein enable a TTRP and backend or origin server to function together as though, from the client's perspective, they are a single logical server side deployment of HTTPS over a mutually-authenticated TLS connection. Use of the "Client-Cert" header outside that intended use case, however, may undermine the protections afforded by TLS client certificate authentication. Therefore steps MUST be taken to prevent unintended use, both in sending the header and in relying on its value.

Producing and consuming the "Client-Cert" header SHOULD be a configurable option, respectively, in a TTRP and backend server (or individual application in that server). The default configuration for both should be to not use the "Client-Cert" header thus requiring an "opt-in" to the functionality.

In order to prevent header injection, backend servers MUST only accept the "Client-Cert" header from a trusted TTRP (or other proxy in a trusted path from the TTRP). A TTRP MUST sanitize the incoming request before forwarding it on by removing or overwriting any existing instances of the header. Otherwise arbitrary clients can control the header value as seen and used by the backend server. It is important to note that neglecting to prevent header injection does not "fail safe" in that the nominal functionality will still work as expected even when malicious actions are possible. As such, extra care is recommended in ensuring that proper header sanitation is in place.

The communication between a TTRP and backend server needs to be secured against eavesdropping and modification by unintended parties.

The configuration options and request sanitization are necessarily functionally of the respective servers. The other requirements can be met in a number of ways, which will vary based on specific deployments. The communication between a TTRP and backend or origin server, for example, might be authenticated in some way with the insertion and consumption of the "Client-Cert" header occurring only on that connection. Alternatively the network topology might dictate a private network such that the backend application is only able to

accept requests from the TTRP and the proxy can only make requests to that server. Other deployments that meet the requirements set forth herein are also possible.

4. IANA Considerations

TODO: register the "Client-Cert" HTTP header field in the registry defined by http-core.

5. References

5.1. Normative References

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5.2. Informative References

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- [RFC7250] Wouters, P., Ed., Tschofenig, H., Ed., Gilmore, J., Weiler, S., and T. Kivinen, "Using Raw Public Keys in Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)", [RFC 7250](#), DOI 10.17487/RFC7250, June 2014, <<https://www.rfc-editor.org/rfc/rfc7250>>.

[Appendix A](#). Example

In a hypothetical example where a TLS client presents the client and intermediate certificate from Figure 1 when establishing a mutually-authenticated TLS connection with the TTRP, the proxy would send the "Client-Cert" header shown in {#example-header} to the backend. Note that line breaks and whitespace have been added to the value of the header field in Figure 2 for display and formatting purposes only.

```
-----BEGIN CERTIFICATE-----
```

```
MIIBqDCCAU6gAwIBAgIBBzAKBggqhkJOPQQDAjA6MRswGQYDVQQKDBJMZXQncyBB  
dXRoZW50aWNhdGUxGzAZBgNVBAMMEkxBIEludGVybWVkaWF0ZSBDQTAeFw0yMDAx  
MTQyMjU1MzNaFw0yMTAxMjMyMjU1MzNaMA0xCzAJBGNVBAMMAkJDMFkwEwYHkoZI  
zj0CAQYIKoZiZj0DAQcDQgAE8YnXXfaUgmnMtOXU/IncWalRhebrXmckC8vJ1p  
5Be5F/3YC80thxM4+k1M6aEAEFcGzkJiNy6J84y7uzo9M6NyMHAwCQYDVR0TBAlw  
ADAFBgNVHSMEGDAWgBRm3WjLa38lbEYCuICPct0ZaSED2DA0BgNVHQ8BAf8EBAMC  
BsAwEwYDVR0lBAwwCgYIKwYBBQUHAWIwHQYDVR0RAQH/BBMwEYEPYmRjQGV4YW1w  
bGUuY29tMAoGCCqGSM49BAMCA0gAMEUCIBHda/r1vaL6G3VliL4/Di6YK0Q6bMje  
SkC3dFC00B8TAiEAX/kHSB4urmiZ0NX5r5XarmPk0wmuydBVoU4hBVZ1yhk=
```

```
-----END CERTIFICATE-----
```

```
-----BEGIN CERTIFICATE-----
```

```
MIIB5jCCAYugAwIBAgIBFjAKBggqhkJOPQQDAjBWMQswCQYDVQQGEwJVUzEhMBkG  
A1UECgwSTGV0J3MgQXV0aGVudGllYXRlMSowKAYDVQQDDCFMZXQncyBBdXRoZW50  
aWNhdGUgUm9vdCBBDXR0b3JpdHkwHhcnMjAwMTE0MjEzMTU1MzNaMA0xCzAJBGNV  
BAMMAkJDMFkwEwYHkoZiZj0CAQYIKoZiZj0DAQcDQgAE8YnXXfaUgmnMtOXU/Inc  
WalRhebrXmckC8vJ1p5Be5F/3YC80thxM4+k1M6aEAEFcGzkJiNy6J84y7uzo9M6  
NyMHAwCQYDVR0TBAlwADAFBgNVHSMEGDAWgBTEA2Q6eecKu9g9yb5glbkhhVINGD  
ASBgNVHRMBAf8ECDAGAQH/AgEAMA4GA1UdDwEB/wQEAwIBhjAKBggqhkJOPQQDAgN  
JADBGAiEA5pLvaFwRRkxomIAtdIwg9D7gC1xzxBl4r28EzmS01pcCIQCJUSHPX09HDI  
QMUgH69fNDEMhXD3RX5gP7kuu2KGMg==
```

```
-----END CERTIFICATE-----
```

```
-----BEGIN CERTIFICATE-----
```

```
MIICBjCCAaygAwIBAgIJAKS0yiqKtlhoMAoGCCqGSM49BAMCMFYxCzAJBGNVBAYT  
AlVTMRswGQYDVQQKDBJMZXQncyBBdXRoZW50aWNhdGUxGzA0BgNVBAMMIUxldCdz  
IEF1dGhlnbnRyY2F0ZSBSb290IEF1dGhvcml0eTAeFw0yMDAxMTQyMjU1MzNaFw00  
MDAxMDkyMTI1NDVaMFYxCzAJBGNVBAYTAlVTMRswGQYDVQQKDBJMZXQncyBBdXR0  
ZW50aWNhdGUxGzA0BgNVBAMMIUxldCdzIEF1dGhlnbnRyY2F0ZSBSb290IEF1dGhv  
cm10eTBZMBMGBYqGSM49AgEGCCqGSM49AwEHA0IABFoAHU+Z5bPKmGzLYxtCf+E6  
HYj62f0RaHD0rt+yyh3H/rTcs7ynFfGn+gyFsrSP3Ez88rajv+U2NfD0o0uZ4Pmj  
YzBhMB0GA1UdDgQWBTEA2Q6eecKu9g9yb5glbkhhVINGDAfBgNVHSMEGDAWgBTE  
A2Q6eecKu9g9yb5glbkhhVINGDAPBgNVHRMBAf8EBTADAQH/MA4GA1UdDwEB/wQE  
AwIBhjAKBggqhkJOPQQDAgNIADBFAiEAmAeg1ycKHriqHnaD4M/UDBPQRpkmdcRF  
YGMg1Qyrkx4CIB4ivz3wQcQkGhcsUZ1S0Imd/lq1Q0FLf09rGfLQPWdc
```

```
-----END CERTIFICATE-----
```

Figure 1: Certificate Chain (with client certificate first)

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```
Client-Cert: MIIBqDCCAU6gAwIBAgIBBzAKBggqhkjOPQQDAjA6MRswGQYDVQQKDBJM
ZXQncyBBdXRoZW50aWNhdGUxGzAZBgNVBAMMEkxBIEludGVybWVkaWF0ZSBDQTAeFw0y
MDAxMTQyMjU1MzNaFw0yMTAxMjMyMjU1MzNaMA0xCzAJBgNVBAMMAkJDMFkwEwYHKoZI
zj0CAQYIKoZIzj0DAQcDQgAE8YnXXfaUgmnMtOXU/IncWalRhebrXmckC8vdgJ1p5Be5
F/3YC80thxM4+k1M6aEAEFcGzkJiNy6J84y7uzo9M6NyMHAwCQYDVR0TBAlwADAfBgNV
HSMEGDAWgBRm3WjLa38lbEYCuICPct0ZaSED2DA0BgNVHQ8BAf8EBAMCBsAwEwYDVR0L
BAwwCgYIKwYBBQUHAWIwHQYDVR0RAQH/BBMwEYEPYmRjQGV4YW1wbGUuY29tMAoGCCqG
SM49BAMCA0gAMEUCIBHda/r1vaL6G3VliL4/Di6YK0Q6bMjeSkC3dFC00B8TAiEAX/kH
SB4urmiZ0NX5r5XarmPk0wmuydBVoU4hBVZ1yhk=
```

Figure 2: Header in HTTP Request to Origin Server

[Appendix B](#). Considerations Considered

[B.1](#). Header Injection

This draft requires that the TTRP sanitize the headers of the incoming request by removing or overwriting any existing instances of the "Client-Cert" header before dispatching that request to the backend application. Otherwise, a client could inject its own "Client-Cert" header that would appear to the backend to have come from the TTRP. Although numerous other methods of detecting/preventing header injection are possible; such as the use of a unique secret value as part of the header name or value or the application of a signature, HMAC, or AEAD, there is no common general standardized mechanism. The potential problem of client header injection is not at all unique to the functionality of this draft and it would therefore be inappropriate for this draft to define a one-off solution. In the absence of a generic standardized solution existing currently, stripping/sanitizing the headers is the de facto means of protecting against header injection in practice today. Sanitizing the headers is sufficient when properly implemented and is normative requirement of [Section 3](#).

[B.2](#). The Forwarded HTTP Extension

The "Forwarded" HTTP header field defined in [[RFC7239](#)] allows proxy components to disclose information lost in the proxying process. The TLS client certificate information of concern to this draft could

have been communicated with an extension parameter to the "Forwarded" header field, however, doing so would have had some disadvantages that this draft endeavored to avoid. The "Forwarded" header syntax allows for information about a full chain of proxied HTTP requests, whereas the "Client-Cert" header of this document is concerned only with conveying information about the certificate presented by the originating client on the TLS connection to the TTRP (which appears as the server from that client's perspective) to backend applications. The multi-hop syntax of the "Forwarded" header is

expressive but also more complicated, which would make processing it more cumbersome, and more importantly, make properly sanitizing its content as required by [Section 3](#) to prevent header injection considerably more difficult and error prone. Thus, this draft opted for the flatter and more straightforward structure of a single "Client-Cert" header.

[B.3.](#) The Whole Certificate and Only the Whole Certificate

Different applications will have varying requirements about what information from the client certificate is needed, such as the subject and/or issuer distinguished name, subject alternative name(s), serial number, subject public key info, fingerprint, etc.. Furthermore some applications, such as "OAuth 2.0 Mutual-TLS Client Authentication and Certificate-Bound Access Tokens" [[RFC8705](#)], make use of the entire certificate. In order to accommodate the latter and ensure wide applicability by not trying to cherry-pick particular certificate information, this draft opted to pass the full encoded certificate as the value of the "Client-Cert" header.

The handshake and validation of the client certificate (chain) of the mutually-authenticated TLS connection is performed by the TTRP. With the responsibility of certificate validation falling on the TTRP, only the end-entity certificate is passed to the backend - the root Certificate Authority is not included nor are any intermediates.

TODO: It has been suggested that more information about the certificate chain might be needed/wanted by the backend application (to independently evaluate the cert chain, for example, although that seems like it would be terribly inefficient) and that any intermediates as well as the root should also be somehow conveyed, which is an area for further discussion

should this draft progress. One potential approach suggested by a few folks is to allow some configurability in what is sent along with maybe a prefix token to indicate what's being sent - something like "Client-Cert: FULL \<cert> \<intermediate> \<anchor>" or "Client-Cert: EE \<cert>" as the strawman. Or a perhaps a parameter or other construct of [[RFC8941](#)] to indicate what's being sent. It's also been suggested that the end-entity certificate by itself might sometimes be too big (esp. e.g., with some post-quantum signature schemes). Hard to account for it both being too much data and not enough data at the same time. But potentially opening up configuration options to send only specific attribute(s) from the client certificate is a possibility for that. In the author's humble opinion the end-entity certificate by itself strikes a good balance for the vast majority of needs and avoids optionality. But, again, this is an area for further discussion should this draft progress.

TODO: It has also been suggested that maybe considerations for [[RFC7250](#)] Raw Public Keys is maybe worth considering. This too is this is an area for further discussion and consideration should this draft progress.

[Appendix C](#). Acknowledgements

The author would like to thank the following individuals who've contributed in various ways ranging from just being generally supportive of bringing forth the draft to providing specific feedback or content:

- * Evan Anderson
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- * Travis Spencer
- * Nick Sullivan
- * Peter Wu
- * Hans Zandbelt

[Appendix D.](#) Document History

To be removed by the RFC Editor before publication as an RFC

[draft-ietf-httpbis-client-cert-field-00](#)

- * Initial WG revision
- * Mike Bishop added as co-editor

[draft-bdc-something-something-certificate-05](#)

- * Change intended status of the draft to Informational
- * Editorial updates and (hopefully) clarifications

[draft-bdc-something-something-certificate-04](#)

- * Update reference from [draft-ietf-oauth-mls](#) to [RFC8705](#)

[draft-bdc-something-something-certificate-03](#)

- * Expanded further discussion notes to capture some of the feedback in and around the presentation of the draft in SECDISPATCH at IETF 107 and add those who've provided such feedback to the acknowledgements

[draft-bdc-something-something-certificate-02](#)

- * Editorial tweaks + further discussion notes

[draft-bdc-something-something-certificate-01](#)

- * Use the RFC v3 Format or die trying

[draft-bdc-something-something-certificate-00](#)

- * Initial draft after a time constrained and rushed secdispatch presentation (<https://datatracker.ietf.org/meeting/106/materials/slides-106-secdispatch-securing-protocols-between-proxies-and-backend-http-servers-00>)

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backend-http-servers-00) at IETF 106 in Singapore with the recommendation to write up a draft (at the end of the minutes (<https://datatracker.ietf.org/meeting/106/materials/minutes-106-secdispatch>)) and some folks expressing interest despite the rather poor presentation

Authors' Addresses

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