Internet Engineering Task Force (IETF)
Request for Comments: 9440
Category: Informational
ISSN: 2070-1721

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July 2023

Client-Cert HTTP Header Field

draft-ietf-httpbis-client-cert-field-06

Abstract

This document describes HTTP extension header fields that allow a TLS terminating reverse proxy (TTRP) to convey the client certificate information of a mutually authenticated TLS connection to the origin server in a common and predictable manner.

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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, including the respective validation of such bindings. The specific details needed from the certificate 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. At the time of writing, a common way this information is conveyed is by using non-standard fields 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 field 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.

The scope of this document is to describe existing practice while codifying specific details sufficient to facilitate improved and lower-touch interoperability. As such, this document describes two HTTP header fields, "Client-Cert" and "Client-Cert-Chain", which a TLS terminating reverse proxy (TTRP) adds to requests sent to the backend origin servers. The Client-Cert field value contains the end-entity client certificate from the mutually authenticated TLS connection between the originating client and the TTRP. Optionally, the Client-Cert-Chain field value contains the certificate chain used for validation of the end-entity certificate. 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 field 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 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

1.2. Terminology and Applicability

This document uses the following terminology from Section 3 of [STRUCTURED-FIELDS] to specify syntax and parsing: List and Byte Sequence.

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 [TLS] [TLS1.2], mutual authentication requires the client to send the Certificate and CertificateVerify messages during the handshake and the server to verify the CertificateVerify and Finished messages.

HTTP/2 restricts TLS 1.2 renegotiation (Section 9.2.1 of [HTTP/2]) and prohibits TLS 1.3 post-handshake authentication (Section 9.2.3 of [HTTP/2]). However, they are sometimes used to implement reactive client certificate authentication in HTTP/1.1 [HTTP/1.1] where the server decides whether to request a client certificate based on the HTTP request. HTTP application data sent on such a connection after receipt and verification of the client certificate is also mutually authenticated and thus suitable for the mechanisms described in this document. With post-handshake authentication, there is also the possibility, though unlikely in practice, of multiple certificates and certificate chains from the client on a connection. In this case, only the certificate and chain of the last post-handshake authentication are to be utilized for the header fields described herein.

2. HTTP Header Fields and Processing Rules

This document designates the following headers, defined further in Sections 2.2 and 2.3, respectively, to carry the client certificate information of a mutually authenticated TLS connection. The headers convey the information from the reverse proxy to the origin server.

Client-Cert: The end-entity certificate used by the client in the TLS handshake with the reverse proxy.

Client-Cert-Chain: The certificate chain used for validation of the end-entity certificate provided by the client in the TLS handshake with the reverse proxy.

2.1. Encoding

The headers in this document encode certificates as Byte Sequences (Section 3.3.5 of [STRUCTURED-FIELDS]) where the value of the binary data is a DER-encoded [ITU.X690] X.509 certificate [RFC5280]. In effect, this means that the binary DER certificate is encoded using base64 (without line breaks, spaces, or other characters outside the base64 alphabet) and delimited with colons on either side.

Note that certificates are often stored in an encoded textual format, such as the one described in Section 5.1 of [RFC7468], which is already nearly compatible with a Byte Sequence. If certificates are encoded as such, it will be sufficient to replace "---(BEGIN|END) CERTIFICATE---" with ":" and remove line breaks in order to generate an appropriate item.

2.2. Client-Cert HTTP Header Field

In the context of a TLS terminating reverse proxy deployment, the proxy makes the TLS client certificate available to the backend application with the Client-Cert HTTP header field. This field contains the end-entity certificate used by the client in the TLS handshake.

Client-Cert is a Byte Sequence with the value of the header encoded as described in Section 2.1.

The Client-Cert header field is only for use in HTTP requests and MUST NOT be used in HTTP responses. It is a singleton header field value as defined in Section 5.5 of [HTTP], which MUST NOT have a list of values or occur multiple times in a request.

Figure 2 in Appendix A has an example of the Client-Cert header field.

2.3. Client-Cert-Chain HTTP Header Field

In the context of a TLS terminating reverse proxy deployment, the proxy MAY make the certificate chain available to the backend application with the Client-Cert-Chain HTTP header field.

Client-Cert-Chain is a List (Section 3.1 of [STRUCTURED-FIELDS]). Each item in the List MUST be a Byte Sequence encoded as described in Section 2.1. The order is the same as the ordering in TLS (as described in Section 4.4.2 of [TLS]).

Client-Cert-Chain MUST NOT appear unless Client-Cert is also present, and it does not itself include the end-entity certificate that is already present in Client-Cert. The root certificate MAY be omitted from Client-Cert-Chain, provided that the target origin server is known to possess the omitted trust anchor.

The Client-Cert-Chain header field is only for use in HTTP requests and MUST NOT be used in HTTP responses. It MAY have a list of values or occur multiple times in a request. For header compression purposes, it might be advantageous to split lists into multiple instances.

Figure 3 in Appendix A has an example of the Client-Cert-Chain header field.

2.4. Processing Rules

This section outlines the applicable processing rules for a TTRP that has negotiated a mutually authenticated TLS connection to convey the client certificate from that connection to the backend origin servers. This technique is to be used as 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 [TLS] or [TLS1.2], and validates the client certificate per its policy and trusted certificate authorities. Each HTTP request on the underlying TLS connection is dispatched to the origin server with the following modifications:

1. The client certificate is placed in the Client-Cert header field of the dispatched request, as described in Section 2.2.
2. If so configured, the validation chain of the client certificate is placed in the Client-Cert-Chain header field of the request, as described in Section 2.3.
3. Any occurrence of the Client-Cert or Client-Cert-Chain header fields in the original incoming request MUST be removed or overwritten before forwarding the request. An incoming request that has a Client-Cert or Client-Cert-Chain header field MAY be rejected with an HTTP 400 response.

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

Backend origin servers may then use the Client-Cert header field 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. Access control decisions based on the client certificate (or lack thereof) can be conveyed by selecting response content as appropriate or with an HTTP 403 response, if the certificate is deemed unacceptable for the given context. Note that TLS clients that rely on error indications at the TLS layer for an unacceptable certificate will not receive those signals.

When the value of the Client-Cert request header field is used to select a response (e.g., the response content is access-controlled), the response MUST either be uncacheable (e.g., by sending Cache-Control: no-store) or be designated for selective reuse only for subsequent requests with the same Client-Cert header field value by sending a "Vary: Client-Cert" response header. If a TTRP encounters a response with Client-Cert or Client-Cert-Chain in the Vary header field (Section 12.5.5 of [HTTP]), it SHOULD prevent the user agent from caching the response by transforming the value of the Vary response header field to "*".

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

3. Deployment Considerations

3.1. Header Field Compression

If the connection between the TTRP and origin is capable of field compression (e.g., HPACK [HPACK] or QPACK [QPACK]), and the TTRP multiplexes more than one client's requests into that connection, the size and variation of Client-Cert and Client-Cert-Chain field values can reduce compression efficiency significantly. An origin could mitigate the efficiency loss by increasing the size of the dynamic table. If the TTRP determines that the origin dynamic table is not sufficiently large, it may find it beneficial to always send the field value as a literal rather than entering it into the table.

3.2. Message Header Size

A server in receipt of a larger message header than it is willing to handle can send an HTTP 431 (Request Header Fields Too Large) status code per Section 5 of [RFC6585]. Due to the typical size of the field values containing certificate data, recipients may need to be configured to allow for a larger maximum header size. An intermediary generating client certificate header fields on connections that allow for advertising the maximum acceptable header size (e.g., HTTP/2 [HTTP/2] or HTTP/3 [HTTP/3]) should account for the additional size of the header of the requests it sends, versus the requests it receives, by advertising a value to its clients that is sufficiently smaller so as to allow for the addition of certificate data.

3.3. TLS Session Resumption

Some TLS implementations do not retain client certificate information when resuming. Providing inconsistent values of Client-Cert and Client-Cert-Chain when resuming might lead to errors, so implementations that are unable to provide these values SHOULD either disable resumption for connections with client certificates or initially omit a Client-Cert or Client-Cert-Chain field if it might not be available after resuming.

4. Security Considerations

The header fields 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. However, use of the header fields outside that intended use case may undermine the protections afforded by TLS client certificate authentication. Therefore, steps such as those described below need to be taken to prevent unintended use, both in sending the header field and in relying on its value.

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

In order to prevent field injection, backend servers MUST only accept the Client-Cert and Client-Cert-Chain header fields 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 fields. Otherwise, arbitrary clients can control the field values as seen and used by the backend server. It is important to note that neglecting to prevent field 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 field 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 necessary functionalities 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 and Client-Cert-Chain header fields occurring only on that connection. Appendix B.3 of [HTTPSIG] gives one example of this with an application of HTTP Message Signatures. 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.

5. IANA Considerations

5.1. HTTP Field Name Registrations

IANA has registered the following entries in the "Hypertext Transfer Protocol (HTTP) Field Name Registry" defined by "HTTP Semantics" [HTTP]:

Field Name	Status	Reference
Client-Cert	permanent	RFC 9440, Section 2
Client-Cert-Chain	permanent	RFC 9440, Section 2

Table 1: Hypertext Transfer Protocol (HTTP) Field Name Registry

6. References

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Appendix A. Example

In a hypothetical example where a TLS client would present 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 field shown in Figure 2 to the backend. Note that line breaks and extra spaces have been added to the field value in Figures 2 and 3 for display and formatting purposes only.

```
-----BEGIN CERTIFICATE-----
MIIBqDCCAU6gAwIBAgIBBzAKBggqhkjOPQQDAjA6MRswGQYDVQQKDBJMZXQncyBB
dXRoZW50aWNhdGUxGzAZBgNVBAMMEkxBIEludGVybWVkaWF0ZSBDQTAeFw0yMDAx
MTQyMjU1MzNaFw0yMTAxMjMyMjU1MzNaMA0xCzAJBgNVBAMMAkJDMFkwEwYHKoZI
zj0CAQYIKoZIzj0DAQcDQgAE8YnXXfaUgmnMtOXU/IncWalRhebrXmckC8vdgJ1p
5Be5F/3YC8OthxM4+k1M6aEAEFcGzkJiNy6J84y7uzo9M6NyMHAwCQYDVR0TBAIw
ADAfBgNVHSMEGDAWgBRm3WjLa38lbEYCuiCPct0ZaSED2DAOBgNVHQ8BAf8EBAMC
BsAwEwYDVR0lBAwwCgYIKwYBBQUHAwIwHQYDVR0RAQH/BBMwEYEPYmRjQGV4YW1w
bGUuY29tMAoGCCqGSM49BAMCA0gAMEUCIBHda/r1vaL6G3VliL4/Di6YK0Q6bMje
SkC3dFCOOB8TAiEAx/kHSB4urmiZ0NX5r5XarmPk0wmuydBVoU4hBVZ1yhk=
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
MIIB5jCCAYugAwIBAgIBFjAKBggqhkjOPQQDAjBWMQswCQYDVQQGEwJVUzEbMBkG
A1UECgwSTGV0J3MgQXV0aGVudGljYXRlMSowKAYDVQQDDCFMZXQncyBBdXRoZW50
aWNhdGUgUm9vdCBBdXRob3JpdHkwHhcNMjAwMTE0MjEzMjMwWhcNMzAwMTExMjEz
MjMwWjA6MRswGQYDVQQKDBJMZXQncyBBdXRoZW50aWNhdGUxGzAZBgNVBAMMEkxB
IEludGVybWVkaWF0ZSBDQTBZMBMGByqGSM49AgEGCCqGSM49AwEHA0IABJf+aA54
RC5pyLAR5yfXVYmNpgd+CGUTDp2KOGhc0gK91zxhHesEYkdXkpS2UN8Kati+yHtW
CV3kkhCngGyv7RqjZjBkMB0GA1UdDgQWBBRm3WjLa38lbEYCuiCPct0ZaSED2DAf
BgNVHSMEGDAWgBTEA2Q6eecKu9g9yb5glbkhhVINGDASBgNVHRMBAf8ECDAGAQH/
AgEAMA4GA1UdDwEB/wQEAwIBhjAKBggqhkjOPQQDAgNJADBGAiEA5pLvaFwRRkxo
mIAtDIwg9D7gC1xzxBl4r28EzmSO1pcCIQCJUShpSXO9HDIQMUgH69fNDEMHXD3R
RX5gP7kuu2KGMg==
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
MIICBjCCAaygAwIBAgIJAKS0yiqKtlhoMAoGCCqGSM49BAMCMFYxCzAJBgNVBAYT
AlVTMRswGQYDVQQKDBJMZXQncyBBdXRoZW50aWNhdGUxKjAoBgNVBAMMIUxldCdz
IEF1dGhlbnRpY2F0ZSBSb290IEF1dGhvcml0eTAeFw0yMDAxMTQyMTI1NDVaFw00
MDAxMDkyMTI1NDVaMFYxCzAJBgNVBAYTAlVTMRswGQYDVQQKDBJMZXQncyBBdXRo
ZW50aWNhdGUxKjAoBgNVBAMMIUxldCdzIEF1dGhlbnRpY2F0ZSBSb290IEF1dGhv
cml0eTBZMBMGByqGSM49AgEGCCqGSM49AwEHA0IABFoaHU+Z5bPKmGzlYXtCf+E6
HYj62fORaHDOrt+yyh3H/rTcs7ynFfGn+gyFsrSP3Ez88rajv+U2NfD0o0uZ4Pmj
YzBhMB0GA1UdDgQWBBTEA2Q6eecKu9g9yb5glbkhhVINGDAfBgNVHSMEGDAWgBTE
A2Q6eecKu9g9yb5glbkhhVINGDAPBgNVHRMBAf8EBTADAQH/MA4GA1UdDwEB/wQE
AwIBhjAKBggqhkjOPQQDAgNIADBFAiEAmAeg1ycKHriqHnaD4M/UDBpQRpkmdcRF
YGMg1Qyrkx4CIB4ivz3wQcQkGhcsUZ1SOImd/lq1Q0FLf09rGfLQPWDc
-----END CERTIFICATE-----
```

Figure 1: Certificate Chain (with Client Certificate First)

```
Client-Cert: :MIIBqDCCAU6gAwIBAgIBBzAKBggqhkjOPQQDAjA6MRswGQYDVQQKDBJ
 MZXQncyBBdXRoZW50aWNhdGUxGzAZBgNVBAMMEkxBIEludGVybWVkaWF0ZSBDQTAeFw0
 yMDAxMTQyMjU1MzNaFw0yMTAxMjMyMjU1MzNaMA0xCzAJBgNVBAMMAkJDMFkwEwYHKoZ
 Izj0CAQYIKoZIzj0DAQcDQgAE8YnXXfaUgmnMtOXU/IncWalRhebrXmckC8vdgJ1p5Be
 5F/3YC8OthxM4+k1M6aEAEFcGzkJiNy6J84y7uzo9M6NyMHAwCQYDVR0TBAIwADAfBgN
 VHSMEGDAWgBRm3WjLa38lbEYCuiCPct0ZaSED2DAOBgNVHQ8BAf8EBAMCBsAwEwYDVR0
 lBAwwCgYIKwYBBQUHAwIwHQYDVR0RAQH/BBMwEYEPYmRjQGV4YW1wbGUuY29tMAoGCCq
 GSM49BAMCA0gAMEUCIBHda/r1vaL6G3VliL4/Di6YK0Q6bMjeSkC3dFCOOB8TAiEAx/k
 HSB4urmiZ0NX5r5XarmPk0wmuydBVoU4hBVZ1yhk=:
```

Figure 2: Header Field in HTTP Request to Origin Server

If the proxy were configured to also include the certificate chain, it would also include the Client-Cert-Chain header field. Note that while the following example does illustrate the TTRP inserting the root certificate, many deployments will opt to omit the trust anchor.

```
Client-Cert-Chain: :MIIB5jCCAYugAwIBAgIBFjAKBggqhkjOPQQDAjBWMQsw
 CQYDVQQGEwJVUzEbMBkGA1UECgwSTGV0J3MgQXV0aGVudGljYXRlMSowKAYDVQQ
 DDCFMZXQncyBBdXRoZW50aWNhdGUgUm9vdCBBdXRob3JpdHkwHhcNMjAwMTE0Mj
 EzMjMwWhcNMzAwMTExMjEzMjMwWjA6MRswGQYDVQQKDBJMZXQncyBBdXRoZW50a
 WNhdGUxGzAZBgNVBAMMEkxBIEludGVybWVkaWF0ZSBDQTBZMBMGByqGSM49AgEG
 CCqGSM49AwEHA0IABJf+aA54RC5pyLAR5yfXVYmNpgd+CGUTDp2KOGhc0gK91zx
 hHesEYkdXkpS2UN8Kati+yHtWCV3kkhCngGyv7RqjZjBkMB0GA1UdDgQWBBRm3W
 jLa38lbEYCuiCPct0ZaSED2DAfBgNVHSMEGDAWgBTEA2Q6eecKu9g9yb5glbkhh
 VINGDASBgNVHRMBAf8ECDAGAQH/AgEAMA4GA1UdDwEB/wQEAwIBhjAKBggqhkjO
 PQQDAgNJADBGAiEA5pLvaFwRRkxomIAtDIwg9D7gC1xzxBl4r28EzmSO1pcCIQC
 JUShpSXO9HDIQMUgH69fNDEMHXD3RRX5gP7kuu2KGMg==:, :MIICBjCCAaygAw
 IBAgIJAKS0yiqKtlhoMAoGCCqGSM49BAMCMFYxCzAJBgNVBAYTAlVTMRswGQYDV
 QQKDBJMZXQncyBBdXRoZW50aWNhdGUxKjAoBgNVBAMMIUxldCdzIEF1dGhlbnRp
 Y2F0ZSBSb290IEF1dGhvcml0eTAeFw0yMDAxMTQyMTI1NDVaFw00MDAxMDkyMTI
 1NDVaMFYxCzAJBgNVBAYTAlVTMRswGQYDVQQKDBJMZXQncyBBdXRoZW50aWNhdG
 UxKjAoBgNVBAMMIUxldCdzIEF1dGhlbnRpY2F0ZSBSb290IEF1dGhvcml0eTBZM
 BMGByqGSM49AgEGCCqGSM49AwEHA0IABFoaHU+Z5bPKmGzlYXtCf+E6HYj62fOR
 aHDOrt+yyh3H/rTcs7ynFfGn+gyFsrSP3Ez88rajv+U2NfD0o0uZ4PmjYzBhMB0
 GA1UdDgQWBBTEA2Q6eecKu9g9yb5glbkhhVINGDAfBgNVHSMEGDAWgBTEA2Q6ee
 cKu9g9yb5glbkhhVINGDAPBgNVHRMBAf8EBTADAQH/MA4GA1UdDwEB/wQEAwIBh
 jAKBggqhkjOPQQDAgNIADBFAiEAmAeg1ycKHriqHnaD4M/UDBpQRpkmdcRFYGMg
 1Qyrkx4CIB4ivz3wQcQkGhcsUZ1SOImd/lq1Q0FLf09rGfLQPWDc:
```

Figure 3: Certificate Chain in HTTP Request to Origin Server

Appendix B. Select Design Considerations

B.1. Field Injection

This document requires that the TTRP sanitize the fields of the incoming request by removing or overwriting any existing instances of the Client-Cert and Client-Cert-Chain header fields before dispatching that request to the backend application. Otherwise, a client could inject its own values that would appear to the backend to have come from the TTRP. Although numerous other methods of detecting and preventing field injection are possible, such as the use of a unique secret value as part of the field name or value or the application of a signature, HMAC, or AEAD, there is no common general mechanism. The potential problem of client field injection is not at all unique to the functionality of this document; therefore, it would be inappropriate for this document to define a one-off solution. Since a generic common solution does not currently exist, stripping and sanitizing the fields is the de facto means of protecting against field injection in practice. Sanitizing the fields is sufficient when properly implemented and is a normative requirement of Section 4.

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 document could have been communicated with an extension parameter to the Forwarded field; however, doing so would have had some disadvantages that this document endeavored to avoid. The Forwarded field syntax allows for information about a full chain of proxied HTTP requests, whereas the Client-Cert and Client-Cert-Chain header fields of this document are 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 field is expressive but also more complicated, which would make processing it more cumbersome and, more importantly, would make properly sanitizing its content, as required by Section 4 to prevent field injection, considerably more difficult and error-prone. Thus, this document opted for a flatter and more straightforward structure.

B.3. The Whole Certificate and Certificate Chain

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 that described in [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 document opted to pass the full, encoded certificate as the value of the Client-Cert field.

The validation of the client certificate and chain of the mutually authenticated TLS connection is typically performed by the TTRP during the handshake. With the responsibility of certificate validation falling on the TTRP, the end-entity certificate is oftentimes sufficient for the needs of the origin server. The separate Client-Cert-Chain field can convey the certificate chain for origin server deployments that require this additional information.

Acknowledgements

The authors would like to thank the following individuals who have contributed to this document in various ways, ranging from just being generally supportive of bringing forth the document to providing specific feedback or content:

- Evan Anderson
- Annabelle Backman
- Alan Frindell
- Rory Hewitt
- Fredrik Jeansson
- Benjamin Kaduk
- Torsten Lodderstedt
- Kathleen Moriarty
- Mark Nottingham
- Erik Nygren
- Mike Ounsworth
- Lucas Pardue
- Matt Peterson
- Eric Rescorla
- Justin Richer
- Michael Richardson
- Joe Salowey
- Rich Salz
- Mohit Sethi
- Rifaat Shekh-Yusef
- Travis Spencer
- Nick Sullivan
- Willy Tarreau
- Martin Thomson
- Peter Wu
- Hans Zandbelt

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