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Updated TLS Server Identity Check Procedure for Email Related Protocols

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Abstract

This document describes TLS server identity verification procedure for SMTP Submission, IMAP, POP and ManageSieve clients. It replaces Section 2.4 of RFC 2595, updates Section 4.1 of RFC 3207, updates Section 11.1 of RFC 3501, updates Section 2.2.1 of RFC 5804.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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Table of Contents

1. Introduction

Use of TLS by SMTP Submission, IMAP, POP and ManageSieve clients is described in [RFC3207], [RFC3501], [RFC2595] and [RFC5804] respectively. Each of the documents describes slightly different rules for server certificate identity verification (or doesn't define any rules at all). In reality, email client and server developers implement many of these protocols at the same time, so it would be good to define modern and consistent rules for verifying email server identities using TLS.

This document describes the updated TLS server identity verification procedure for SMTP Submission [RFC6409] [RFC3207], IMAP [RFC3501], POP [RFC1939] and ManageSieve [RFC5804] clients. Section 3 of this document replaces Section 2.4 of [RFC2595].

Note that this document doesn't apply to use of TLS in MTA-to-MTA SMTP.

This document provides a consistent TLS server identity verification procedure across multiple email related protocols. This should make it easier for Certification Authorities and ISPs to deploy TLS for email use, and would enable email client developers to write more secure code.

2. Conventions Used in This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

The following terms or concepts are used through the document:

reference identifier: (formally defined in [RFC6125]) One of the domain names that the email client (an SMTP, IMAP, POP3 or ManageSieve client) associates with the target email server. For some identifier types, the identifier can also include an application service type for performing name checks on the server certificate. When name checks are applicable, at least one of the reference identifiers MUST match an [RFC6125] DNS-ID or SRV-ID (or if none are present the [RFC6125] CN-ID) of the server certificate.

CN-ID, DNS-ID, SRV-ID and URI-ID are identifier types (see [RFC6125] for details). For convenience, their short definitions from [RFC6125] are listed below:

CN-ID = a Relative Distinguished Name (RDN) in the certificate subject field that contains one and only one attribute-type-and-value pair of type Common Name (CN), where the value matches the overall form of a domain name (informally, dot- separated letter-digit-hyphen labels).

DNS-ID = a subjectAltName entry of type dNSName

SRV-ID = a subjectAltName entry of type otherName whose name form is SRVName

URI-ID = a subjectAltName entry of type uniformResourceIdentifier whose value includes both (i) a "scheme" and (ii) a "host" component (or its equivalent) that matches the "reg-name" rule (where the quoted terms represent the associated [RFC5234] productions from [RFC3986]).

3. Email Server Certificate Verification Rules

During a TLS negotiation, an email client (i.e., an SMTP, IMAP, POP3 or ManageSieve client) MUST check its understanding of the server hostname against the server's identity as presented in the server Certificate message, in order to prevent man-in-the-middle attacks. This check is only performed after the server certificate passes certification path validation as described in Section 6 of [RFC5280]. Matching is performed according to the rules specified in Section 6

of [RFC6125], including "certificate pinning" and the procedure on failure to match. The following inputs are used by the verification procedure used in [RFC6125]:

1. For DNS-ID and CN-ID identifier types the client MUST use one or more of the following as "reference identifiers": (a) the domain portion of the user's email address, (b) the hostname it used to open the connection (without CNAME canonicalization). The client MAY also use (c) a value securely derived from (a) or (b), such as using "secure" DNSSEC [RFC4033][RFC4034][RFC4035] validated lookup.

2. When using email service discovery procedure specified in [RFC6186] the client MUST also use the domain portion of the user's email address as another "reference identifier" to compare against SRV-ID identifier in the server certificate.

The rules and guidelines defined in [RFC6125] apply to an email server certificate, with the following supplemental rules:

1. Support for the DNS-ID identifier type (subjectAltName of dNSName type [RFC5280]) is REQUIRED in Email client software implementations.

2. Support for the SRV-ID identifier type (subjectAltName of SRVName type [RFC4985]) is REQUIRED for email client software implementations that support [RFC6186]. List of SRV-ID types for email services is specified in [RFC6186]. For the ManageSieve protocol the service name "sieve" is used.

3. URI-ID identifier type (subjectAltName of uniformResourceIdentifier type [RFC5280]) MUST NOT be used by clients for server verification, as URI-ID were not historically used for email.

4. For backward compatibility with deployed software CN-ID identifier type (CN attribute from the subject name, see [RFC6125]) MAY be used for server identity verification.

5. Email protocols allow use of certain wildcards in identifiers presented by email servers. The "*" wildcard character MAY be used as the left-most name component of DNS-ID or CN-ID in the certificate. For example, a DNS-ID of *.example.com would match a.example.com, foo.example.com, etc. but would not match example.com. Note that the wildcard character MUST NOT be used as a fragment of the left-most name component (e.g., *oo.example.com, f*o.example.com, or foo*.example.com).

4. Compliance Checklist for Certification Authorities

1. CA MUST support issuance of server certificates with DNS-ID identifier type (subjectAltName of dNSName type [RFC5280]).

2. CA MUST support issuance of server certificates with SRV-ID identifier type (subjectAltName of SRVName type [RFC4985]) for each type of email service. See Section 4.1 for more discussion on what this means for Certification Authorities.

3. For backward compatibility with deployed client base, CA MUST support issuance of server certificates with CN-ID identifier type (CN attribute from the subject name, see [RFC6125]).

4. CA MAY allow "*" (wildcard) as the left-most name component of DNS-ID or CN-ID in server certificates it issues.

4.1. Notes on handling of SRV-ID by Certification Authorities

[RFC6186] provides an easy way for organizations to autoconfigure email clients. It also allows for delegation of email services to an email hosting provider. When connecting to such delegated hosting service an email client that attempts to verify TLS server identity needs to know that if it connects to imap.hosting.example.net that such server is authorized to provide email access for an email such as alice@example.org. In absence of SRV-IDs, users of compliant email clients would be forced to manually confirm exception, because the TLS server certificate verification procedures specified in this document would result in failure to match the TLS server certificate against the expected domain(s). One way to provide such authorization is for the TLS certificate for imap.hosting.example.net to include SRV-ID(s) (or DNS-ID) for the example.org domain. (Another way is for SRV lookups to be protected by DNSSEC, but this solution depends on DNSSEC and thus is not discussed in this document. A future update to this document might rectify this.)

The ability to issue certificates that contain SRV-ID implies the ability to verify that entities requesting them are authorized to run email service for these SRV-IDs. In particular, certification authorities that can't verify such authorization MUST NOT include email SRV-IDs in certificates they issue. This document doesn't specify exact mechanism(s) that can be used to achieve this. However, a few special case recommendations are listed below.

A certification authority willing to sign a certificate containing a particular DNS-ID SHOULD also support signing a certificate containing one or more of email SRV-IDs for the same domain, because the SRV-ID effectively provides more restricted access to an email

service for the domain (as opposed to unrestricted use of any services for the same domain, as specified by DNS-ID).

A certification authority which also provides DNS service for a domain can use DNS information to validate SRV-IDs for the domain.

5. Compliance Checklist for Mail Service Providers and Certificate Signing Request generation tools

1. MUST include the DNS-ID identifier type in Certificate Signing Requests for the host name(s) where the email server(s) are running. SHOULD include the DNS-ID identifier type in Certificate Signing Requests for the domain portion of served email addresses.

2. If the email services provided are discoverable using DNS SRV as specified in [RFC6186], the Mail Service Provider MUST include the SRV-ID identifier type for each type of email service in Certificate Signing Requests.

3. SHOULD include CN-ID identifier type for the host name where the email server(s) is running in Certificate Signing Requests for backward compatibility with deployed email clients. (Note, a certificate can only include a single CN-ID, so if a mail service is running on multiple hosts, either each host has to use different certificate with its own CN-ID, a single certificate with multiple DNS-IDs, or a single certificate with wildcard in CN-ID can be used).

4. MAY include "*" (wildcard) as the left-most name component of DNS-ID or CN-ID in Certificate Signing Requests.

5.1. Notes on hosting multiple domains

A server that hosts multiple domains needs to do one of the following (or some combination thereof):

1. Use DNS SRV records to redirect each hosted email service to a fixed domain, deploy TLS certificate(s) for that single domain, and instruct users to configure their clients with appropriate pinning (unless the SRV records can always be obtained via DNSSEC). Some email clients come with preloaded list of pinned certificates for some popular domains, which can avoid the need for manual confirmation.

2. Use a single TLS certificate that includes a complete list of all the domains it is serving.

3. Serve each domain on its own IP/port, using separate TLS certificates on each IP/port.

4. Use Server Name Indication (SNI) TLS extension [RFC6066] to select the right certificate to return during TLS negotiation. Each domain has its own TLS certificate in this case.

Each of these deployment choices have their scaling disadvantages when the list of domains changes. Use of DNS SRV without SRV-ID requires manual confirmation from users. While preloading pinned certificates avoids the need for manual confirmation, this information can get stale quickly or would require support for a new mechanism for distributing preloaded pinned certificates. A single certificate (the second choice) requires that when a domain is added, then a new Certificate Signing Request that includes a complete list of all the domains needs to be issued and passed to a CA in order to generate a new certificate. Separate IP/port can avoid regenerating the certificate, but requires more transport layer resources. Use of TLS SNI requires each email client to support it.

Several Mail Service Providers host hundreds and even thousands of domains. This document, as well as its predecessors RFC 2595, RFC 3207, RFC 3501 and RFC 5804 don't address scaling issues caused by use of TLS in multi-tenanted environments. Further work is needed to address this issue, possibly using DNSSEC or something like POSH [RFC7711].

6. Examples

Consider an IMAP-accessible email server which supports both IMAP and IMAPS (IMAP-over-TLS) at the host "mail.example.net" servicing email addresses of the form "user@example.net". A certificate for this service needs to include DNS-IDs of "example.net" (because it is the domain portion of emails) and "mail.example.net" (this is what a user of this server enters manually, if not using [RFC6186]). It might also include CN-ID of "mail.example.net" for backward compatibility with deployed infrastructure.

Consider the IMAP-accessible email server from the previous paragraph which is additionally discoverable via DNS SRV lookups in domain "example.net" (DNS SRV records "_imap._tcp.example.net" and "_imaps._tcp.example.net"). In addition to DNS-ID/CN-ID identity types specified above, a certificate for this service also needs to include SRV-IDs of "_imap.example.net" (when STARTTLS is used on the IMAP port) and "_imaps.example.net" (when TLS is used on IMAPS port). See [RFC6186] for more details. (Note that unlike DNS SRV there is no "_tcp" component in SRV-IDs).

Consider the IMAP-accessible email server from the first paragraph which is running on a host also known as "mycompany.example.com". In addition to DNS-ID identity types specified above, a certificate for this service also needs to include DNS-ID of "mycompany.example.com" (this is what a user of this server enters manually, if not using [RFC6186]). It might also include CN-ID of "mycompany.example.com" instead of the CN-ID "mail.example.net" for backward compatibility with deployed infrastructure. (This is so, because a certificate can only include a single CN-ID)

Consider an SMTP Submission server at the host "submit.example.net" servicing email addresses of the form "user@example.net" and discoverable via DNS SRV lookups in domain "example.net" (DNS SRV records "_submission._tcp.example.net"). A certificate for this service needs to include SRV-IDs of "_submission.example.net" (see [RFC6186]) along with DNS-IDs of "example.net" and "submit.example.net". It might also include CN-ID of "submit.example.net" for backward compatibility with deployed infrastructure.

Consider a host "mail.example.net" servicing email addresses of the form "user@example.net" and discoverable via DNS SRV lookups in domain "example.net", which runs SMTP Submission, IMAPS and POP3S (POP3-over-TLS) and ManageSieve services. Each of the servers can use their own certificate specific to their service (see examples above). Alternatively they can all share a single certificate that would include SRV-IDs of "_submission.example.net", "_imaps.example.net", "_pop3s.example.net" and "_sieve.example.net" along with DNS-IDs of "example.net" and "mail.example.net". It might also include CN-ID of "mail.example.net" for backward compatibility with deployed infrastructure.

7. Operational Considerations

Section 5 covers operational considerations (in particular use of DNS SRV for autoconfiguration) related to generating TLS certificiates for email servers so that they can be successfully verified by email clients. Additionally, Section 5.1 talks about operational considerations related to hosting multiple domains.

8. IANA Considerations

This document doesn't require any action from IANA.

9. Security Considerations

The goal of this document is to improve interoperability and thus security of email clients wishing to access email servers over TLS protected email protocols, by specifying a consistent set of rules that email service providers, email client writers and Certification Authorities can use when creating server certificates.

TLS Server Identity Check for Email relies on use of trustworthy DNS hostnames when constructing "reference identifiers" that are checked against an email server certificate. Such trustworthy names are either entered manually (for example if they are advertised on a Mail Service Provider's website), explicitly confirmed by the user (e.g. if they are a target of a DNS SRV lookup) or derived using a secure third party service (e.g. DNSSEC-protected SRV records which are verified by the client or trusted local resolver). Future work in this area might benefit from integration with DANE [RFC6698], but it is not covered by this document.

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Appendix A. Acknowledgements

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Appendix B. Changes since draft-ietf-uta-email-tls-certs-00

[[Note to RFC Editor: Please delete this section before publication]]

Added another example, clarified that subjectAltName and DNS SRV are using slightly different syntax.

As any certificate can only include one CN-ID, corrected examples.

Split rules to talk seperately about requirements on MUAs, CAs and MSPs/CSR generation tools.

Updated Introduction section.

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