

[MS-FTPS-Diff]:

File Transfer Protocol over Secure Sockets Layer (FTPS)

Intellectual Property Rights Notice for Open Specifications Documentation

- **Technical Documentation.** Microsoft publishes Open Specifications documentation (“this documentation”) for protocols, file formats, data portability, computer languages, and standards support. Additionally, overview documents cover inter-protocol relationships and interactions.
- **Copyrights.** This documentation is covered by Microsoft copyrights. Regardless of any other terms that are contained in the terms of use for the Microsoft website that hosts this documentation, you can make copies of it in order to develop implementations of the technologies that are described in this documentation and can distribute portions of it in your implementations that use these technologies or in your documentation as necessary to properly document the implementation. You can also distribute in your implementation, with or without modification, any schemas, IDLs, or code samples that are included in the documentation. This permission also applies to any documents that are referenced in the Open Specifications documentation.
- **No Trade Secrets.** Microsoft does not claim any trade secret rights in this documentation.
- **Patents.** Microsoft has patents that might cover your implementations of the technologies described in the Open Specifications documentation. Neither this notice nor Microsoft's delivery of this documentation grants any licenses under those patents or any other Microsoft patents. However, a given Open Specifications document might be covered by the Microsoft [Open Specifications Promise](#) or the [Microsoft Community Promise](#). If you would prefer a written license, or if the technologies described in this documentation are not covered by the Open Specifications Promise or Community Promise, as applicable, patent licenses are available by contacting iplg@microsoft.com.
- **License Programs.** To see all of the protocols in scope under a specific license program and the associated patents, visit the [Patent Map](#).
- **Trademarks.** The names of companies and products contained in this documentation might be covered by trademarks or similar intellectual property rights. This notice does not grant any licenses under those rights. For a list of Microsoft trademarks, visit www.microsoft.com/trademarks.
- **Fictitious Names.** The example companies, organizations, products, domain names, email addresses, logos, people, places, and events that are depicted in this documentation are fictitious. No association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred.

Reservation of Rights. All other rights are reserved, and this notice does not grant any rights other than as specifically described above, whether by implication, estoppel, or otherwise.

Tools. The Open Specifications documentation does not require the use of Microsoft programming tools or programming environments in order for you to develop an implementation. If you have access to Microsoft programming tools and environments, you are free to take advantage of them. Certain Open Specifications documents are intended for use in conjunction with publicly available standards specifications and network programming art and, as such, assume that the reader either is familiar with the aforementioned material or has immediate access to it.

Support. For questions and support, please contact dochelp@microsoft.com.

Revision Summary

Date	Revision History	Revision Class	Comments
9/25/2009	0.1	Major	First Release.
11/6/2009	0.1.1	Editorial	Changed language and formatting in the technical content.
12/18/2009	0.1.2	Editorial	Changed language and formatting in the technical content.
1/29/2010	0.1.3	Editorial	Changed language and formatting in the technical content.
3/12/2010	0.1.4	Editorial	Changed language and formatting in the technical content.
4/23/2010	1.0	Major	Updated and revised the technical content.
6/4/2010	1.0.1	Editorial	Changed language and formatting in the technical content.
7/16/2010	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
8/27/2010	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
10/8/2010	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
11/19/2010	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
1/7/2011	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
2/11/2011	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
3/25/2011	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
5/6/2011	1.0.1	None	No changes to the meaning, language, or formatting of the technical content.
6/17/2011	1.1	Minor	Clarified the meaning of the technical content.
9/23/2011	1.1	None	No changes to the meaning, language, or formatting of the technical content.
12/16/2011	2.0	Major	Updated and revised the technical content.
3/30/2012	2.0	None	No changes to the meaning, language, or formatting of the technical content.
7/12/2012	2.0	None	No changes to the meaning, language, or formatting of the technical content.
10/25/2012	2.0	None	No changes to the meaning, language, or formatting of the technical content.
1/31/2013	2.0	None	No changes to the meaning, language, or formatting of the technical content.
8/8/2013	3.0	Major	Updated and revised the technical content.

Date	Revision History	Revision Class	Comments
11/14/2013	3.0	None	No changes to the meaning, language, or formatting of the technical content.
2/13/2014	3.0	None	No changes to the meaning, language, or formatting of the technical content.
5/15/2014	3.0	None	No changes to the meaning, language, or formatting of the technical content.
6/30/2015	4.0	Major	Significantly changed the technical content.
10/16/2015	4.0	None	No changes to the meaning, language, or formatting of the technical content.
7/14/2016	4.0	None	No changes to the meaning, language, or formatting of the technical content.
<u>6/1/2017</u>	<u>4.0</u>	<u>None</u>	<u>No changes to the meaning, language, or formatting of the technical content.</u>

Table of Contents

1	Introduction	6
1.1	Glossary	6
1.2	References	6
1.2.1	Normative References	6
1.2.2	Informative References	7
1.3	Overview	7
1.4	Relationship to Other Protocols	7
1.5	Prerequisites/Preconditions	7
1.6	Applicability Statement	8
1.7	Versioning and Capability Negotiation	8
1.8	Vendor-Extensible Fields	8
1.9	Standards Assignments	8
2	Messages	9
2.1	Transport	9
2.2	Message Syntax	9
2.2.1	AUTH SSL	9
3	Protocol Details	10
3.1	Client Role Details	10
3.1.1	Abstract Data Model	10
3.1.2	Timers	10
3.1.3	Initialization	10
3.1.4	Higher-Layer Triggered Events	10
3.1.5	Message Processing Events and Sequencing Rules	10
3.1.5.1	Control Connection Negotiation with Implicit FTPS	10
3.1.5.2	CCC Message Handling	10
3.1.5.3	REIN Message Handling	10
3.1.5.4	AUTH SSL Message Handling	11
3.1.5.5	FEAT Message Handling	11
3.1.5.6	AUTH Message Handling	11
3.1.6	Timer Events	11
3.1.7	Other Local Events	11
3.2	Server Role Details	11
3.2.1	Abstract Data Model	11
3.2.2	Timers	11
3.2.3	Initialization	11
3.2.4	Higher-Layer Triggered Events	11
3.2.5	Message Processing Events and Sequencing Rules	11
3.2.5.1	Control Connection Negotiation with Implicit FTPS	11
3.2.5.2	CCC Message Handling	12
3.2.5.3	REIN Message Handling	12
3.2.5.4	AUTH SSL Message Handling	12
3.2.5.5	FEAT Message Handling	12
3.2.5.6	AUTH Message Handling	12
3.2.6	Timer Events	12
3.2.7	Other Local Events	13
4	Protocol Examples	14
4.1	Control Connection Negotiation with Implicit FTPS	14
4.2	FEAT Response Example for "AUTH SSL" Support	14
5	Security	16
5.1	Security Considerations for Implementers	16
5.2	Index of Security Parameters	16

6	Appendix A: Product Behavior	17
7	Change Tracking.....	18
8	Index.....	19

1 Introduction

The File Transfer Protocol over TLS, commonly referred to as FTPS, is defined in [RFC4217]. The FTPS protocol enables the use of TLS to secure FTP transfers.

This specification extends the FTPS protocol with a feature that is commonly referred to as Implicit SSL. It also introduces the AUTH SSL message, to allow interoperability with legacy FTP clients.

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative. All other sections and examples in this specification are informative.

1.1 Glossary

This document uses the following terms:

Explicit FTPS: A common term for an FTPS implementation based on [RFC4217]. It refers to the fact that an explicit protocol handshake is required to promote a FTP connection (most commonly connected to port 21) from a non-secure to secure one.

File Transfer Protocol (FTP): A member of the TCP/IP suite of protocols that is used to copy files between two computers on the Internet if both computers support their respective FTP roles. One computer is an FTP client and the other is an FTP server.

FTPS: The File transfer Protocol over SSL/TLS Extension [RFC4217] of [RFC959], which enables the secure transfer of information between client and server.

Implicit FTPS: A common term for an early implementation of FTPS (based on the now-expired Internet draft [EXPIRED-FTP-DRAFT]) that required a dedicated port that would be used exclusively for the SSL/TLS protected data transfer. TLS/SSL would be negotiated immediately after a TCP connection was established. It is analogous to HTTPS protocol handling [RFC2818].

Implicit SSL: See Implicit FTPS.

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as defined in [RFC2119]. All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the Errata.

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, <http://www.rfc-editor.org/rfc/rfc2119.txt>

[RFC2228] Horowitz, M., and Lunt, S., "FTP Security Extensions", RFC 2228, October 1997, <http://www.ietf.org/rfc/rfc2228.txt>

[RFC2246] Dierks, T., and Allen, C., "The TLS Protocol Version 1.0", RFC 2246, January 1999, <http://www.rfc-editor.org/rfc/rfc2246.txt>

[RFC2389] Hethmon, P., Elz, R., "Feature negotiation mechanism for the File Transfer Protocol", RFC 2389, August 1998, <http://ietf.org/rfc/rfc2389.txt>

[RFC4217] Ford-Hutchinson, P., "Securing FTP with TLS", RFC 4217, October 2005, <http://www.ietf.org/rfc/rfc4217.txt>

[RFC959] Postel, J., and Reynolds, J., "File Transfer Protocol (FTP)", RFC 959, October 1985, <http://www.ietf.org/rfc/rfc959.txt>

1.2.2 Informative References

[EXPIRED-FTP-DRAFT] Ford-Hutchinson, P., Carpenter, M., Hudson, T., et al., "Securing FTP with TLS (Expired Draft)", September 2000, <http://tools.ietf.org/id/draft-murray-auth-ftp-ssl-06.txt>

1.3 Overview

This document provides the following extensions to the File Transfer Protocol over TLS [RFC4217]:

- Implicit FTPS support
- AUTH SSL message support

The primary purpose of these extensions is to accommodate legacy FTP client and firewall behaviors.

The FTP protocol uses a dynamic range of ports for data connections. Firewalls implement packet filters that can parse the port information from the FTP traffic and temporarily open those ports. If FTPS [RFC4217] is used, then a number of legacy firewall packet filters can be confused by the mixture of encrypted and unencrypted traffic and might disconnect FTP connections. Implicit FTPS support that uses dedicated port 990 (assigned by IANA) helps with firewall issues by keeping encrypted and unencrypted traffic on separate ports. Additional configuration is needed on the firewall to allow data connections over FTPS but that discussion is outside the scope of this document.

Implicit FTPS support is an extension to the FTPS protocol [RFC4217], and was originally documented in a draft that has expired (see [EXPIRED-FTP-DRAFT]). A client connects to Implicit FTPS over port 990. The server will delay sending the connection welcome greeting until the TLS session is negotiated. The server assumes that the client has sent an AUTH TLS message immediately after the TCP connection was established. The client assumes that the server sent a positive reply to the implicit AUTH TLS message. The actual TLS session negotiation takes place as specified in [RFC4217]. Once the TLS session has been negotiated, the server assumes that the client sent PROT P and PBSZ 0 messages and sets the FTP session's state accordingly. These implicit commands will force the default mode for the FTP data channel to be protected. The client can later reset the protection level on the data channel by sending the PROT C message as specified in [RFC4217].

AUTH SSL message support allows legacy clients that are not TLS-aware to work with FTPS. The TLS protocol [RFC2246] is backward compatible with the SSL protocol. The server will accept both AUTH SSL and AUTH TLS messages interchangeably. If an AUTH SSL message is sent by a client, the server will treat it as if an AUTH TLS message was received.

1.4 Relationship to Other Protocols

The File Transfer Protocol over Secure Sockets Layer depends on FTPS [RFC4217], which in turn depends on the File Transfer Protocol [RFC959], the FTP Security Extensions [RFC2228], and the TLS Protocol Version 1.0 [RFC2246].

1.5 Prerequisites/Preconditions

This specification requires that client and server support FTPS [RFC4217].

1.6 Applicability Statement

The protocol extensions documented in this specification apply to situations where legacy FTPS clients are used and/or when legacy firewalls are unable to handle a mixture of unencrypted and encrypted FTP protocol traffic on the default FTP port 21.

Although the Implicit FTPS protocol is considered to be deprecated, there are some benefits it provides. For example, some legacy firewalls might not process a mixture of encrypted and unencrypted traffic over FTP port 21 correctly. Also, many popular FTP clients support Implicit SSL, and a lack of support for Implicit SSL on the server might confuse users and be interpreted as functionality that is missing.

1.7 Versioning and Capability Negotiation

If AUTH SSL message is supported by the server, then the output to the FEAT message that is used for feature negotiation, as specified in [RFC2389], includes the AUTH command with the supported SSL parameter.

The actual TLS/SSL negotiation is handled by TLS protocol, as specified in [RFC2246].

1.8 Vendor-Extensible Fields

None.

1.9 Standards Assignments

Parameter	Value	Reference
TCP Port	990	The IANA-assigned port that Implicit FTPS uses for control connections.
TCP Port	989	The IANA-assigned port that Implicit FTPS uses for active data connections.

2 Messages

2.1 Transport

FTP messages are transported over TCP. The server SHOULD use the IANA-assigned default ports 989 and 990 for the Implicit FTPS. The server MAY choose other ports.

2.2 Message Syntax

The extensions specified in this document use or reference messages documented in [RFC4217], [RFC2389], [RFC959], and [RFC2228]. The list of existing messages that relate to the File Transfer Protocol over Secure Sockets Layer is as follows:

- AUTH TLS from [RFC4217]
- PROT P from [RFC4217]
- PBSZ 0 from [RFC2228] and [RFC4217]
- CCC from [RFC4217]
- REIN from [RFC959]
- FEAT from [RFC2389]

The AUTH SSL message is introduced in this specification. This new message is fully synonymous with the existing AUTH TLS message.

2.2.1 AUTH SSL

The AUTH SSL message behaves identical to the AUTH TLS message [RFC4217]. The only difference is the parameter name for the AUTH command. Both messages can be used interchangeably. The server will take identical action for both of them. The only function of this message is to enable compatibility with legacy clients.

3 Protocol Details

3.1 Client Role Details

3.1.1 Abstract Data Model

No new abstract data model is introduced beyond the existing underlying protocol.

3.1.2 Timers

None.

3.1.3 Initialization

To implement the Implicit FTPS support, the server SHOULD listen on the default port 990, as assigned by IANA. The server MAY choose to listen on a custom port.

3.1.4 Higher-Layer Triggered Events

None.

3.1.5 Message Processing Events and Sequencing Rules

3.1.5.1 Control Connection Negotiation with Implicit FTPS

The client connects to the TCP port dedicated to Implicit FTPS, but MUST NOT expect the greeting message immediately. Instead, the client MUST proceed as if it had sent an AUTH TLS message and received a positive reply in response. The TLS session negotiation MUST follow the sequence specified in [RFC4217].

After TLS negotiation has completed, the client MUST NOT send PBSZ 0 and PROT P messages. Instead, it MUST assume that the server successfully processed PBSZ 0 and PROT P messages and sent a positive reply. Implicit PROT P messages will switch the FTP session to the mode requiring secure data connections as specified in [RFC4217]. The client MUST maintain the internal state about the data connection mode based on the implicitly assumed PROT P message.

After TLS negotiation the client MUST receive the connection greeting message as specified in [RFC959] section 5.4.

3.1.5.2 CCC Message Handling

The client SHOULD NOT send a CCC message over a session negotiated with Implicit FTPS, as the server will always reject it.

3.1.5.3 REIN Message Handling

A client can send a REIN message over a session negotiated with Implicit FTPS. The server responds with a reply as specified by [RFC959] and then shuts down the TLS session.

At the end of the REIN message, processing the client MUST restore the internal state for the connection to the same state it was when the original TCP connection was established. If the client is to reuse the TCP connection, it MUST negotiate the Implicit FTPS again.

3.1.5.4 AUTH SSL Message Handling

The client can send an AUTH SSL message when used with Explicit FTPS instead of AUTH TLS. It MUST assume that the server will process it identically to an AUTH TLS message.

3.1.5.5 FEAT Message Handling

The handling of a FEAT message on the client is not affected by this protocol.

3.1.5.6 AUTH Message Handling

The client SHOULD NOT send AUTH TLS or AUTH SSL messages over the Implicit FTPS connection. These messages will always be rejected by the server because the implicit AUTH TLS command has already been processed and additional messages sent over the already encrypted session are not allowed.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

None.

3.2 Server Role Details

3.2.1 Abstract Data Model

No new abstract data model is introduced beyond the existing underlying protocol.

3.2.2 Timers

None.

3.2.3 Initialization

To implement the Implicit FTPS support, the server SHOULD listen on the default port 990, as assigned by IANA. The server MAY choose to listen on a custom port.

3.2.4 Higher-Layer Triggered Events

None.

3.2.5 Message Processing Events and Sequencing Rules

3.2.5.1 Control Connection Negotiation with Implicit FTPS

When a client connects to the TCP port dedicated for Implicit FTPS, the server MUST NOT send the connection greeting message immediately. Instead, the server MUST assume that the AUTH TLS message was sent by the client. The server MUST do internal processing identical to handling an AUTH TLS message without sending a positive reply to the client. The client MUST assume that a positive reply was sent in response to the implicit AUTH TLS message. TLS session negotiation will follow as specified in [RFC4217].

After TLS negotiation has completed, the server MUST assume that client sent a PBSZ 0 message followed by a PROT P message. The server MUST process implicit messages without sending a response to the client. Implicit PROT P messages will switch the FTP session to the mode requiring secure data connections as specified in [RFC4217].

After handling the implicit PBSZ 0 and PROT P messages, the secure connection negotiation is completed. The server MUST send the connection greeting message as specified in section 5.4 of [RFC959].

The implicit message processing specified previously assumes that the server maintains internal state as if implicit commands were sent by the client. For example, if an AUTH TLS message sent over the Implicit FTPS connection by a client will be rejected by the server, because the server assuming that it already processed the implicitly assumed AUTH TLS message during the control connection negotiation (even though the AUTH TLS message was not actually sent by the client).

3.2.5.2 CCC Message Handling

If a client sends a CCC message over a session negotiated with Implicit FTPS, the server MUST reject the message as if the server-side policy was configured to not allow CCC messages. The reply to the CCC message is governed by [RFC4217].

3.2.5.3 REIN Message Handling

If a client sends a REIN message over a session negotiated with Implicit FTPS, then the server MUST respond with a reply as specified by [RFC959] and then shut down the TLS session. At the end of the server processing, the FTP and TLS session for the connection MUST be in the same state it was when the original TCP connection negotiation has completed.

3.2.5.4 AUTH SSL Message Handling

The AUTH SSL message can be used with Explicit FTPS and does not apply to Implicit FTPS. When server receives an AUTH SSL message, it will interpret it as an AUTH TLS message and the rest of the execution will proceed as specified in [RFC4217]. There is no semantic difference between processing AUTH TLS and AUTH SSL messages. The AUTH SSL message is supported for the compatibility with legacy clients.

3.2.5.5 FEAT Message Handling

If a server is configured to support AUTH SSL messages, then it MUST include SSL on the list of parameters supported for the AUTH command. FEAT message handling and reply formatting MUST comply with [RFC2389].

If Implicit FTPS is used, then FEAT can only be sent over the encrypted TLS session. This means that feature negotiation cannot be used before the TLS session is negotiated. Hence the AUTH message information included in the FEAT message response has only informational value for the implicit SSL negotiation. This applies primarily to Explicit FTPS.

3.2.5.6 AUTH Message Handling

If the client sends an AUTH TLS or AUTH SSL message over the Implicit FTPS connection, it will be rejected as specified in [RFC4217] due to the fact that implicit AUTH TLS command has already been processed and a second one over the already encrypted session is not allowed.

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

4 Protocol Examples

4.1 Control Connection Negotiation with Implicit FTPS

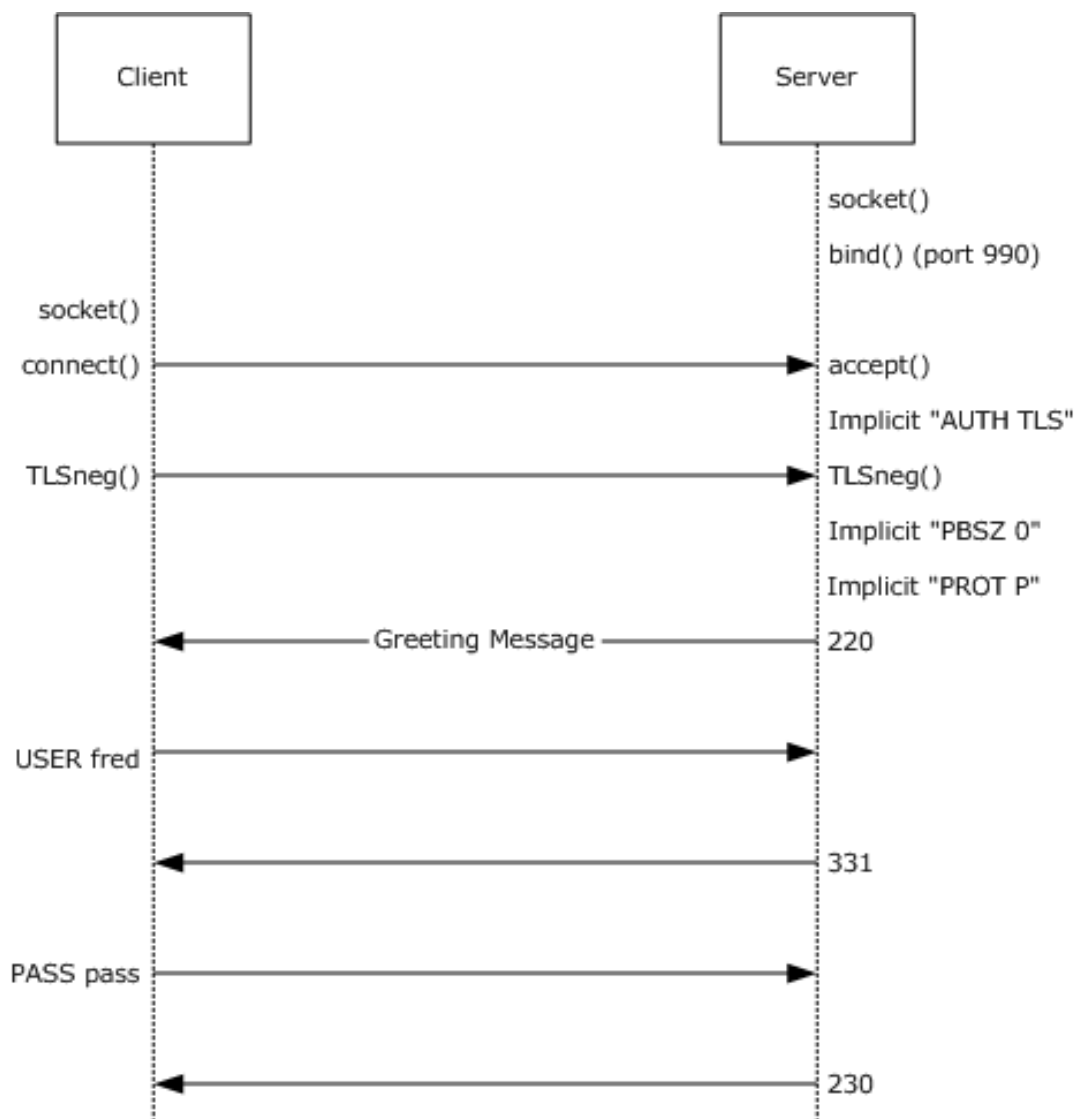


Figure 1: Control connection negotiation with Implicit FTPS

4.2 FEAT Response Example for "AUTH SSL" Support

The following is an example of a server response to the FEAT message from the server that implements AUTH SSL as follows:

```
C> FEAT
S> 211-Extended features supported:
    LANG EN*
    UTF8
    AUTH TLS;SSL;
```

PBSZ
PROT C;P;
CCC
HOST
SIZE
MDTM
REST STREAM
211 END

5 Security

5.1 Security Considerations for Implementers

No new security considerations are introduced by the File Transfer Protocol over Secure Sockets Layer. The security considerations of [RFC4217] apply.

5.2 Index of Security Parameters

No new security parameters are introduced by the File Transfer Protocol over Secure Sockets Layer. The base protocol [RFC4217] includes all the relevant security parameters.

6 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs.

- Windows Vista operating system
- Windows Server 2008 operating system
- Windows 7 operating system
- Windows Server 2008 R2 operating system
- Windows 8 operating system
- Windows Server 2012 operating system
- Windows 8.1 operating system
- Windows Server 2012 R2 operating system
- Windows 10 operating system
- Windows Server 2016 operating system

Exceptions, if any, are noted below. If a service pack or Quick Fix Engineering (QFE) number appears with the product version, behavior changed in that service pack or QFE. The new behavior also applies to subsequent service packs of the product unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms **"SHOULD"** or **"SHOULD NOT"** implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term **"MAY"** implies that the product does not follow the prescription.

7 Change Tracking

No table of changes is available. The document is either new or has had no changes since its last release.

8 Index

A

- Abstract data model 11
- Applicability 8
- AUTH message handling 12
- AUTH SSL message 9
- AUTH SSL message handling 12

C

- Capability negotiation 8
- CCC message handling 12
- Change tracking 18
- Control connection negotiation with implicit FTPS 11
- Control connection negotiation with implicit FTPS example 14

D

- Data model - abstract 11
- Details
 - AUTH message handling 12
 - AUTH SSL message handling 12
 - CCC message handling 12
 - control connection negotiation with implicit FTPS 11
 - FEAT message handling 12
 - REIN message handling 12

E

- Events
 - local 13
 - timer 12
- Example
 - control connection negotiation with implicit FTPS 14
 - response to FEAT message 14

F

- FEAT message handling 12
- Fields - vendor extensible 8
- Fields - vendor-extensible 8

G

- Glossary 6

H

- Higher-layer triggered events 11

I

- Implementer - security considerations 16
- Index of security parameters 16
- Informative references 7
- Initialization 11
- Introduction 6

L

- Local events 13

M

Message handling

- AUTH 12
- AUTH SSL 12
- CCC 12
- control connection negotiation with implicit FTPS 11
- FEAT 12
- REIN 12

Messages

- AUTH SSL 9
- AUTH SSL message 9
- syntax 9
- transport 9

N

Normative references 6

O

- Overview 7
- Overview (synopsis) 7

P

- Parameters - security index 16
- Preconditions 7
- Prerequisites 7
- Product behavior 17

R

- References 6
 - informative 7
 - normative 6
- REIN message handling 12
- Relationship to other protocols 7
- Response to FEAT message example 14

S

- Security
 - implementer considerations 16
 - parameter index 16
- Standards assignments 8
- Syntax 9

T

- Timer events 12
- Timers 11
- Tracking changes 18
- Transport 9
- Triggered events - higher layer 11

V

- Vendor-extensible fields 8
- Versioning 8