

[MS-OFBA]: Office Forms Based Authentication Protocol Specification

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Preliminary

1 Introduction

This document specifies the Office Forms Based Authentication Protocol (for more information, see [\[RFC2616\]](#)), in addition to other standard authentication mechanisms. This protocol offers protocol clients and servers with HTTP forms-based authentication when other authentication mechanisms (as described in [\[RFC4559\]](#) and [\[RFC2617\]](#)) are not available.

Sections 1.8, 2, and 3 of this specification are normative and contain RFC 2119 language. Sections 1.5 and 1.9 are also normative but cannot contain RFC 2119 language. All other sections and examples in this specification are informative.

1.1 Glossary

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

1.2 References

References to Microsoft Open Specification documents do not include a publishing year because links are to the latest version of the documents, which are updated frequently. References to other documents include a publishing year when one is available.

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. Please check the archive site, <http://msdn2.microsoft.com/en-us/library/E4BD6494-06AD-4aed-9823-445E921C9624>, as an additional source.

[MS-FPSE] Microsoft Corporation, "[FrontPage Server Extensions Remote Protocol Specification](#)".

[MS-WEBDAVE] Microsoft Corporation, "[Web Distributed Authoring and Versioning Error Extensions Protocol Specification](#)".

[MS-WEBSS] Microsoft Corporation, "[Webs Web Service Protocol Specification](#)".

[MS-WSSHP] Microsoft Corporation, "[HTTP Windows SharePoint Services Headers Protocol Specification](#)".

[RFC1945] Berners-Lee, T., Fielding, R., and Frystyk, H., "Hypertext Transfer Protocol -- HTTP/1.0", RFC 1945, May 1996, <http://www.ietf.org/rfc/rfc1945.txt>

[RFC2109] Kristol, D., and Montulli, L., "HTTP State Management Mechanism", RFC 2109, February 1997, <http://www.ietf.org/rfc/rfc2109.txt>

[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>

[RFC2616] Fielding, R., Gettys, J., Mogul, J., et al., "Hypertext Transfer Protocol -- HTTP/1.1", RFC 2616, June 1999, <http://www.ietf.org/rfc/rfc2616.txt>

[RFC2617] Franks, J., Hallam-Baker, P., Hostetler, J., et al., "HTTP Authentication: Basic and Digest Access Authentication", RFC 2617, June 1999, <http://www.ietf.org/rfc/rfc2617.txt>

[RFC3986] Berners-Lee, T., Fielding, R., and Masinter, L., "Uniform Resource Identifier (URI): Generic Syntax", STD 66, RFC 3986, January 2005, <http://www.ietf.org/rfc/rfc3986.txt>

[RFC5234] Crocker, D., Ed., and Overell, P., "Augmented BNF for Syntax Specifications: ABNF", STD 68, RFC 5234, January 2008, <http://www.rfc-editor.org/rfc/rfc5234.txt>

1.2.2 Informative References

[MS-AUTHSO] Microsoft Corporation, "[Windows Authentication Services System Overview](#)".

[MS-OCPROTO] Microsoft Corporation, "[Office Client Protocols Overview](#)".

[RFC4559] Jaganathan, K., Zhu, L., and Brezak, J., "SPNEGO-based Kerberos and NTLM HTTP Authentication in Microsoft Windows", RFC 4559, June 2006, <http://www.ietf.org/rfc/rfc4559.txt>

1.3 Protocol Overview (Synopsis)

The protocol client connects to a protocol server gated by Office Forms Based Authentication by sending messages via HTTP. The following sequence diagram illustrates one possible way of establishing an identity using forms based authentication between a protocol client and a protocol server, entailing three steps.

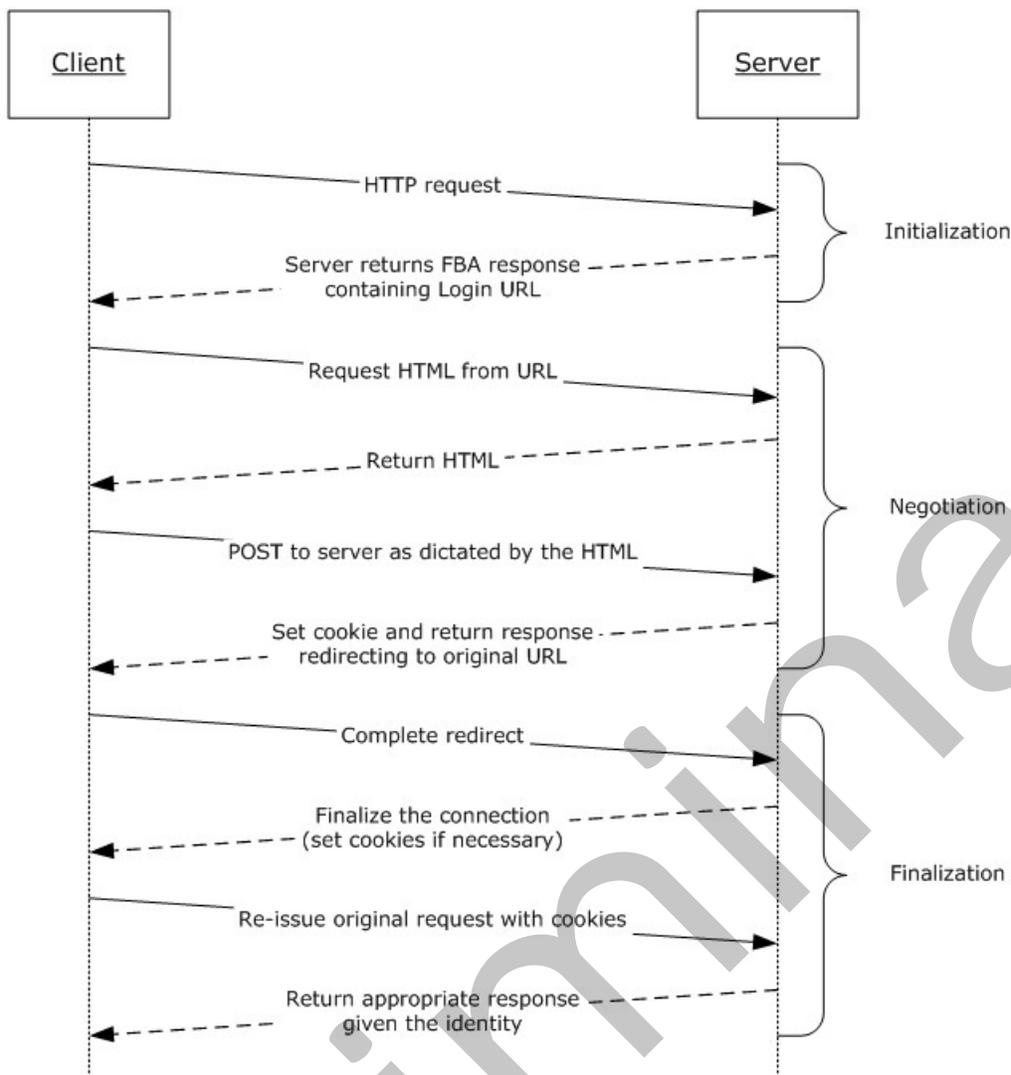


Figure 1: Sequence diagram

The three steps for establishing an identity using forms based authentication between a protocol client and a protocol server are as follows:

Initialization: The protocol client sends an initial request for any transaction between client and the protocol server. The server responds that its authentication method is forms based, as described in section 2.2.2, including the location to which the client should navigate to authenticate. If the server response does not include this location, then the location is assumed to be the location to which the original request was issued. This response optionally includes the location to which the protocol server will redirect the user upon successfully authenticating the user.

Negotiation: Having determined that the protocol server is capable of establishing an identity using forms based authentication, the client renders the HTML returned from the request to the remote location provided by the server in step (1). Note that the length of this stage is non-deterministic and not specified by this protocol, as the client will continue to follow as many redirects and

refreshes as are necessary to successfully establish the identity until the server redirects either to the original URI, or, if specified, the return URI provided by the server in step (1).

Finalization: Once the server redirects the client to the return URI, the protocol client assumes that the identity has been successfully established, and re-issues the original request from step (1). Note that the process of actually establishing the user's identity is not specified by this protocol.

1.4 Relationship to Other Protocols

This protocol depends upon the HTTP transport, as described in [\[RFC2616\]](#). To transfer the authentication state between the client and the server, this protocol is also dependent upon HTTP state management, as described in [\[RFC2109\]](#).

1.5 Prerequisites/Preconditions

Forms based authentication over HTTP assumes the following:

The HTTP Server is configured such that the user's identity is established using forms-based authentication. The user's identity is transferred between the client and the server using HTTP state management as described in [\[RFC2109\]](#).

The client is configured to store and transmit cookies as described in [\[RFC2109\]](#).

1.6 Applicability Statement

Forms based authentication is used in environments where Windows Integrated Authentication methods (basic, digest, SPNEGO-based Kerberos, and NTLM HTTP Authentication), which are described in [\[MS-AUTHSO\]](#) section 2, are not available. Additionally, the protocol client and protocol server must both support Forms Based Authentication.

1.7 Versioning and Capability Negotiation

Versioning and capability is handled by the HTTP protocols described in [\[RFC2617\]](#) (for more information, see [\[RFC2616\]](#)). This protocol has no additional versioning or capability negotiation.

1.8 Vendor-Extensible Fields

None.

1.9 Standards Assignments

None.

2 Messages

2.1 Transport

Forms-based authentication over HTTP Protocol messages are carried in the HTTP message headers ([\[RFC2616\]](#) section 4.2) and message body ([\[RFC2616\]](#) section 4.3).

2.2 Message Syntax

The use of forms-based authentication over HTTP Protocol is indicated by an HTTP Response header X-FORMS_BASED_AUTH_REQUIRED. The value of this header is a URI that points to an HTTP-based server. For more details about HTTP headers, see [\[RFC2616\]](#). For more details about URIs, see [\[RFC3986\]](#).

2.2.1 Protocol Discovery Requests

The protocol client will establish an identity with a protocol server based on a specific challenge issued by the client to the server, which identifies the protocol client as a non-browser client application.

To be recognized as a non-browser client that supports this protocol, the protocol client MUST specify either a header ([\[RFC2616\]](#) section 4.2) or a user agent string ([\[RFC1945\]](#) section 10.3) in an HTTP OPTIONS request ([\[RFC2616\]](#) section 9.2). If the protocol client request is not authenticated, the protocol server SHOULD <1> respond based on the criteria specified in order of priority in the following table, but the protocol server MAY ignore the header and use only the user agent string, as specified after the table.

Windows Authentication is described in [\[MS-AUTHSO\]](#) section 2.

Client request	Server response
Header contains field name "X-FORMS_BASED_AUTH_ACCEPTED" and field value of "f".	If the protocol server supports any type of Windows Authentication, the protocol server MUST NOT respond with a Forms Based Authentication Required response header (section 2.2.2) and MUST respond with a Windows Authentication challenge. If the protocol server does not support any type of Windows Authentication, then the server MUST respond with a Forms Based Authentication Required response header (section 2.2.2).
Header does not contain field name "X-FORMS_BASED_AUTH_ACCEPTED", and user agent string contains "MS Search" followed by "Robot".	If the protocol server supports any type of Windows Authentication, the protocol server MUST NOT respond with a Forms Based Authentication Required response header (section 2.2.2) and MUST respond back with a Windows Authentication challenge. If the protocol server does not support any type of Windows Authentication, then the server MUST respond with a Forms Based Authentication Required response header (section 2.2.2).
Header contains field name "X-FORMS_BASED_AUTH_ACCEPTED" and field value of "t".	The protocol server MUST respond with a Forms Based Authentication Required response header, as specified in section 2.2.2 .

If the HTTP request sent by the protocol client is not authenticated but the protocol server requires the request to be authenticated, and the HTTP request sent by the protocol client does not include the HTTP header "X-FORMS_BASED_AUTH_ACCEPTED", <2> and the user agent string conforms to the following ABNF, as defined in [RFC5234], the protocol server MUST respond with the Forms Based Authentication Required response header specified in section 2.2.2:

- "Microsoft Data Access Internet Publishing Provider"
- "Microsoft-WebDAV-MiniRedir"
- "Non-browser"
- "MSOffice 12"
- "Mozilla/4.0 (compatible; MS FrontPage "N

N = 1 - 14

If the request is a FPRPC request as defined by [MS-FPSE] and the client has negotiated a protocol version greater than or equal to 12.0.0.6403 ([MS-FPSE] section 1.7.1), the protocol server MUST respond with the Forms Based Authentication Required response header specified in section 2.2.2.

If the request is a FPRPC request as defined by [MS-FPSE] and the client has negotiated a protocol version less than 12.0.0.6403 ([MS-FPSE] section 1.7.1), the protocol server MUST respond with a "200 OK" HTTP status code ([RFC2616] section 10.2.1).

2.2.2 Forms Based Authentication Required Response Header

If the protocol server receives a request for an access-protected object and the request requires a forms-based authentication required response as specified in section 2.2.1, the server MUST respond with a "403 Forbidden" HTTP status code ([RFC2616] section 10.4.4). Servers compliant with this specification SHOULD also return an HTTP header with field name X-FORMS_BASED_AUTH_REQUIRED<3>, as specified in [MS-WSSHP] section 2.2.12. If the server returns an X-FORMS_BASED_AUTH_REQUIRED header, the value of the header MUST be a URI, as specified by [RFC3986], that specifies the protocol server login page. The protocol client MUST navigate to the login page to establish the user's identity with the protocol server.

The protocol server SHOULD return an HTTP header with a field name X-FORMS_BASED_AUTH_RETURN_URL header<4>, as specified in [MS-WSSHP] section 2.2.13. The value of this header contains a URI, as specified by [RFC3986], that specifies the protocol server return page, which the protocol client will use to determine whether authentication succeeded. If the URI is not present, then the protocol client assumes that the URI is the same as the login page specified by the X-FORMS_BASED_AUTH_REQUIRED header. If the URI of the return page is a path, then the path MUST contain a '/' at the end.

The server MAY return an HTTP header with **field-name** X-FORMS_BASED_AUTH_DIALOG_SIZE. The value of this header MUST be formatted as a string that conforms to the following ABNF [RFC5234] grammar:

```
size    = width "x" height
width   = 1*10(DIGIT)
height  = 1*10(DIGIT)
```

width specifies the preferred width, in pixels, of the login dialog.

height specifies the preferred height, in pixels, of the login dialog.

If the dialog size is not specified, then the value "660x495" is used by the protocol client.

Both the login page and the return page MUST point to an HTTP-based server.

2.2.3 HTML Request

Once the protocol client has determined that the user's identity will be established using forms-based authentication, the client MUST issue an HTTP GET ([RFC2616](#) section 9.3) to the login page. The user agent string ([RFC1945](#) section 10.3) of this GET request MUST contain:

```
Mozilla/4.0
```

3 Protocol Details

3.1 Common Details

This protocol is used to establish a user's identity with a remote protocol server that uses an HTML form to establish that user's identity, for which reason a model that leverages existing HTTP and HTML semantics within the client is useful.

3.1.1 Abstract Data Model

The protocol client relies on the remote protocol server to set the user's identity as one or more HTTP cookies. Once the user's identity is established, the client will then send each cookie with each subsequent HTTP request, per the rules specified in [\[RFC2109\]](#).

3.1.2 Timers

None.

3.1.3 Initialization

None.

3.1.4 Higher-Layer Triggered Events

None.

3.1.5 Message Processing Events and Sequencing Rules

The **Protocol Discovery** request MUST be sent by the client (for details, see section [2.2.1](#)). The X-FORMS_BASED_AUTH_REQUIRED header and the X-FORMS_BASED_AUTH_RETURN_URL header SHOULD [<5>](#) be returned by the server (for details, see section [2.2.2](#)). Clients and servers MUST be compliant with [\[RFC2616\]](#), [\[RFC2617\]](#), and [\[RFC2109\]](#).

3.1.6 Timer Events

None.

3.1.7 Other Local Events

None.

3.2 Client Details

3.2.1 Abstract Data Model

The abstract data model follows that set forth in section [3.1.1](#).

3.2.2 Timers

The client has a single timer used to determine how much time should elapse prior to re-issuing the **Protocol Discovery** request.

The value of this timer is not specified by this protocol, and it is up to the protocol client to choose an optimal value.

3.2.3 Initialization

The protocol is initialized upon receiving the X-FORMS_BASED_AUTH_REQUIRED header from the server.

3.2.4 Higher-Layer Triggered Events

The client can cause additional requests to be sent to the server, depending upon the contents of the HTML sent to the client by the server. The number of HTTP requests sent by the protocol client to the protocol server to establish the user's identity are non-deterministic and not specified by this protocol.

3.2.5 Message Processing Events and Sequencing Rules

There are no additional message processing events and sequencing rules beyond those detailed in section [3.1.5](#).

3.2.6 Timer Events

When the timer specified in section [3.2.2](#) expires, the **Protocol Discovery** request, specified in section [2.2.1](#), will first be sent prior to any additional HTTP request made by the client.

3.2.7 Other Local Events

When the remote server issues a redirect to the return page, the client will complete that request, and then allow any other pending HTTP requests to continue, which **MUST** contain the cookies, as specified by [\[RFC2109\]](#).

3.3 Server Details

3.3.1 Abstract Data Model

The abstract data model follows that specified in section [3.1.1](#).

3.3.2 Timers

None.

3.3.3 Initialization

The protocol is initialized upon receiving the Protocol Discovery request from the client.

3.3.4 Higher-Layer Triggered Events

None.

3.3.5 Message Processing Events and Sequencing Rules

There are no additional message processing events and sequencing rules beyond those specified in section [3.1.5](#).

3.3.6 Timer Events

None.

3.3.7 Other Local Events

None.

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4 Protocol Examples

This scenario shows the message exchanges when a protocol client requests an access-protected document from a Forms Based Authentication gated protocol server at the URI <https://www.contoso.com/dir/document.docx>.

Prior to requesting this document, the client will attempt to determine the capabilities of the server:

```
C: OPTIONS /dir/  
C: User-Agent: MSOffice 12
```

The server issues a response indicating it is forms based authentication capable:

```
S: HTTP/1.1 403 Forbidden  
S: X-FORMS_BASED_AUTH_REQUIRED:  
https://www.contoso.com/fbalogin.aspx?wreply=https://www.contoso.com/OnSuccess.aspx  
S: X-FORMS_BASED_AUTH_RETURN_URL: https://www.contoso.com/OnSuccess.aspx  
S: X-FORMS_BASED_AUTH_DIALOG_SIZE: 800x600.
```

The client will then issue an HTTP request to the header specified in the X-FORMS_BASED_AUTH_REQUIRED URI, requesting HTML that the user can leverage to establish his or her identity:

```
C: GET /fbalogin.aspx?wreply=https://www.contoso.com/OnSuccess.aspx  
C: User-Agent: Mozilla/4.0
```

The server will then reply with an HTML form containing enough logic to establish the user's identity with the server. In this example, the server simply returns a simple form.

```
S: HTTP/1.1 200 OK  
S: <body>  
S: <form name="CredentialForm" method="post"  
S: action="fbalogin.aspx?wreply=https://www.contoso.com/OnSuccess.aspx"  
S: id="Creds">  
S: <table>  
S: <tr><td>Login: </td></tr>  
S: <tr><td>Username: <input name="UsernameTextBox" type="text"  
S: id="UsernameTextBox" </td></tr>  
S: <tr><td>Password: <input name="PasswordTextBox"  
S: type="password"  
S: id="PasswordTextBox" /></td></tr>  
S: <tr><td><input type="submit" name="UsernamePasswordButton"  
S: value="Submit" id="UsernamePasswordButton" /></td></tr>  
S: </table>  
S: </form>  
S: </body>
```

On receipt of this HTML, the client will instantiate a dialog box of the size specified in the initial response to the OPTIONS request (in this example, that size would be 800x600). Once rendered, the rich client will follow the instructions dictated by the HTML form. In this example, assume that

the user entered the credentials "user:pass" for the user name and password, and then clicked the submit button.

```
C: POST /fbalogin.aspx?wreply=https://www.contoso.com/OnSuccess.aspx
C: User-Agent: Mozilla/4.0
C: UsernameTextBox=user&PasswordTextBox=pass
```

If the user's interactions with the HTML form have allowed the server to establish the user's identity, then the remote server sets the identity as a cookie on the request, and redirects the user back to the return_url specified in the response to the **Protocol Discovery** request.

```
S: HTTP/1.1 302 Object Moved
Location: https://www.contoso.com/OnSuccess.aspx
Set-Cookie: Authentication=<server determined hash of the user's identity>
```

Upon seeing the redirect, the client determines that this URI matches that returned in response to the **Protocol Discovery** request. Because the URIs match, the client assumes success, follows the redirect, and then closes the form that it was using to render the HTML

```
C: GET /OnSuccess.aspx
C: User-Agent: Mozilla/4.0
C: Cookie: Authentication=<server determined hash of the user's identity>
```

The server can then respond with any sort of finalization logic required.

```
S: HTTP/1.1 200 OK
S: Set-Cookie: FooCookie=bar
```

Once this call completes, the client will then run the series of HTTP transactions required to successfully open <https://www.contoso.com/dir/document.docx>. For more information about this series of transactions, see [\[MS-OCPROTO\]](#) section 2.1.2.1.2.

5 Security

5.1 Security Considerations for Implementers

Forms Based Authentication necessarily transmits the user's identity as plain text. Implementers are encouraged to use secure channels, such as HTTPS, to avoid inadvertently exposing the user's identity.

5.2 Index of Security Parameters

None.

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:

- The 2007 Microsoft® Office system
- Microsoft® Office 2010 suites
- Microsoft® Office 15 Technical Preview
- Windows® SharePoint® Services 3.0
- Microsoft® SharePoint® Foundation 2010
- Microsoft® SharePoint® Foundation 15 Technical Preview

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.

<1> Section 2.2.1: SharePoint 2007 Products and Technologies ignores the header and processes the request based solely on the user agent string.

<2> Section 2.2.1: Microsoft Office 2010 and the 2007 Office system client applications never send the X-FORMS_BASED_AUTH_ACCEPTED header and always rely on the user agent string to identify themselves as non-browser clients to a protocol server.

<3> Section 2.2.2: SharePoint 2007 Products and Technologies does not return the X-FORMS_BASED_AUTH_REQUIRED header. Rather, the protocol server returns the following extended error, as defined in [\[MS-WEBDAVE\]](#) section 2.2.3:

```
X-MSDAVEXT_Error: 917656;  
Access%20denied%2e%20%20Before%20opening%20files%20in%20this%20location%2c%20you%20must%20fir  
st%20browse%20to%20the%20web%20site%20and%20select%20the%20option%20to%20login%20automaticall  
y%2e
```

<4> Section 2.2.2: SharePoint 2007 Products and Technologies does not return the X-FORMS_BASED_AUTH_RETURN_URL header. Rather, the protocol server returns the following extended error, as defined in [\[MS-WEBDAVE\]](#) section 2.2.3:

```
X-MSDAVEXT_Error: 917656;  
Access%20denied%2e%20%20Before%20opening%20files%20in%20this%20location%2c%20you%20must%20fir  
st%20browse%20to%20the%20web%20site%20and%20select%20the%20option%20to%20login%20automaticall  
y%2e
```

<5> Section 3.1.5: SharePoint 2007 Products and Technologies does not explicitly return to any protocol client the X-FORMS_BASED_AUTH_REQUIRED header to the Protocol Discovery request as

detailed in section [2.2.2](#). Rather, the server returns the following extended error, as defined in [\[MS-WEBDAVE\]](#) section 2.2.3:

```
X-MSDAVEXT_Error: 917656;  
Access%20denied%2e%20%20Before%20opening%20files%20in%20this%20location%2c%20you  
%20must%20first%20browse%20to%20the%20web%20site%20and%20select%20the%20option%  
20to%20login%20automatically%2e
```

Upon receipt of this error, the protocol client should issue a request to determine the Web URL for the given URL, as defined in [\[MS-WEBS\]](#).

Upon determination of the Web URL, the client should consider the following URL to be the equivalent of the value for X-FORMS_BASED_AUTH_REQUIRED, as defined in section [2.2.2](#):

```
http://server/weburl/_layouts/Authenticate.aspx?Source=Error.aspx
```

Where

Server is the address of the SharePoint 2007 Products and Technologies.

Weburl is the value returned from the previous **UriToWebUrl** request.

/_layouts/Authenticate.aspx?Source=Error.aspx is a hard-coded string.

Additionally, because the server return the client to the Error.aspx page on successful authentication, the client consider the following URL equivalent to the value of the X-FORMS_BASED_AUTH_RETURN_URL, as defined in section [2.2.2](#):

```
http://server/weburl/_layouts/Error.aspx
```

Where

Server is the address of the SharePoint 2007 Products and Technologies.

Weburl is the value returned from the previous UriToWebUrl request.

/_layouts/Error.aspx is a hard coded string.

7 Change Tracking

This section identifies changes that were made to the [MS-OFBA] protocol document between the June 2011 and January 2012 releases. Changes are classified as New, Major, Minor, Editorial, or No change.

The revision class **New** means that a new document is being released.

The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:

- A document revision that incorporates changes to interoperability requirements or functionality.
- An extensive rewrite, addition, or deletion of major portions of content.
- The removal of a document from the documentation set.
- Changes made for template compliance.

The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.

The revision class **Editorial** means that the language and formatting in the technical content was changed. Editorial changes apply to grammatical, formatting, and style issues.

The revision class **No change** means that no new technical or language changes were introduced. The technical content of the document is identical to the last released version, but minor editorial and formatting changes, as well as updates to the header and footer information, and to the revision summary, may have been made.

Major and minor changes can be described further using the following change types:

- New content added.
- Content updated.
- Content removed.
- New product behavior note added.
- Product behavior note updated.
- Product behavior note removed.
- New protocol syntax added.
- Protocol syntax updated.
- Protocol syntax removed.
- New content added due to protocol revision.
- Content updated due to protocol revision.
- Content removed due to protocol revision.
- New protocol syntax added due to protocol revision.

- Protocol syntax updated due to protocol revision.
- Protocol syntax removed due to protocol revision.
- New content added for template compliance.
- Content updated for template compliance.
- Content removed for template compliance.
- Obsolete document removed.

Editorial changes are always classified with the change type **Editorially updated**.

Some important terms used in the change type descriptions are defined as follows:

- **Protocol syntax** refers to data elements (such as packets, structures, enumerations, and methods) as well as interfaces.
- **Protocol revision** refers to changes made to a protocol that affect the bits that are sent over the wire.

The changes made to this document are listed in the following table. For more information, please contact protocol@microsoft.com.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
1.2.1 Normative References	Added references [MS-FPSE], [MS-WEBSS], and [RFC5234].	N	New content added.
2.2.1 Protocol Discovery Requests	Modified the user agent string for request.	N	Content updated.
2.2.1 Protocol Discovery Requests	Modified the product behavior note about the server behavior of user agent string.	N	Product behavior note updated.
2.2.1 Protocol Discovery Requests	Added description of response when older protocol is negotiated in a FPRPC request.	N	New content added.
2.2.1 Protocol Discovery Requests	Clarified how the server responds when an HTTP request is not authenticated.	N	New content added.
2.2.2 Forms Based Authentication Required Response Header	Clarified the server response if it receives a request for an access-protected object and clarified the reference for the ABNF grammar.	N	Content updated.
3.1.5 Message Processing Events and Sequencing Rules	Clarified prescriptive language in description.	N	Content updated.
3.1.5	Removed the section 6.1 and added the	N	New product

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
Message Processing Events and Sequencing Rules	description as an endnote.		behavior note added.
3.2.4 Higher-Layer Triggered Events	Clarified description to use "client" instead of "end-user to client".	N	Content updated.
6 Appendix A: Product Behavior	Updated list of product versions.	N	Content updated.

Preliminary

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