HTTPAPI and NTLM

Using NTLM Authentication with HTTPAPI

Status of this document

Date: 25.10.2012
Version: 1.6

Preface

The authentication schemes supported by HTTPAPI are BASIC and DIGEST. These are the most common authentication methods used for HTTP transactions. Starting with HTTPAPI v1.25beta3, NTLM authentication, which is often used by Microsoft's IIS servers, is also supported.

This document describes how to use NTLM authentication with HTTPAPI.

Prerequisites

A C compiler is required to compile the MD4C4 module. If there is no C compiler available, module MD4C4 is replaced by the RPG module MD4R4, which slightly decreases performance.

The minimum OS release level is V5R3M0.

References

Microsoft links:

NTLM Protocol	NT LAN Manager (NTLM) Authentication Protocol Specification
[MS-NLMP]	NT LAN Manager (NTLM) Authentication Protocol Specification (pdf)
[MS-NTHT]	NTLM Authentication Scheme for HTTP (pdf included in the zip file)

Third party links:

davenport	The NTLM Authentication Protocol and Security Support Provider

Using NTLM

Basically there are no differences between using BASIC or DIGEST and NTLM authentication.

Once that your GET or POST operations ends with a 401 authentication error you should call `http_getAuth()` as usually. Make sure to pass the new and optional parameter "**`isNtlm`**", which is set to **`*ON`** in case the server requires NTLM authentication:

```
rc = http_url_get(...);
if (rc <> 1);
   http_error(err);
   if (err = HTTP_NDAUTH);
      if (http_getAuth(isBasic: isDigest: realm: isNtlm) = 0);
         select;
         when (isNtlm);
            http_setAuth(HTTP_AUTH_NTLM
                         : getUser(): getPassword());
         when (isDigest);
            http_setAuth(HTTP_AUTH_MD5_DIGEST
                         : getUser(): getPassword());
         other;
            http_setAuth(HTTP_AUTH_BASIC
                         : getUser(): getPassword());
         endsl;
         rc = http_url_get(...);
      endif;
   endif;
endif;
```

In the following example (Win7, IIS 7.5) the server supports BASIC and NTLM authentication and therefore it is up to the client to decide which authentication scheme to use. Based on the code fragment above it would choose NTLM which is more secure than BASIC authentication:

```
POST /HelloWorld.asmx HTTP/1.1
Host: 10.115.14.91
User-Agent: http-api/1.24
Content-Length: 227
Content-Type: text/xml
SOAPAction: "http://tempuri.org/HelloWorld"


sendraw(): entered
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope ...></soapenv:Envelope>
recvresp(): entered
HTTP/1.1 401 Unauthorized
Content-Type: text/html
Server: Microsoft-IIS/7.5
WWW-Authenticate: Basic realm="Test"
WWW-Authenticate: Negotiate
WWW-Authenticate: NTLM
X-Powered-By: ASP.NET
```

BASIC authentication is less secure because username and password are not encrypted. They are sent over the wire as a combined Base64 encoded string.

DIGEST and NTLM authentication are more secure because they use hashes when sending the password to the server.

Realm

Also notice that NTLM actually does not use a realm at all. Instead of an empty realm, the NTLM authentication module returns the host name as the realm value.

The NTLM module always returns the host name as a substitute of the realm.

Domain

On the other hand NTLM knows something that is called a “domain”. A user is assigned to a domain just the way your email address belongs to a domain. Since BASIC and DIGEST authentication do not use a domain at all, HTTPAPI does not provide any option to specify a domain for authentication.

Usually there is no need to specify the domain because in most cases the server belongs to the same domain as the users who use the services of the server.

But in case you need to specify a domain you can prefix the user name with the domain name, separated by a backslash as shown here:

domain\username

Or you can use the following format:

username@domain

A problem you may be faced with might be, that HTTPAPI restricts the length of the user name to 80 characters, which might be too short to take a domain and a user name. You can get around that problem by specifying the user name and password in the URL as shown here:

http://domain\username:password@the.hostname.com/index.html

LAN Manager Compatibility Modes

The LAN Manager Compatibility Mode is controlled by variable ‘g_LMCompatibilty’ of module NTLMR4.

The default mode is NTLMv2. Beside NTLMv2 the following modes are supported:

0 Sends NTLMv1 responses. That may also include the cryptographically-weak LM response.
(Flags: NTLMSSP_NEGOTIATE_NT_ONLY + NTLMSSP_NEGOTIATE_NTLM2)

1 Sends NTLMv1 responses but the cryptographically-weak LM response is excluded. The communication fails when the server does not support NT_ONLY or NTLM2.
(Flags: NTLMSSP_NEGOTIATE_NT_ONLY + NTLMSSP_NEGOTIATE_NTLM2)

2 Sends NTLMv1 responses but enforces NTLM2.
(Flags: NTLMSSP_NEGOTIATE_NTLM2)

3 Sends NTLMv2 responses. Recommended default mode.

NTLM Protocol

In contrast to BASIC and DIGEST authentication NTLM authenticates a connection and not a request. Since the NTLM authentication process is more expensive than BASIC or DIGEST authentication, it is recommended to use a persistent connection and no single GET or POST request in case multiple requests have to be sent to the server.

HTTPAPI exposes a bunch of procedures all starting with http_persist_* to manage persistent connections.

BASIC/DIGEST Handshake

BASIC or DIGEST authentication requires a total of 4 messages between the client and server to get a file from the server.

```
GET /basic/index.html HTTP/1.1
```

Since the client is not yet authorized the server returns a 401 “Unauthorized” status code along with a “WWW-Authenticate” header to let the client know the supported authentication scheme:

```
HTTP/1.1 401 Unauthorized

WWW-Authenticate: Basic realm="Basic Authentication"
```

Now the client retrieves the user credentials and resends the same request enriched with an “Authorisation” header:

```
GET /basic/index.html HTTP/1.1

Authorization: Basic YWRtaW46bXlTZWNyZXQ=
```

Eventually the server verifies the user credentials and returns the requested resource along with a 200 “OK” status code:

```
HTTP/1.1 200 OK
```

NTLM Handshake

NTLM however requires a total of 6 messages to get the first resource from the server. Again the communication starts with an initial request for a resource:

```
POST /HelloWorld.asmx HTTP/1.1
```

The server returns a 401 “Unauthorized” status code along with a “WWW-Authenticate” header requesting NTLM authentication:

```
WWW-Authenticate: NTLM
```

Now the two additional messages come into play to negotiate the authentication details. First the client sends a NEGOTIATE message to the server:

```
GET /HelloWorld.asmx HTTP/1.1

Authorization: NTLM <base64-encoded type-1-message>
```

The server response to that with a CHALLENGE message:

```
HTTP/1.1 401 Unauthorized

Authorization: NTLM <base64-encoded type-2-message>
```

Eventually the client uses an AUTHENTICATE (Type-3) message to get the resource from the server:

```
POST /HelloWorld.asmx HTTP/1.1

Authorization: NTLM <base64-encoded type-3-message>
```

If everything is fine, the server returns the requested resource to the client:

```
HTTP/1.1 200 OK
```

From now on the client can continue requesting resources as long as the connection is established without going through the complete authentication process.

Please have in mind that connections are not persistent when using HTTPAPI’s GET or POST procedures. The only way to establish a persistent connection with HTTPAPI is to use the `http_persist_*` procedures which are slightly more complex than `http_url_get()` or `http_url_get()`.

Debugging NTLM Authentication Headers

Debugging connection problems always starts with the HTTP API debug log. The HTTP API debug log contains the complete HTTP data flow that was exchanged between the client and the server. Sometimes you may need to know the content of the NTLM authentication headers, e.g. you may be asked about the NTLM negotiating flags that were used. These headers are Base64 encoded data that is not easy to analyse.

For that the “NTLM Message Inspector” comes into play. The NTLM Message Inspector lets you easily look at the content of a given NTLM authentication header. It is shipped as a self-executing jar file:

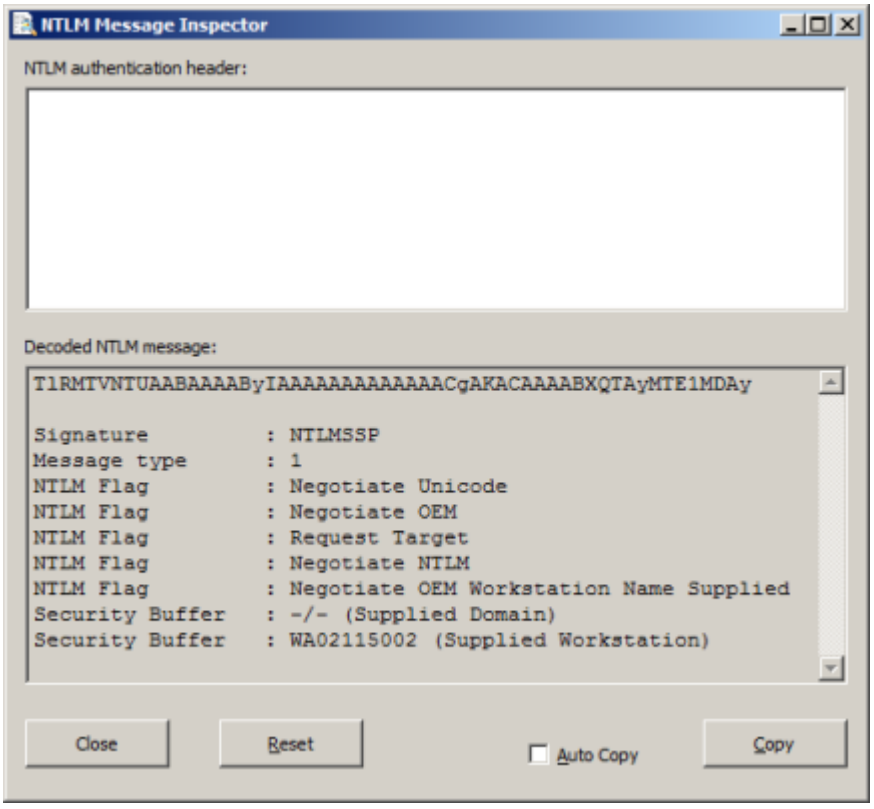
```
NTLMMessageInspector.jar
```

Double click the jar file to start the inspector. If that does not work, make sure you have a JRE 1.6 or higher installed and try to start it from the command line:

```
java -cp NTLMMessageInspector.jar
de.tools400.net.ntlm.analyzer.NTLMMessageInspector
```

When the inspector has been started, copy the authentication header in question into the input field “NTLM authentication header”. You do not necessarily need to remove the “Authorization: NTLM” prefix from the header. Just paste the complete line as shown in the example below:

```
GET /ntlm.html HTTP/1.1
Host: 10.115.14.91:80
User-Agent: http-api/1.24
Authorization: NTLM TlRMTVNTUAABAAAAByIAAAAAAAAAAAAAACgAKACAAAABXQTAyMTE1MDAy
```



The input field is cleared and the result is shown below.

Example: Persistent Connection

This example demonstrates how to call a web service twice, storing the response SOAP messages in a single stream file. The complete source code is shipped with the NTLM package.

```
URL = 'http://' + Job_getTcpIpAddr() + '/HelloWorld.asmx';
IFS = '/home/raddatz/httpapi_example37.xml';

// Open output file
fd = open(IFS: O_WRONLY + O_TRUNC + O_CREAT + O_CCSID: 511: 1208);

// Produce SOAP message
postData =
   '<soapenv:Envelope +
       xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" +
       xmlns:tem="http://tempuri.org/">+
       <soapenv:Header/>+
       <soapenv:Body>+
          <tem:HelloWorld/>+
       </soapenv:Body>+
    </soapenv:Envelope>';

// Open persistent connection
pComm = http_persist_open(URL);

// Set credentials
http_setauth(HTTP_AUTH_NTLM: user: password);

dou '1';

   // Call web service
   if ( http_persist_post( pComm: URL: 0: *null
                         : %addr(postData)+2: %len(postData)
                         : fd: %paddr('write')) = -1);
       leave;
    endif;

   // Call web serviceonce more
   if ( http_persist_post( pComm: URL: 0: *null
                         : %addr(postData)+2: %len(postData)
                         : fd: %paddr('write')) = -1);
       leave;
    endif;

enddo;

// Close http connection
http_persist_close(pComm);

// Close output file
callp close(fd);
```

Sample “HelloWorld” Web Service:

You can easily set up a web service with NTLM authentication. On a Windows PC just install and start the IIS service and drop the following file into folder “wwwroot”:

HelloWorld.asmx

```
<%@ WebService Language="C#"
Class="ProgWS.Ch02.HelloWorldService" %>
using System.Web.Services;
namespace ProgWS.Ch02
{
  public class HelloWorldService: WebService
  {
    [WebMethod]
    public string HelloWorld()
    {
      return "Hello World";
    }
  }
}
```

Refer to Installing IIS on Windows 7 for a brief description of how to install IIS 7.5 on Windows 7.

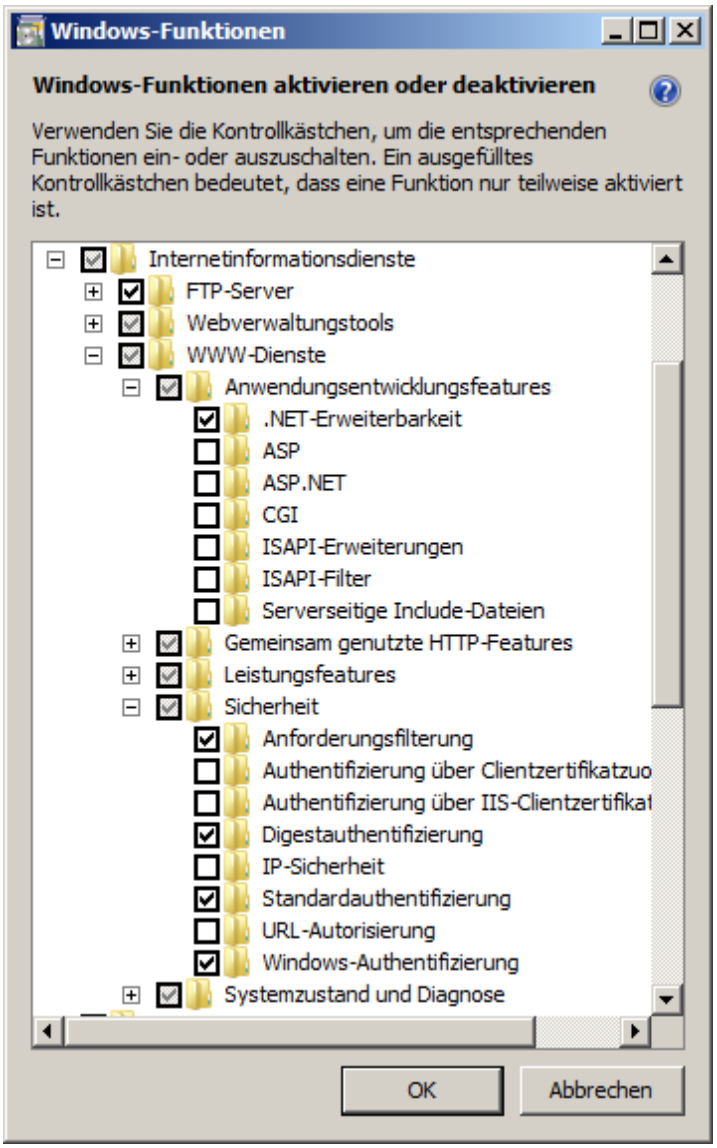
Installing IIS on Windows 7

The following description is part of the Microsoft TechNet Library at http://technet.microsoft.com/en-us/library/cc731911.aspx:

By default, IIS 7.5 is not installed on Windows® 7. You can install IIS by clicking **Windows Features** in **Advanced Options** under **Programs** in **Control Panel**.

You can perform this procedure using the user interface (UI) or a script.

1. Click **Start** and then click **Control Panel**.
2. In **Control Panel**, click **Programs** and then click **Turn Windows features on or off**.
3. In the **Windows Features** dialog box, click **Internet Information Services** and then click **OK**.

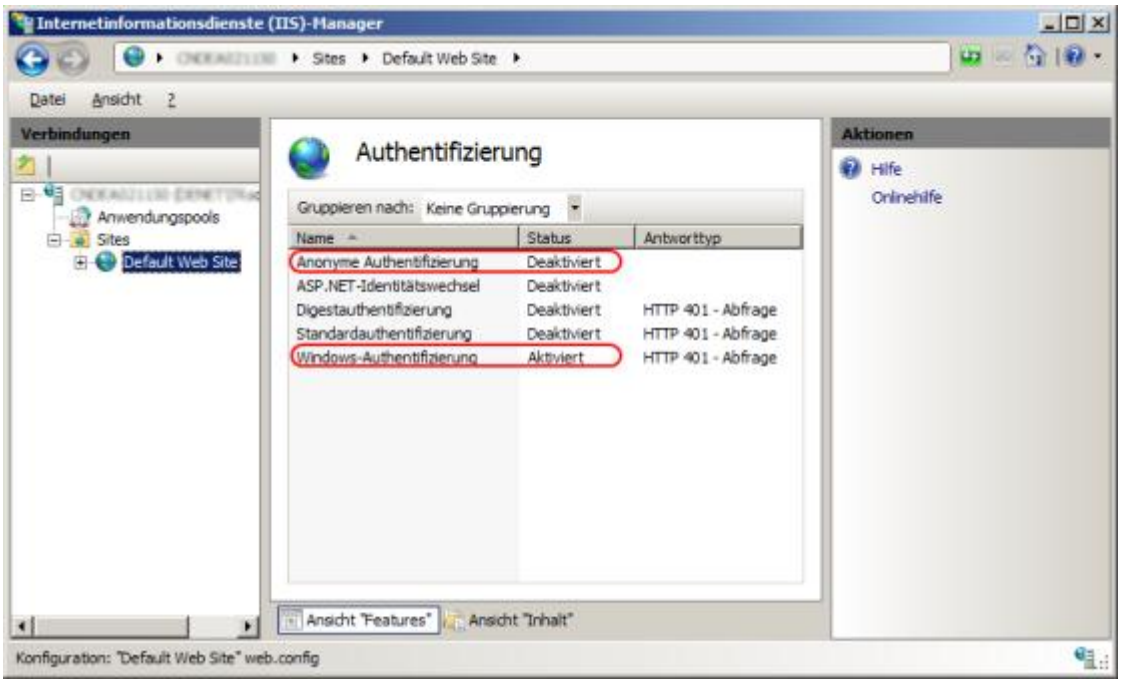


Sorry for the German screen shot. I do not have an English Windows 7.

Make sure to turn off „Anonymous Authentication“ and to enable “Windows Authentication.

1. Click **Start** and then click **Control Panel**.
2. In **Control Panel**, click **System and Security** and then click **Administrative Tools**.
3. In the **Administrative Tools** window, double-click **Internet Information Services (IIS) Manager**.

(http://technet.microsoft.com/en-us/library/cc770472%28v=ws.10%29.aspx)



(http://technet.microsoft.com/en-us/library/cc754628%28v=ws.10%29.aspx)

Sorry for the German screen shots. I do not have an English Windows 7.

NTLM Proxy Authentication

Currently NTLM proxy authentication is not supported by the NTLM extension of HTTPAPI. The reason is that I do not have a proxy server that uses NTLM authentication and therefore cannot test it.

Examples

EXAMPLE25	This example demonstrates how to use http_url_get() to get a web page that is protected by NTLM authentication.
EXAMPLE26	This example demonstrates how to use http_persist_get() to get a web page that is protected by NTLM authentication. The advantage of this example is that you can call http_persist_get() multiple times once that you passed the authentication process.
EXAMPLE27	This example demonstrates how to use http_persist_get() to get a web page that is protected by NTLM authentication. This time http_setauth() is directly called after http_persist_open() to minimize the overhead of the authentication process.
EXAMPLE35	This example demonstrates how to use http_url_post() to call a web service using NTLM authentication.
EXAMPLE37	This example demonstrates how to use http_persist_post() to call a web service using NTLM authentication.