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Content (translated into English)

Machine translation of `blog-48bits-com-48bits-blog-blog-archive-iis6-asp-file-upload-fun-profit.md` *, which holds the source's own words. Code, payloads, type names, URLs and CVE identifiers were masked before translating and restored after, so they are byte-identical to the original.*

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** Random IRC quote :* <Tarako> If Java had a real garbage collector, most programs would delete themselves when run.*

IIS6/ASP & file upload for fun and profit

Today we are going to discuss a little-known IIS6 behavior that I find interesting and that may be useful when conducting security audits. This article explains how IIS6 works alongside third-party applications that perform operations on the file system (creating directories, uploading files), such as web-based file managers.

Description

While trying to bypass security in the file upload component of an ASP application running under IIS 6, I realized that IIS uses only the part of the URL before a '/' or '\' to determine whether a file will be executed as an Active Server Page by the ASP.dll library. Specifically, IIS does not correctly parse directory names when they have executable extensions such as 1) .asp, 2) .asa, and 3) .cer.

The .aspx extension does not appear to be affected, returning a 404 error even when the file exists at that path.

When a URL such as 'maliciousfolder.asp/code.pdf' is parsed, a routine is executed that checks whether the file should be executed by ASP.dll. The '/' (or '\') character breaks the string, and IIS determines that the file should be executed as an ASP script. However, when executing it, a different routine reads the correct file, 'maliciousfolder.asp/code.pdf', and executes the code it contains. A remote attacker could therefore execute ASP code on the web server from a PDF file or any other file type considered "safe" by file upload applications.

In addition, this attack can be combined with the *CVE-2009-4444* bug, allowing remote attackers to create a directory with an executable extension followed by a ';' character and then an extension considered safe or any other suffix, as demonstrated by the use of ASP.dll to handle strings such as ".asp;.jpg".

Proof of concept

IIS will execute the ASP code contained in the file 'document.pdf' when the following URLs are accessed. Some examples are provided here:

```
```

http://host/path/folder.asp/document.pdf

http://host/path/user.cer/documents/document.pdf

http://host/path/folder.asa/other/path/document.pdf

http://host/path/folder.asp\document.pdf

http://host/path/folder.cer\document.pdf

http://host/path/folder.asa\document.pdf

When combined with the *CVE-2009-4444* ref #1, the following URL is also valid:

```
```

http://host/path/folder.asp;.jpg/document.pdf

In other cases, I have encountered blacklist filters for filtering extensions, but what we normally try to convey to developers is that these filters do not work: there is always a way to bypass them. The solution is to use whitelist filters and the defense-in-depth principle.

For example, one real-world case involved an application that filtered "dangerous" extensions such as ".asa", ".asp", ".php", ".jsp", ".cer", etc., but used *only* the three characters immediately after the period to check whether the extension was allowed. This could be bypassed using NTFS Alternate Data Streams (ADS), thanks to the ':' character after the filename and the "$DATA" stream. This would create the file 'file.asp' containing code of our choice and make it accessible through the web server, allowing us to execute it.

Proof of concept: file.asp::$DATA

Even when whitelist filters are used, there are ways to bypass certain protections, such as the one presented above, or by using other techniques.

Developers will normally take the last three characters and compare them against the list of safe extensions (such as jpg, gif, png, etc.). In this case, using ADS and the ':' character *(CVE-2009-4445 ref. #2)*, we could construct a filename string such as "filename.asp:.jpg". This would make the extension valid because jpg would be on the list of permitted extensions, allowing us to create empty files with an asp extension. By combining this vulnerability with others, we could potentially compromise the server.

>

PoC: file.asp:.jpg -> The file file.asp is created in the DocumentRoot with no content.

In addition to these, there are other techniques for attempting to circumvent the protection system, but each case must be studied separately. File upload components in web applications are among the most sensitive elements and must receive close attention at every stage of the SDLC.

If you do not know how ADS work, take a look at ref. #3

Impact

The impact of this vulnerability is high because attackers can bypass file extension management protections in 3rd-party webapps by uploading files with any extension (e.g., pdf, txt) to a folder whose name ends with an executable extension (such as .asp, .cer, .asa, ...).

The ASP.dll library behaves unexpectedly when handling these types of URLs and could allow remote attackers to execute code if the directory has execution permission.

Affected systems

Tested on an up-to-date Microsoft Windows 2003 SP2 system with Internet Information Services (IIS) version 6 Note: an attacker needs to interact with an application that must have permission to upload files and execute them on the web server. Unaffected systems: IIS 5.1 on Windows XP SP3 appears to return a 404 code when attempting to reproduce the PoC, IIS 7.x not tested

The response

La respuesta del MSRC fue una frase que a muchos os sonará: *HOYGAN! This is not a bug, it's a feature!*

[[image: bug-feature]](http://blog.48bits.com/wp-content/uploads/2010/09/bug-feature.jpg)

In any case, I believe it is important to publish the technical description because it may be useful in some pen-tests/security audits and, just as importantly or even more so, to help sysadmins prevent these types of attacks (the solution to this problem is described in the final section of this article). Thanks nonetheless to the MSRC and everyone who participated in the research in one way or another.

Nevertheless, it can also be argued (and this was the final conclusion) that this vulnerability is not in IIS itself, but in the 3rd-party webapp, because it is the webapp's responsibility to filter all types of malicious characters in both filenames and folder names. The fact is that many web applications apply security protections to filenames but not to folder names in apps that work with directories. This is precisely where this research applies.

The reason why

I will now explain the technical details:

When a new request reaches IIS, it determines which module will process it by parsing the URL from left to right and looking for valid extensions in each segment.

When an extension is found, it is first compared against a list of executable extensions (.exe, .com, .dll, and .isa). If it is .exe or .com, IIS passes control to CGI, or to ISAPI if it is .dll or .isa. Similarly, it also compares the extension against the configured list of script extensions (by default, this list contains .asp, .cer, .asa, etc.). If any of these extensions match, control is passed to the script engine associated with that extension.

The string found after a valid extension and before the '?' character is considered the PATH_INFO variable according to the CGI specification (the string after the '?' character is the query string)

But what is PATH_INFO?

As can be read in #4:

>

The extra path information, as given by the client. In other words, scripts can be accessed by their virtual pathname, followed by extra information at the end of this path. The extra information is sent as PATH_INFO. This information should be decoded by the server if it comes from a URL before it is passed to the CGI script.

It is therefore the extra information at the end of the virtual path name (where the virtual path name is the URL). The problem is that ASP handles both the PATH_INFO variable and the PATH_TRANSLATED variable in a nonstandard way when locating the script file to execute. ASP assumes that the PATH_TRANSLATED variable will contain the complete physical path to the script file.

For ASP to function correctly, PATH_INFO must be the URL, because mapping the URL to a physical path will lead to the ASP page. However, according to the CGI 1.3 specification, #ref 4, PATH_INFO is not defined as a URL.

IIS has a configuration switch that controls whether script engines see the URL or the information defined by CGI in the PATH_INFO server variable. This configuration switch is called AllowPathInfoForScriptMappings, and you can find more information in ref #5

We must consider the two possible configuration values for the AllowPathInfoForScriptMappings variable; the PoC can be reproduced in both cases:

AllowPathInfoForScriptMappings=FALSE **(Default)**

In this situation, the URL will be assigned to the PATH_INFO variable, so the PATH_TRANSLATED variable will contain the complete physical path to the URL.

Let us use the URL "http://host/path/folder.asp/file.txt", as an example and see what it looks like:

- URL: http://host/path/folder.asp/file.txt
- *PATH_INFO: */path/folder.asp/file.txt
- PATH_TRANSLATE: c:\inetpub\wwwroot\path\folder.asp\file.txt

Because the identified '.asp' extension is mapped to be processed by a script, the request will be handled by asp.dll, which will attempt to open the final path (#3). If this file exists, ASP will process

it as an ASP script and send the output to the client. For the PoC to work, the file “file.txt” must exist in the “folder.asp” directory. *This is the case discussed above.*

AllowPathInfoForScriptMappings=TRUE

In this case, let us see what it looks like:

- URL: http://host/path/folder.asp/file.txt
- *PATH_INFO: */file.txt
- PATH_TRANSLATE: c:\inetpub\wwwroot\file.txt

Using the same example, and taking into account that the identified extension is also .asp, the request will be handled by asp.dll.

ASP will open the file “c:\inetpub\wwwroot\file.txt” (#3) and process it as an ASP script. In this case, the sysadmin must have changed the value of AllowPathInfoForScriptMappings manually, so I consider the attack much more difficult.

It should be noted that setting AllowPathInfoForScriptMappings to TRUE will break normal ASP operation. Considering a “normal” ASP request such as “http://host/path/file.asp”, would mean that the PATH_INFO variable would be an empty string (because there is nothing after the URL) and PATH_TRANSLATED would be “c:\inetpub\wwwroot\” with no file. This means that normal ASP requests would not work, and it is highly unlikely that a system administrator would want to serve ASP with this configuration.

The solution

The solution is aimed at two different roles:

- **Sysadmins**: **Remove execution permission from directories where file uploads are allowed.** Follow the security best practices guide for IIS 6 (Ref #6)
- **Developers**: Do not trust user-supplied input and *never* use it as a filename.* *Generate a random filename** and store the real name elsewhere (e.g., in a database). If possible, have the application itself set the extension, using switch-case clauses, for example. Accept only alphanumeric strings for the extension and filename.

References

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- CVE-2009-4445 http://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2009-4445
- Alternate Data Streams (ADS) http://es.wikipedia.org/wiki/Alternate_Data_Streams
- CGI 1.3 specification http://web.bilkent.edu.tr/WWW/hoohoo/cgi/env.html
- AllowPathInfoForScriptMappings http://www.microsoft.com/technet/prodtechnol/WindowsServer2003/Library/IIS/b9368427-8c20-42fb-af4e-85c4b7ff3b49.mspx?mfr=true
- IIS 6.0 Security Best Practices (IIS 6.0) [http://www.microsoft.com/technet/prodtechnol/WindowsServer2003/Library/IIS/596cdf5a-c852-4b79-b55a-708e5283ced5.mspx?mfr=true

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- File system http://www.owasp.org/index.php/File_System

- Unrestricted File Upload http://www.owasp.org/index.php/Unrestricted_File_Upload
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