Thirteen Years On: Advancing the Understanding of IIS Short File Name (SFN) Disclosure!

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Thirteen Years On: Advancing the Understanding of IIS Short File Name (SFN) Disclosure!

The topic of IIS Short File Name (SFN, also known as 8.3) disclosure has been explored across various platforms in the past. In this blog post, I'll take a look at the insights I presented at SteelCon 2023, which extended the scope of the original research.

The presentation can be downloaded from: https://github.com/irsdl/IIS-ShortName-Scanner/blob/master/presentation/Steelcon-2023-Beyond_Microsoft_IIS_Short_File_Name_Disclosure.pdf

The original research can be seen here: https://soroush.me/downloadable/microsoft_iis_tilde_character_vulnerability_feature.pdf

If you're particularly keen on diving straight into the latest insights, feel free to navigate to the final two sections of this post.

Happy Birthday

First thing first, I originally identified the IIS Short File Name (SFN, also known as 8.3) Disclosure on August 1, 2010 – meaning it's now entered its teenage years!

[image: Thirteen Years On: Advancing the Understanding of IIS Short File Name (SFN) Disclosure!]

A Quick Look at the History of Short File Names

Originally, the FAT file systems were somewhat limited and could only support short names. These short file or directory names contain a maximum of 8 characters. If an extension is present, it requires a dot, followed by up to 3 more characters. Therefore, the maximum total length of these names, including the extension, is 12 characters.

[image: Thirteen Years On: Advancing the Understanding of IIS Short File Name (SFN) Disclosure!]

With the introduction of VFAT, support for long file names began with Windows 95. In the NTFS system, short file names aren't necessary, but Windows still creates them for the sake of backwards compatibility. This happens when file names don't conform to the rules for short file names, such as when they exceed the character limit, contain unsupported characters, or feature more than one dot.

[image: Thirteen Years On: Advancing the Understanding of IIS Short File Name (SFN) Disclosure!]

SFN Rules

SFNs, or Short File Names, are case-insensitive and utilize uppercase characters exclusively. They consist of alphanumerical characters and a select few special characters. Spaces are not included, and there should only be one dot character used, which is followed by an extension.

Windows uses certain rules when creating short file names for file names. Typically, the short name begins with the first six characters of the actual file name, followed by a tilde (~) character and a number. If the file name includes an extension, the first three characters of the extension are appended after a dot.

During this process, Windows also eliminates disallowed characters, additional dots, and space characters. It will also substitute a plus sign (+) with an underscore (_).

In cases where a short name equivalent already exists for a different file, the system increments the number following the tilde. If you're curious to see the short names that have been generated in Windows, you can use the 'dir /x' or 'dir /-n' commands to view them.

As you might imagine, due to the constraints on character length, many long names can result in identical short names. Prior to Windows 2000, Windows permitted the number following the tilde character to go as high as 9. However, starting from Windows 2000, this number has been capped at 4. This raises the question: what happens if there are more than four files resulting in the same short name, given that Windows no longer uses ~5?

Well, the formula for generating short names changes. Now it utilizes the first two (or less if any exists) characters of the file name, followed by four hexadecimal characters produced by an algorithm. If the file name contains just one character, that single character is used. Thomas Galvin has done extensive research on this hexadecimal algorithm, and I highly recommend reading his work if you're interested. I'd also suggest checking out these resources and their references for a more in-depth exploration.

Recently, @bitquark has also explored this feature further using the leaked Windows 2003 source code. He has implemented his findings in his IIS short name scanner tool coded in the Go

language, which you can find here: https://github.com/bitquark/shortscan

What's Affected?

As of the time of this writing, all IIS versions are susceptible to this issue. However, this might not be the case if the SFN feature was disabled on Windows prior to the creation of the web directory.

Usefulness

While the risk associated with uncovering short file names on its own is quite low (mostly informational), it often proves useful by accelerating penetration testing or providing quick insights during bug bounty hunts.

Leveraging this vulnerability, I've discovered numerous sensitive files and even managed to download databases in the past. I've also identified several files with inadequate access control, including admin control panels leading to high risk issues.

Automation

- https://github.com/bitquark/shortscan (implementation in Go with checks to find the real file name)
- https://github.com/irsdl/IIS-ShortName-Scanner (the original tool in Java)
- https://github.com/sw33tLie/sns (another Go one)
- https://github.com/cyberaz0r/Burp-IISTildeEnumerationScanner (burp suite extension)
- https://github.com/0xRTH/IISRecon/ (bash script to find real file names too)

Manual Checks in 2023

If you're interested in checking this manually, I'll share my approach. I typically choose several HTTP methods and suffixes, to target a short file name that should exist (such as web.config or default.aspx) and one that should not. If the HTTP response differs, then I know I've hit the jackpot.

Initially, I select the OPTIONS HTTP method and pair it with the /~1/.rem pattern for the suffix. If this doesn't yield results, I switch the HTTP method to POST, DEBUG, GET, or PATCH. I also experiment with different suffixes such as /~1.rem, /~1.aspx, /~1.svc, /~1.xamlx, or /~1.soap.

This process can be automated using Burp Suite Intruder, as follows:

[image: Thirteen Years On: Advancing the Understanding of IIS Short File Name (SFN) Disclosure!]

Tips and Tricks for Manual Checks

- Don't solely rely on the response status code—make sure to compare the entire response.
- Don't confuse Kestrel or HTTP.SYS with IIS. Recent versions of .NET, such as 6, 7, and Core, might be running on Kestrel.

- Web Forms that use the .NET Framework can be served with or without extensions.
- This process won't work on virtual files or IIS virtual/app paths.
- Note that wildcards can be replaced:
- ? can be replaced with >
- * can be replaced with <
- " can be replaced with .
- URL encoding may be crucial in certain instances.
- Web Application Firewalls (WAFs) can lead to anomalies, so be aware of that.
- Spaces and periods can be employed as padding characters.

For more detailed tips and insights, I recommend checking out the slides available at https://github.com/irsdl/IIS-ShortName-Scanner/blob/master/presentation/Steelcon-2023-Beyond_Microsoft_IIS_Short_File_Name_Disclosure.pdf or SteelCon 2023's videos when they are available on YouTube.

What's New

In the following sections, I will address a couple of topics that weren't covered prior to my presentations in 2023. These could prove handy in certain scenarios when managing files or directories on IIS.

Application vs Directory vs Virtual Directory

In a prior blog post, I discussed how to differentiate between an "application" and a "directory/virtual directory" on IIS. You can find it here: https://soroush.me/blog/2019/07/iis-application-vs-folder-detection-during-blackbox-testing/.

To condense it into a nutshell: we append something like "/profile_json_appservice.axd/js" to the path. If the response status code is 200, it indicates an "application". Conversely, an HTTP status code of 500 signifies a "directory" or a "virtual directory". An example is:

Copy

```
1https://victim.com/path1/profile_json_appservice.axd/js
```

Now, if we aim to distinguish between a "directory" and a "virtual directory", we can use the HTTP method OPTIONS coupled with a suffix that includes an Alternate Data Stream pattern. An example of this might be "::$DATA/~1.rem", as illustrated below:

Copy

```
1OPTIONS /path1::$DATA/~1.rem HTTP/2

2Host: victim.com

3Accept: */*

4Accept-Language: en-US;q=0.9,en;q=0.8

5User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/115.0.5790.

6

7
```

If a 404 status code is returned, it indicates that 'path1' exists and is classified as a directory. Conversely, if we receive a 200 HTTP status code, it implies that 'path1' either does not physically exist or it's considered a virtual directory.

Revealing a Special Long File Name (LFN) Containing the ~DIGIT Pattern

When a file includes a ~ character followed by a number anywhere in its name, it's possible to reveal the full file name using IIS—not just the short name. The enumeration process is identical to that used for revealing short file names, with the only difference being that we continue the enumeration even after identifying the 6th letter of the file name!

To determine if such a file exists within a path, you can use seven question mark (?) characters either before or after the tilde character, followed by a number (enumerated from 0 to 9). This should be padded with asterisk characters. The patterns below illustrate how this can be achieved:

Copy

```
1???????~1

2~1???????
```

Under normal circumstances, if a long file name with the ~DIGIT pattern DOES NOT exist, we should encounter an error when using seven question marks, since the maximum would be six.

This technique proves especially beneficial when files or directories are generated by an application using user-supplied input within the name. This method could then be employed to

uncover other users' data by revealing the full file names, particularly when security measures are predicated on obscurity!
