Dell EMC PowerScale OneFS: Long Filename Support

Abstract

This white paper describes a storage solution based on Dell EMC PowerScale scale-out NAS that helps organizations to drive down data management complexity. OneFS provides a simple, scalable file system solution for unstructured data which supports long filenames.

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Executive summary

The scale, variety, and demands of unstructured data continue to grow at a relentless rate, making the need for optimized file-based data storage, and its simplified and automated management, more crucial than ever.

To help customers maximize the long-term value of their critical business data and drive down data management cost and complexity, Dell Technologies offers a simple, scalable solution for datasets containing long filenames, based on Dell EMC PowerScale NAS storage.

Audience

This paper presents information for managing data with long filenames in a Dell EMC PowerScale cluster. This paper does not intend to provide a comprehensive background to the OneFS architecture.

See the *OneFS Technical Overview* white paper for further details on the OneFS architecture.

The target audience for this white paper is anyone configuring and managing support for long filenames within a OneFS-powered clustered storage environment. It is assumed that the reader has an understanding and working knowledge of the OneFS components, architecture, commands, and features.

More information about OneFS commands and feature configuration is available in the *OneFS Administration Guide*.

Overview

As commerce becomes ever more global, the need for data to span and bridge geographic, cultural, and linguistic barriers is expanding rapidly. Along with this is the requirement to support multiple languages, dialects, and alphabets— and their associated electronic representations—within a universal data lake.

Across the information technology realm, Unicode has evolved to become the generally accepted universal standard that governs the consistent encoding, representation, and transmission of electronic text. Maintained by the Unicode Consortium, UTF-8 is by far the most prevalent encoding on the Internet, being used in over 95% of websites.

Traditionally, OneFS has always supported Unicode-encoded filenames with a length of up to 255 bytes. However, depending on the encoding type, this limit can constrain the number of characters in a filename to a range of 63 to 255 Unicode characters. This can be an impediment for certain languages such as Chinese, Hebrew, Japanese, Korean, Thai, and so forth, and can create issues for customers who work with international languages that use multi-byte UTF-8 characters.

Examples of common workflows that can experience challenges with long filename support include:

- Meeting minutes or documents where names are reflected in both the local language and English
- Saved email addresses, where a long name is recorded using multi-byte characters
- Migration of mixed-encoding and long named data to PowerScale from other storage vendors

Since some international languages use up to 4 bytes per character, a file name of 255 bytes could be limited to as few as 63 characters when using certain languages on a OneFS cluster.

To address this, the OneFS long filenames feature provides support for names consisting of up to 255 Unicode characters, by increasing the maximum file name length from 255 bytes to 1024 bytes. It also allows for specifying the maximum number of characters per name for instances where a filename is composed of multi-byte characters, for example UTF-8. In conjunction with this, the OneFS maximum path length is also increased from 1024 bytes to 4096 bytes.

Architecture

OneFS 9.3 long filename support extends both the maximum length of a file name and the maximum length of a directory path name from the previous maximum limit of 255 bytes to new limits of 1024 UTF-8 characters and/or 1024-byte file names. In concert with this increase in file name size, the maximum path length is quadrupled to 4096 bytes from the current limit of 1024 bytes.

Under the hood, filename length configuration is governed by OneFS domains. A domain defines a set of behaviors for a collection of files under a specified directory tree. Using domains allows for a uniform maximum length of a file name across all OneFS protocol heads and with a single configuration point per domain. The 'isi namelength list -v' CLI command can be used to show the backing domain ID on a particular directory. For example:

```
# isi namelength list -v
      Path: /ifs/test
    Policy: custom
Max Bytes: 1024
Max Chars: 1024
        ID: 1e.0600
```

Long Filename Creation and Management

OneFS long filename support is configured at a directory level, rather than globally, although the base /ifs directory can be selected. If a directory, for example /ifs/test, is configured for a namelength of 1024 characters and 1024 bytes, then long filenames (up to 1024 characters) can be created.

```
# isi namelength create --max-bytes 1024 --max-chars 1024 /ifs/test
# isi namelength list
Path      Policy  Max Bytes  Max Chars
```

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```
----------------------------------------
/ifs/test custom  1024       1024
----------------------------------------
Total: 1
```

However, without long filename support configured (the default), any attempt to create a file with more than a 255-character name from the OneFS CLI will fail with a "File name too long" error message. For example:

```
# cd /ifs/test

# touch
1234567890123456789012345678901234567890123456789012345678901234567890123456789
0123456789012345678901234567890123456789012345678901234567890123456789012345678
901234567890123456789012345678901234567890123456789012345678901234567890123456789012.tmp

touch:
1234567890123456789012345678901234567890123456789012345678901234567890123456789
0123456789012345678901234567890123456789012345678901234567890123456789012345678
90123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456: File name
too long
```

Namelength limits can also be configured using the OneFS WebUI File system explorer by going to File system > File system explorer:

Figure 1   Windows Explorer File Name Limits Configuration

Removing the long namelength configuration for a directory will not affect its contents, including any previously created files and directories with long names. It will however prevent any new long-named files from being created under that directory until the long filename configuration is restored.

Filename Mangling

If a filename is too long for a particular protocol, OneFS will automatically truncate the name to around 249 bytes with a 'hash' appended to it, which can be used to consistently identify and access the file. This shortening process is referred to as 'name mangling' in the OneFS lexicon, resulting in a 'mangled' filename. If, for example, a filename longer than 255 bytes is created and then returned in a directory listing over the NFSv3 protocol, the file's mangled name will be presented. Any subsequent lookup operations performed on this mangled name will resolve to the same file with the original long name.

Taking the long-named '.tmp' file created in the previous example: When viewed from an NFSv3 client, this file is shortened to a 255-character mangled encoding:

```
# ls ./test/*.tmp

12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
9012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789#2c0b5*
```

The same file, viewed through a cluster's SMB share from a Windows 10 client's file explorer, also displays the same 255-character 'mangled name' truncation:

Figure 2   Windows Explorer View Showing Mangled Filename

Filename extensions will be lost when a name is mangled. For example, a MS Word .docx long-named file may no longer appear as a .docx file after name mangling.

Protocol Considerations

Currently OneFS supports a variety of protocols, including NFS, SMB, S3, HDFS, HTTP, and FTP, for accessing a common set of data. However, each of these protocols can support a different file or object length.

Table 1   OneFS Protocol Namelength Limits

Protocol	Detail
NFSv3	No limit but controlled by service implementation or client and typically limited to 255 bytes.
SMB	255 characters for file component of a path (not to be confused with the 260-character legacy limitation in the win32 API)
S3	1024 bytes (see https://docs.aws.amazon.com/AmazonS3/latest/dev/UsingMetadata.html)
FTP	No published limit.
Straight HTTP	8 KB

Protocols supporting file names restricted to 255 bytes in prior OneFS releases are increased to a maximum of 1024 bytes or 255 characters in OneFS 9.3. If the protocol cannot support greater than 255 bytes, name mangling is employed to uniquely identify the file, as described above.

More information on OneFS protocol support is available in the OneFS NFS Protocol white paper and OneFS SMB Protocol white paper.

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NFS Exports

Configuring NFS Protocol Long Filename Parameters

For the NFS protocol, the default export configuration in OneFS 9.3 is to continue limiting the names to 255 bytes, as in previous releases. However, long filename limits (and encoding types) can be specified under the export settings. This can be configured from the OneFS CLI with the following syntax:

```
# isi nfs settings export modify --name-max size <integer> --encoding <string>
```

Or alternatively using the OneFS WebUI, by going to Protocols > UNIX Sharing (NFS) > Export Settings and editing the 'File name limits' field:
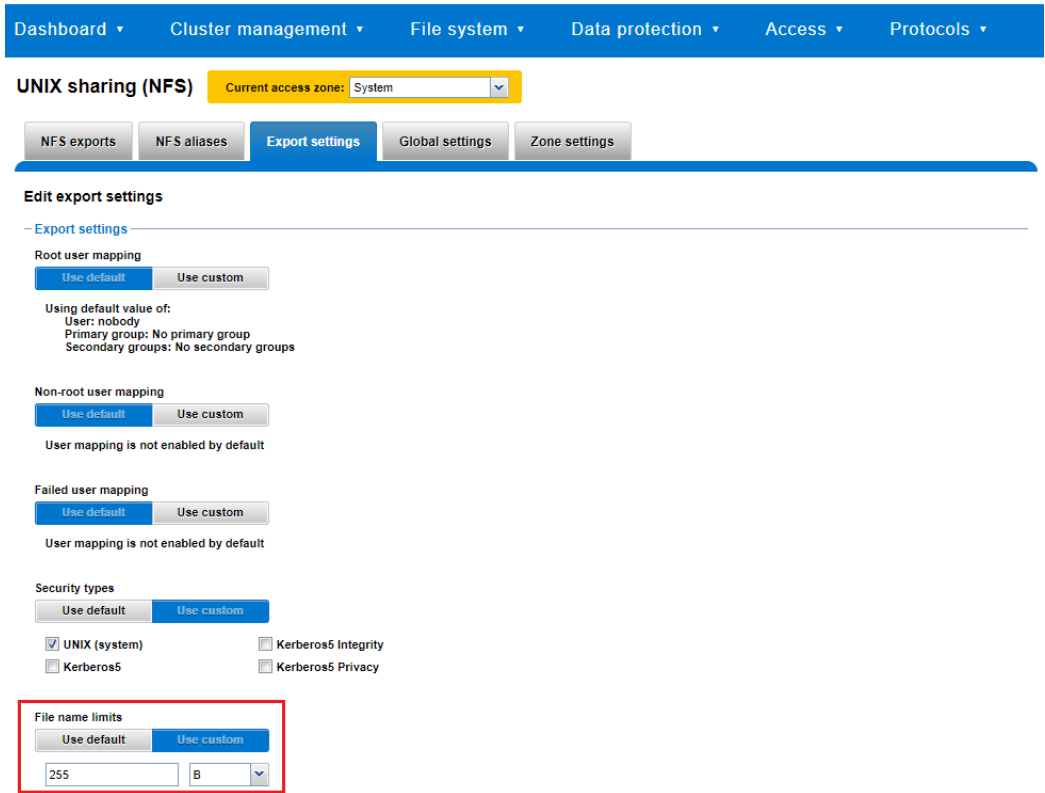
Figure 3   OneFS NFS Exports Configuration.

The OneFS ISI_PRIV_NFS role-based access control (RBAC) privilege is required by any cluster administrator account wishing to perform the following operations:

Operation	Required privilege
Create an NFS export specifying maximum name length	ISI_PRIV_NFS
Change global NFS exports setting to specify maximum file name length	ISI_PRIV_NFS

SMB Shares

SMB share file name limits can be configured from the OneFS WebUI by going to Protocols > Windows Sharing (SMB) > SMB shares and selecting the desired share:
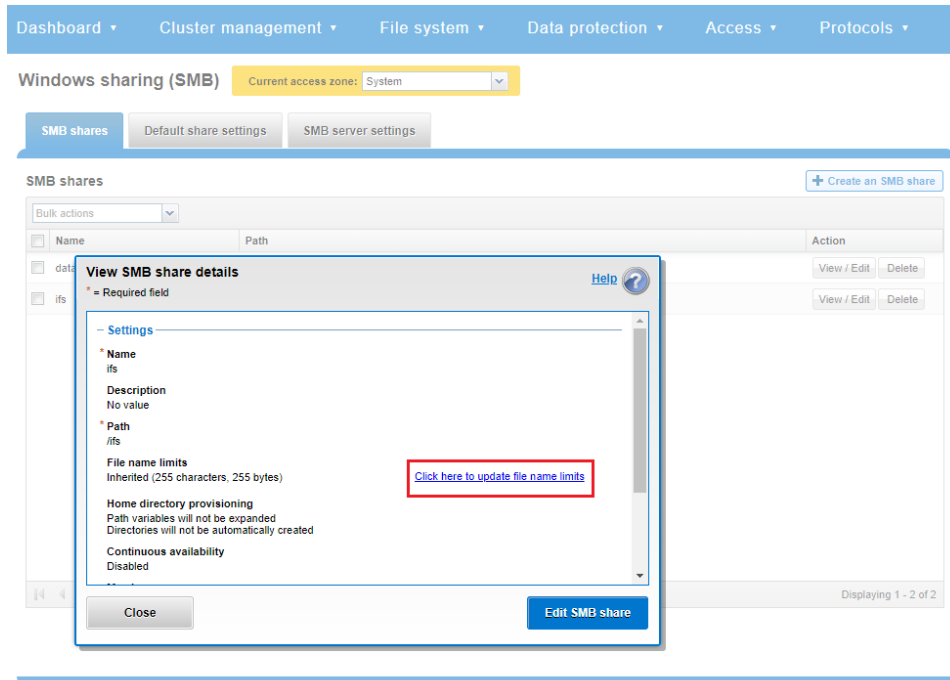
Figure 4   OneFS SMB Share Configuration

A link is available on the 'view SMB share details' page, prompting "Click here to update the file name limits."
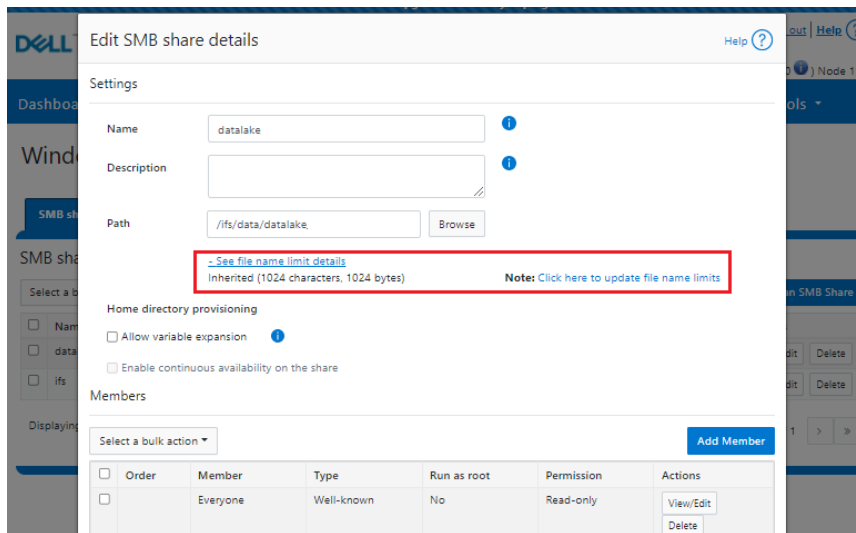
Figure 5   OneFS SMB Filename Length Configuration.

The file name limits can be configured on a directory by editing the 'Restrict Name Length' field for the desired directory. Either restricted or full-length name configurations can be selected, as follows:

Name-length Option	Value
Restricted (default)	255 bytes, 255 characters. The default if no name length configuration is specified.
Full length	1024 bytes, 255 characters.

Client OS Considerations

Client maximums

The vast majority of clients that access PowerScale clusters are systems running Windows, Linux, or MacOS, and communicating via the SMB or NFS protocols. In general, the file name and path limitations for each of these operating systems are as follows:

Table 2   Client operating system operating system filename limits

Operating system	File name and path limits
Linux	255 bytes, path length varies.
Windows	Windows 8 and later– 32,000~ for path, and 256 characters for each file or path component.†
macOS	255 characters, or as restricted by protocol.

† Win32 Explorer Limitations: Still to this day, various Windows APIs remain limited to 260 characters (not bytes). In order to circumvent this limitation, Microsoft addressed this in NTFS by using a 'short-name format'. Also referred to as '8.3', this short-name format reduces a long name down to a maximum file name of eight characters and up to a three-character extension.

This limitation can be mitigated to a large extent in Windows 10 by editing the Windows registry key 'HKLM\System\CurrentControlSet\Control\FileSystem\LongPathsEnabled' to value '1'. However, this change may not help explorer or other components using older versions of the API.

Another interesting facet of Windows paths is that NT based paths have always supported 32K characters if the path starts with "\\?\". However, this has to be an absolute path (not relative) as the Win32 API passes this directly to the kernel.

OneFS Encoding Settings

OneFS currently supports a range of character encodings that accommodate a variety of global languages and dialects. The following table lists and describes the available options:

Table 3   OneFS Supported Character Encoding Schemes.

Encoding scheme	Description
UTF-8	Default. UTF-8 is a variable-width character encoding used for electronic communication. Defined by the Unicode Standard, the name is derived from Unicode Transformation Format – 8-bit. UTF-8 is capable of encoding all 1,112,064 valid character code points in Unicode using one to four one-byte code units.
Windows-SJIS	Shift JIS (Shift Japanese Industrial Standards, also SJIS, MIME name Shift_JIS) is a character encoding for the Japanese language
Windows-949	Unified Hangul Code, or Extended Wansung, also known under Microsoft Windows as 'Code Page 949', is the Microsoft Windows encoding for the Korean language. It is an extension of Wansung Code to include all 11172 Hangul syllables present in Johab.
Windows-1252	Windows-1252, or CP-1252, is a single-byte character encoding of the Latin alphabet, used by default in the legacy components of Microsoft Windows for English and many European languages including Spanish, French, and German.
EUC-KR	Variable-width encoding to represent Korean text using two coded character sets, KS X 1001 (formerly KS C 5601) and either ISO 646:KR (KS X 1003, formerly KS C 5636) or US-ASCII, depending on variant. KS X 2901 (formerly KS C 5861) stipulates the encoding and RFC 1557 dubbed it as EUC-KR.
EUC-JP	Multibyte, variable-width character encoding system used primarily for Japanese, Korean, and simplified Chinese.
EUC-JP-MS	Microsoft compatible encodings for Japanese.
UTF-8-MAC	A variant utf-8 encoding used by Apple's OSX file system
ISO-8859-1 (Latin-1)	Western European language encoding. ISO 8859-1 encodes what it refers to as "Latin alphabet no. 1," consisting of 191 characters from the Latin script.
ISO-8859-2 (Latin-2)	Non-Cyrillic Central and Eastern European language encoding.
ISO-8859-3 (Latin-3)	Southern European languages including Turkish, Maltese, and Esperanto language encoding.
ISO-8859-4 (Latin-4)	Estonian, Latvian, Lithuanian, Greenlandic, and Sami.
ISO-8859-5 (Cyrillic)	Russian, Bulgarian, Belarusian, Macedonian, Serbian, Ukrainian (partial) language encoding.
ISO-8859-6 (Arabic)	Arabic language encoding.
ISO-8859-7 (Greek)	Greek language encoding.
ISO-8859-8 (Hebrew)	Hebrew language encoding.

Encoding scheme	Description
ISO-8859-9 (Latin-5)	Turkish language encoding.
ISO-8859-10 (Latin-6)	A rearrangement of Latin-4. Considered more useful for Nordic languages. Baltic languages use Latin-4 more.
ISO-8859-13 (Latin-7)	Added some characters for Baltic languages which were missing from Latin-4 and Latin-6. Related to Windows-1257.
ISO-8859-14 (Latin-8)	Covers Celtic languages such as Gaelic and the Breton language.
ISO-8859-15 (Latin-9)	A revision of 8859-1 that removes some little-used symbols, replacing them with the euro sign € and the letters Š, š, Ž, ž, Œ, œ, and Ÿ, which completes the coverage of French, Finnish and Estonian.
ISO-8859-16 (Latin-10)	Albanian, Croatian, Hungarian, Italian, Polish, Romanian and Slovene, but also Finnish, French, German and Irish Gaelic (new orthography) language encoding.

By default, OneFS automatically uses UTF-8 encoding, as defined by the Unicode standard. Conversion between encodings is accomplished in OneFS using an intermediate translation to UTF-8.

A cluster's current OneFS global character encoding can be viewed and configured from the OneFS WebUI by going to File system > File system settings > Character encoding:
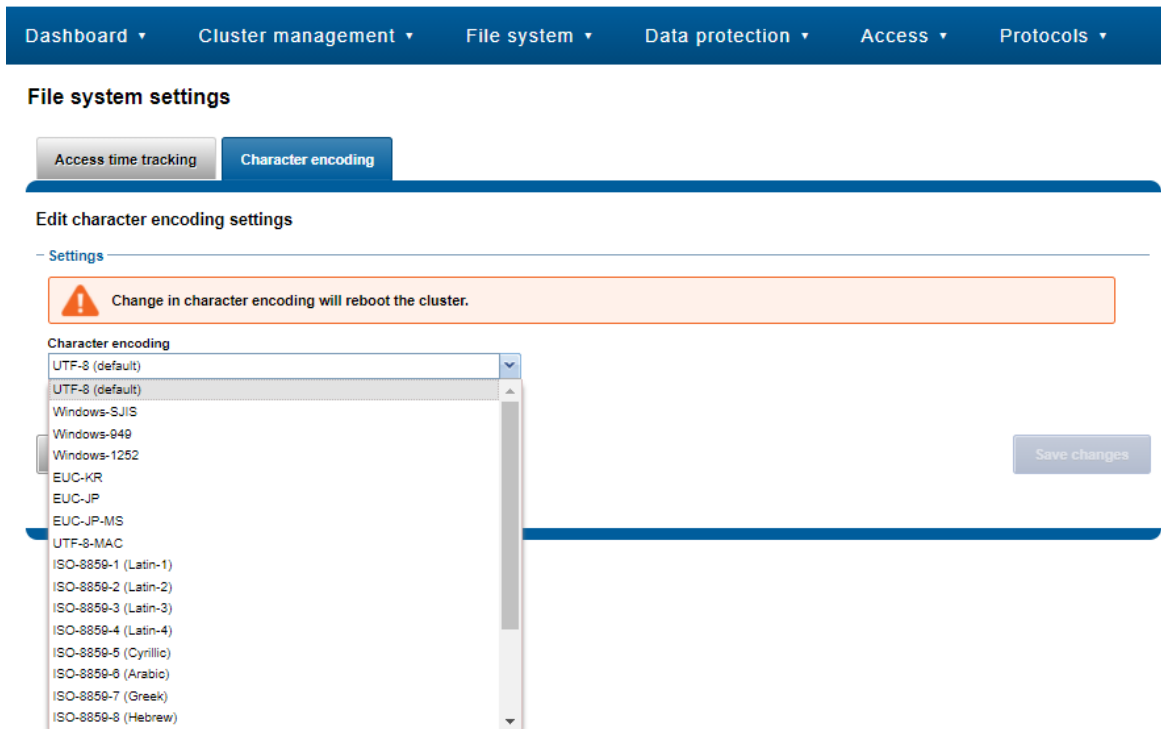

Figure 6   OneFS Character Encoding Configuration

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Similarly, a cluster's character encoding can be viewed and managed from the OneFS CLI using the following command syntax:

```
Usage:
    isi cluster encoding <action>
        [--timeout <integer>]
        [{--help | -h}]

Actions:
    list      List valid filesystem character encodings.
    modify    Modify the current filesystem character encoding.
    view      View the current filesystem character encoding.
```

For example:

```
# isi cluster encoding view
Current Encoding: UTF-8
Default Encoding: UTF-8
```

Alternatively, a cluster's character encoding can also be configured from the 'isi config' CLI command subsystem. This can be accomplished as follows:

1. Run the isi config command:

```
# isi config
Welcome to the Isilon IQ configuration console.
Copyright (c) 2001-2021 Dell Inc. All Rights Reserved.
Enter 'help' to see list of available commands.
Enter 'help <command>' to see help for a specific command.
Enter 'quit' at any prompt to discard changes and exit.

        Node build: Isilon OneFS 9.3.0.0
        Node serial number: JWXNT190300640

Cluster1 >>>
```

2. Modify the character encoding by running the encoding command. For example, the following command sets the encoding for the cluster to ISO-8859-1:

```
Cluster1 >>> encoding ISO-8859-1
```

3. Run the commit command to save your changes and exit the isi config subsystem:

```
Cluster1 >>> commit
```

4. Reboot the cluster to apply character encoding modifications:

```
Cluster1 >>> reboot
```

ⓘ Warning: Character encoding is typically established during installation of the cluster. Modifying the character encoding setting after installation may render files unreadable if done incorrectly.

Only OneFS-supported character sets are available for selection. UTF-8 is the default character set for OneFS nodes. If the cluster character encoding is not set to UTF-8, SMB share names are case-sensitive.

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Alternate Data Streams

The OneFS long filename limits and operations also apply to Alternate Data Streams (ADS) and macOS Resource Forks, in addition to regular files.

Long Filename Support Pre-requisites

Before long filename support can be enabled on a cluster, the following prerequisites must be met:

- The cluster is running OneFS 9.3. If upgrading, to OneFS 9.3, the upgrade must be committed.
- If a directory configured for long filenames is to be replicated by SyncIQ, all remote clusters must be running OneFS 9.3 or later and also have the corresponding target directory hierarchy configured for long filenames with the same max characters and bytes settings as the source.

Long filename configuration with SyncIQ replication is covered in more detail in a later section of this paper.

Enabling Long Filenames

The following decision tree shows the prerequisites for enabling long filename support on a cluster:
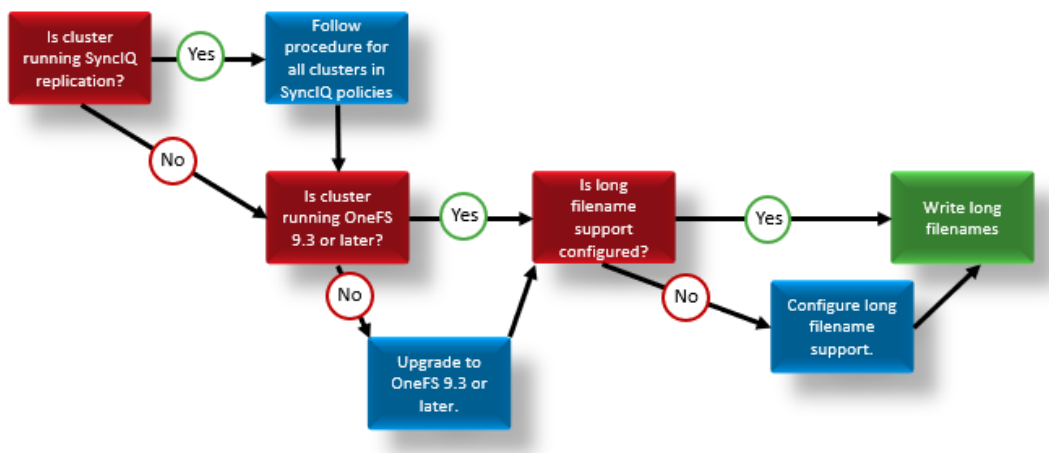
Figure 7   Long filename support configuration decision tree

Long filename support configuration is performed using either the OneFS command-line interface (CLI) or OneFS WebUI as described in the following section.

Configuring Long Filename Support

OneFS long filename support can be configured and managed from the OneFS CLI using the 'isi namelength' command set. The subcommands and syntax for this utility are as follows:

```
# isi namelength -h
Description:
    Manage file name length configurations.

Required Privileges:
    ISI_PRIV_CLUSTER

Usage:
    isi namelength <action>
        [--timeout <integer>]
        [{--help | -h}]
```

```
Actions:
    create    Create a file name length configuration domain.
    delete    Delete a file name length configuration or all configurations.
    modify    Modify a file name length configuration domain.
    list      View a list of file name length configuration domains.
    view      View detailed properties of a file name length configuration
              domain.

Options:

  Display Options:
    --timeout <integer>
        Number of seconds for a command timeout (specified as 'isi --timeout NNN
        <command>').
    --help | -h
        Display help for this command.

See 'isi namelength <subcommand> --help' for more information on a specific
subcommand.
```

The following procedure can be used to configure a PowerScale cluster for long filename support:

Step 1: Verify OneFS Version and Upgrade Cluster

The 'uname' CLI command output will display a cluster's current OneFS version.

For example:

```
# uname -sr
Isilon OneFS v9.3.0.0
```

The current OneFS version information is also displayed at the upper right of any of the OneFS WebUI pages.

Step 2:   Upgrade Cluster OneFS Version, If Required

If the output from step 1 shows the cluster running an earlier release, an upgrade to OneFS 9.3 will be required. This can be accomplished either using the 'isi upgrade cluster' CLI command or from the OneFS WebUI, by going to Cluster Management > upgrade.
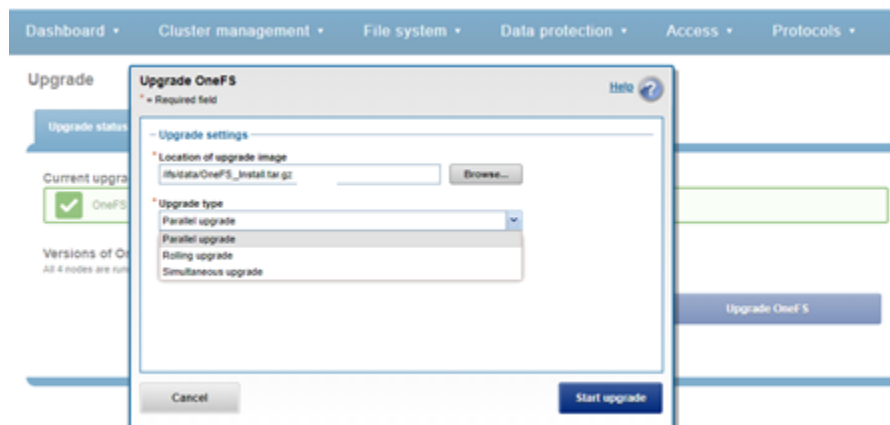

Figure 8   Upgrading OneFS using the WebUI

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ⓘ Once the upgrade has completed it will need to be committed, either by following the WebUI prompts, or using the 'isi upgrade cluster commit' CLI command.

Step 3. Verify Cluster's Long Filename Support Configuration

a)   Viewing a Cluster's Long Filename Support Settings

The 'isi namelength list' CLI command output will verify a cluster's long filename support status. For example, the following cluster already has long filename support enabled on the /ifs/tst path:

```
# isi namelength list

Path     Policy     Max Bytes  Max Chars

----------------------------------------

/ifs/tst restricted 255        255

----------------------------------------

Total: 1
```

Step 4. Configure Long Filename Support

The 'isi namelength create <path>' CLI command can be run on the cluster to enable long filename support.

```
# mkdir /ifs/lfn

# isi namelength create --max-bytes 1024 --max-chars 1024 /ifs/lfn
```

ⓘ By default, namelength support is created with default maximum values of 255 Bytes in length and 255 characters.

Step 5: Confirm Long Filename Support is Configured

The 'isi namelength list' CLI command output will confirm that the cluster's /ifs/lfn directory path is now configured to support long filenames:

```
# isi namelength list

Path     Policy     Max Bytes  Max Chars

----------------------------------------

/ifs/lfn custom  1024        1024

/ifs/tst restricted 255        255

----------------------------------------

Total: 2
```

Licensing Requirements

There are no additional licenses required to enable OneFS long filename support beyond a general cluster license and adherence to the minimum cluster size criteria described previously.

Monitoring and Reporting

Files with long names look, feel, and operate similarly to any other file under OneFS. As such, there are no there are no special tools or flags required to view performance or attributes of long filenames beyond the regular CLI commands.

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OneFS employs a unified permission model to ensure that authentication and data access control remains consistent, irrespective of the access protocol.

📖 More information on OneFS file permissions and access control is available in the <u>OneFS Authentication and Identity Management Guide</u>.

For more granular file metadata information, the OneFS 'isi get' CLI command syntax will report a file's character encoding.

```
# isi get -D longfilename.dat | egrep -A1 -i encoding
POLICY   W   LEVEL PERFORMANCE COAL  ENCODING      FILE            IADDRS
default      6+2/2 concurrency on    UTF-8         tst2.txt
<1,14,105637912576:8192>, <2,4,80415655040:8192>, <3,6,404668416:8192> ct: 1616614062 rt:
0
```

In the above example, the file 'longfilenmae.dat' is configured for UTF-8 encoding.

Similarly, the 'isi set CLI command with a '-e' flag can be used to set the character encoding on a specific file:

```
# isi set -h

usage: isi set [-fFLnvrR] [-p <policy>] [-w <width>] [-c on|off|endurant_all|coal_only]
[-g <restripe_goal>] [-e <encoding>] [-d <@r drives>] [-a
default|streaming|random|disabled|custom{1..5}] [-l concurrency|streaming|random] [--
nodepool <id|name>] [--packing on|off] [--strategy|-s avoid|metadata|metadata-write|data]
[--mm-access|-A on|off] [--mm-packing on|off] [--mm-protection|-P on|off] file_or_lin ...
```

Character encoding settings can also be configured from the OneFS WebUI by going to 'File system > File system settings > Character encoding' and selecting the preferred encoding scheme from the drop-down list:

Figure 9   OneFS Character Configuration.

More information about OneFS commands and feature configuration is available in the <u>OneFS Administration Guide</u>.

Long Filename Performance

OneFS 9.3 or later fully supports long filenames for general use on a cluster. As such, there are no limitations around client IO access patterns, protection levels, or sparseness for long names. Furthermore, the suite of OneFS storage management and data protection features are compatible with long filenames, as described in the following chapter.

While an increase in name lengths could potentially reduce in the number of file names contained within OneFS metadata structures (for example, DFM btree leaves), the overall performance impact of creating files with longer names is negligible.

Long Filenames and OneFS Data Services

Long filename support coexists happily with the majority of other OneFS data services. The exceptions are ICAP anti-virus and SyncIQ replication, prerequisites that are covered in more detail in the next section of this paper. The following table describes the integration, influence, and compatibility between inline data reduction and the various OneFS data services:

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Table 4   OneFS long filenames and data services integration

OneFS feature	Detail
SyncIQ	See following section.
NDMP Backup	Long filename backup and restore is supported and works as expected on clusters running OneFS 9.3. Be aware that restoring data from a OneFS 9.3 backup containing long filenames to earlier OneFS versions will fail with an 'ENAMETOOLONG' error for the long-named files. However, files with regular length names will be restored from the backup stream successfully.
SnapshotIQ	Filename length and/or directory name length will not affect the data stored in a snapshot. SnapshotIQ will successfully capture a snapshot of a dataset which contains long filename and or long directory pathnames. Similarly, the SnapRestore job will successfully restore a snapshot containing long names.
SmartLock	Long filenames are fully compatible with SmartLock, OneFS' data retention and compliance product. Long filenames support provides additional flexibility to OneFS immutable archives and write once, read many (or WORM) protected datasets.
SED Encryption	Clusters employing encryption with SED drives are fully compatible with long filenames.
SmartQuotas	OneFS SmartQuotas is one of the principle methods for inline data reduction efficiency reporting. From the quota side, long named files are reported on and acted upon as expected in configured quota policies.
SmartPools	Long filenames are fully compatible with SmartPools tiering, and conversely.
CloudPools	CloudPools cloud tiering fully supports long filenames. When tiered, the data associated with a long-named file will be moved to a cloud provider, and stub file reference created locally.
Non-disruptive Upgrade	Long filename support is introduced in OneFS 9.3.0. Non-disruptive upgrade to later release is fully supported. Files with long file names cannot be created on the cluster until the OneFS 9.3 release has been committed to the cluster.
File Clones	File cloning, and the underlying shadow stores, fully support long filenames.
In-line Data Reduction	In-line data reduction, including compression, deduplication, and single instancing, are fully compatible with long names.
SmartDedupe	SmartDedupe post process deduplication is fully compatible with long filenames and conversely.
Small File Storage Efficiency (SFSE)	Long filenames will co-exist with OneFS small file storage efficiency (SFSE) features, including both containerized small files and those that store inline in inodes.

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OneFS feature	Detail
Job Engine	The job engine and associated restriping jobs all fully support long filenames.
InsightIQ and DataIQ	InsightIQ and DataIQ both support and accurately report on OneFS long names.
Anti-virus	While ICAP does not support LFN, its replacement, CAVA, does support long file names.

With the exception of the job engine, file clones, and non-disruptive upgrade (NDU), the above services each require a product license or specific hardware. Licensed data services are not enabled, configured and active by default on a cluster.

SyncIQ Requirements for Long Filenames

With the ability to increase file name length in OneFS 9.3 beyond the previous limit of 255 bytes, an incompatibility is introduced with prior OneFS versions. As such, files created with names in excess of 255 bytes are unable to be replicated using SyncIQ to a cluster running a OneFS version earlier than 9.3. This incompatibility will be identified before SyncIQ attempts to replicate any file from the source cluster to an incompatible target cluster, and the SyncIQ policy will fail, a CELOG event will be generated and the replication session will be terminated without any files being transferred.

If long filename support is enabled on a cluster with active SyncIQ replication policies, all source and target clusters with a remote replication dependency must satisfy the following pre-requisites:

- OneFS 9.3 or later installed and committed

- Long filename support enabled

A cluster containing long-named files will be unable to replicate to a cluster that has not been upgraded OneFS 9.3, so any SyncIQ target clusters will need to be updated prior to enabling long name support on the source cluster. Note that the long filename configuration does not need to be identical between the source and target clusters; it only needs to be enabled. SyncIQ will successfully replicate long-named files to a target cluster with a restricted/default policy.
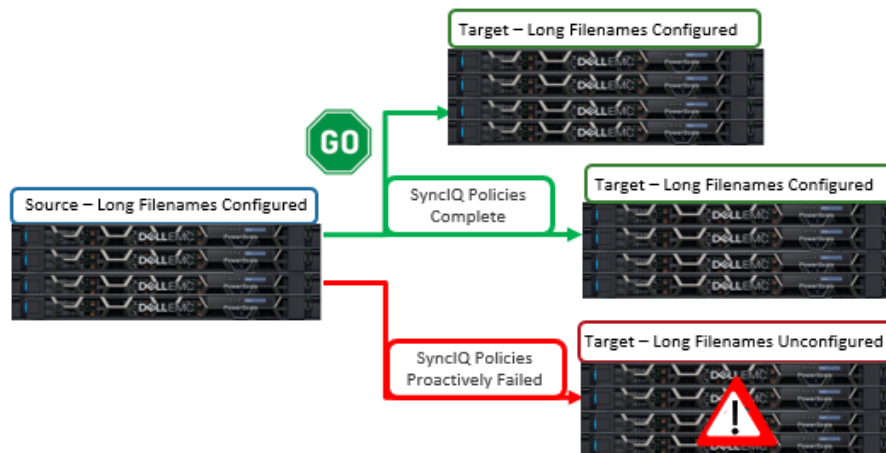

Figure 10   OneFS Requirements for Long Filename Support Within SyncIQ Replication Environments

For any cluster not meeting the above pre-requisites, SyncIQ replication policies will fail when attempting to establish a connection.

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Long filenames can be enabled on a SyncIQ target cluster either by creating a long filename configuration using the 'isi namelength create' CLI command as described previously, or by setting the following 'long_file_name_enabled' sysctl to value "1". For example:

```
# sysctl efs.bam.long_file_name_enabled=1"
```

When the target cluster for a Sync policy does not support long file names for a SyncIQ policy and the source domain has long file names enabled, the replication job will fail. The subsequent SyncIQ job report will include the following error message:
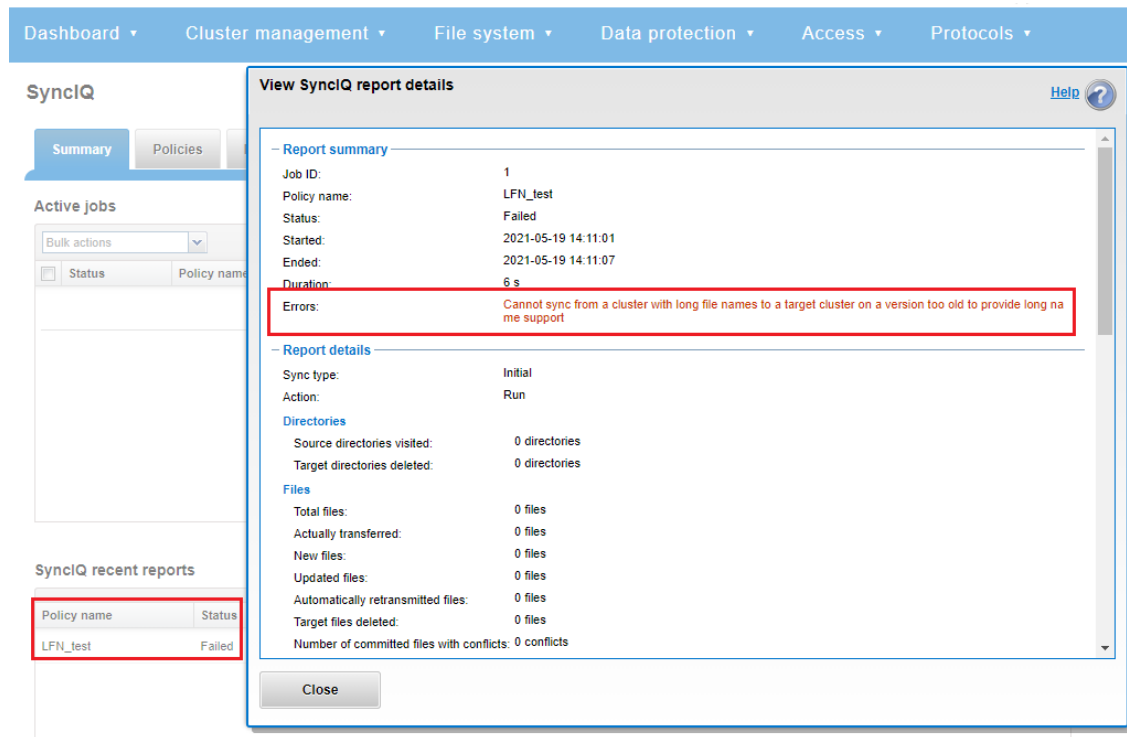

Figure 11   OneFS Long Filename Failure Across SyncIQ Replication Environment

A similar failure report is displayed through the CLI:

```
# isi sync reports view LFN_test 1
                Policy Name: LFN_test
                    Job ID: 1
                Start Time: 2021-05-19T21:11:01
                  End Time: 2021-05-19T21:11:07
                    Action: run
                     State: failed
                        ID: 1-LFN_test
                 Policy ID: 7a80761e4b013dcd8141b9ff1a5c1fb7
                 Sync Type: initial
                  Duration: 6s
                    Errors: Cannot sync from a cluster with long file names to a target cluster
on a version too old to provide long name support
                 Encrypted: No
  Source Directories Visited: 0
  Source Directories Deleted: 0
            Quotas Deleted: 0
      Num Retransmitted Files: 0
```

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```
              Retransmitted Files: -
                     Total Files: 0
            New Files Replicated: 0
            Source Files Deleted: 0
                   Files Changed: 0
            Target Files Deleted: 0
    Worm Committed File Conflicts: 0
                 Committed Files: 0
         Up To Date Files Skipped: 0
      User Conflict Files Skipped: 0
           Error Io Files Skipped: 0
          Error Net Files Skipped: 0
     Error Checksum Files Skipped: 0
               Bytes Transferred: 0
             Total Network Bytes: 0
                Total Data Bytes: 0
                 File Data Bytes: 0
               Sparse Data Bytes: 0
                Target Snapshots: -
                    Total Phases: 0

Subreports:
Policy Name  Job ID  Subreport ID  Start Time           End Time                    Action  State
------------------------------------------------------------------------------------------------
LFN_test      1       1            2021-05-19T21:11:01 2021-05-19T21:11:07 run      failed
------------------------------------------------------------------------------------------------
Total: 1
```

Additionally, a CELOG event and alert is also generated when a SyncIQ replication policy fails due to the target cluster's inability to support long filenames:
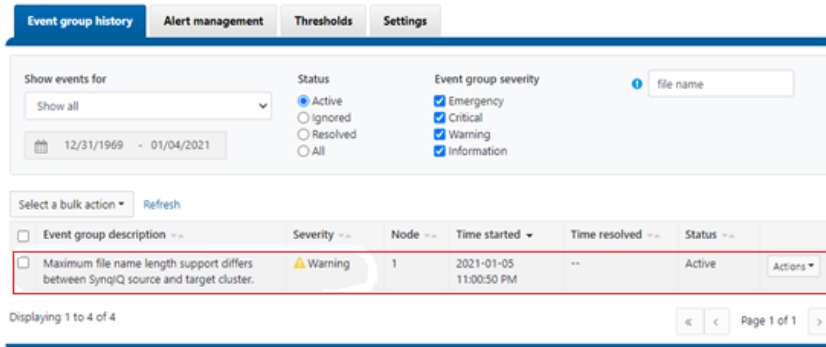

Figure 12   OneFS CELOG SyncIQ Replication Alert for Long Filename Incompatibility Failure

With SyncIQ cascaded replication configurations, be aware that only the immediate target can be verified for long filename compatibility from the source cluster. The OneFS checks which verify and fail an incompatible SyncIQ job are unable to identify and terminate instances in which the first level target is running OneFS 9.3 with long filename support enabled, but where the cascaded target is running an earlier OneFS version and/or does not have long filenames configured. In these cases, SyncIQ will fail without warning on the cascaded cluster:

Figure 13   Cascaded SyncIQ Replication with Secondary Target and Unconfigured Large Filename Support

Enabling Long Filename Support Across a SyncIQ Replication Environment

The following procedure can be employed to configure a SyncIQ replication environment for long filename support:

Step #	Action
1	Identify any SyncIQ target clusters that are not running OneFS 9.3.0 or later.
2	Upgrade and commit these target clusters to OneFS 9.3.0 or later.
3	Run the desired 'isi namelength create …' command on the primary cluster.
4	Enable long filename support on all target clusters. This can be done either using the 'isi namelength create …' command, or by using setting 'sysctl efs.bam.long_file_name_enabled=1'.
5	Confirm the long filename support configuration by running the 'isi namelength list' command on the cluster and its SyncIQ targets.

If an administrator does not wish to upgrade a cluster with SyncIQ replication policies to cluster(s) with long filename support configured, another option is to remove the existing replication policies to or from this cluster across all SyncIQ partners. The following CLI commands can be used to delete SyncIQ policies:

SyncIQ CLI Command	Description
'isi sync delete <policy>'	CLI syntax to delete outbound policies on a source cluster.
'isi sync break'	CLI syntax to delete inbound policies on a target cluster.

See the SyncIQ white paper for further details on configuring OneFS replication.

Best Practices and Considerations

Recommended best practices and considerations for managing long filenames on OneFS include:

- Long filename support is introduced in OneFS 9.3 and accommodates names up to a maximum of 1024 bytes and 255 characters.

- After upgrade to OneFS 9.3, the long filename feature is not activated or enabled by default. The cluster administrator has to opt-in by creating a "name length" configuration.

- Only enable long filename support if you are actually planning on using names that exceed the OneFS defaults of 255 bytes and 255 characters.

- Once long filename capabilities have been enabled by creating a 'name length' configuration, the long filename feature cannot be disabled. OneFS does not track if or when a long file name or path is created.

- If the maximum name length configuration is reduced after long named files have been created, those existing files with long names can still be read and written. However, new long named files cannot be created.

- Symbolic links (symlinks) created over the SMB protocol are limited to1024 bytes due to the size limit on the size of extended attributes in OneFS.

- Any pathnames specified in long filename platform API (pAPI) operations are limited to 4068 bytes.

- All SyncIQ target clusters described in existing SyncIQ policies must be running version 9.3 or greater and have long filename support configured to match the source cluster. Failure to install and commit the OneFS 9.3 or later release and/or to enable the long filename support feature on all SyncIQ target clusters can result in the failure of SyncIQ policies.

- SyncIQ policies will fail when establishing a connection with a cluster without Long Filename Support.

- With SyncIQ cascaded replication configurations, the checks which OneFS uses to verify and fail an incompatible SyncIQ job are unable to identify and terminate a configuration where the first level target is running OneFS 9.3 with long filename support enabled, but the cascaded target is running an earlier OneFS version and/or does not have long filenames configured. In these cases, SyncIQ will fail without warning on the cascaded cluster.

- Restoring data from a OneFS 9.3 NDMP backup containing long filenames to a cluster running an earlier OneFS version will fail with an 'ENAMETOOLONG' error for each long-named file. However, all the files with regular length names will be successfully restored from the backup stream.

- OneFS ICAP anti-virus does not support long filenames. However OneFS CAVA (ICAP's replacement) is compatible with long names.

- The OneFS 'isi_vol_copy' migration utility does not support long filenames.

- OneFS' WebDAV protocol implementation does not support long filenames.

Summary

OneFS long filename support, on top of the industry's leading Scale-Out NAS architecture, delivers on the promise for the evolving needs of global workloads - without sacrificing the ease of management, performance, scalability, and protection that OneFS affords.

Dell EMC PowerScale clusters provide a scalable, multi-protocol solution, which is further evidence of the Dell EMC commitment to developing the next generation of data management products and solutions for the enterprise.

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References

The following is a list of documentation and industry standards definitions related to the OneFS long filename feature:

POSIX	https://pubs.opengroup.org/onlinepubs/9699919799
UTF-8	https://tools.ietf.org/html/rfc3629#ref-ISO.10646
NFS v3	https://tools.ietf.org/html/rfc1813
NFS v4	https://tools.ietf.org/html/rfc7530
SMB	https://winprotocoldoc.blob.core.windows.net/productionwindowsarchives/MS-SMB2/%5bMS-SMB2%5d.pdf

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