BS ISO/IEC 24775-5:2021

BSI Standards Publication

Information technology — Storage management

Part 5: File systems

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National foreword

This British Standard is the UK implementation of ISO/IEC 24775-5:2021. It supersedes BS ISO/IEC 24775-5:2014, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ICT/1, Information systems co-ordination.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Part 5: File systems

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted (see www.iso.org/directives).

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This document was prepared by SNIA (as Storage Management Technical Specification, Part 5 Filesystems, Version 1.8.0, Revision 5) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

This second edition cancels and replaces the first edition (ISO/IEC 24775-5:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— USAGE text was revised to address code (now included in the front matter for all SNIA specifications)

— All recipes and their references were deleted.

— Instances of subprofile were changed to profile. In the annex, instances of subprofile were changed to component profile (TSG meeting voice vote).

— Profile versions and related text were updated. (TSG meeting voice vote).

— Indications have been replaced by DMTF Indications, and all affected clauses updated. (TSG meeting voice vote).

— Instances of Experimental within profiles already labeled as Experimental were removed to avoid confusion and redundancy. (Editorial change)

— CIM/XML was changed to CIM-XML (Response to ballot comments).

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— Annex: SMI-S Information Mo

— The CIM schema version was changed to 2.51 for V1.8.0 Rev3.

— Multiple profiles

  — Changed LocalAccessAvailable LocalAccessAvailableToFS, to respond to a DMTF change.

— File Export Profile (SMIS-170-Draft-SCR00004)

  — Removed the deprecated LogicalFile, ConcreteDependency and FileStorage from the diagrams.
  — Removed GetElementNameCapabilities from CIM_EnabledLogicalElementCapabilities (moved to the File Export Manipulation Profile).
  — Changed the FileShare reference in CIM_SAPAvailableForFileShare to ManagedElement to match the mof.
  — Added mandatory indications for FileShare.

— File Export Manipulation Profile

  — Added missing figure: FileShares and Simple Identity Management in Section 5.1.3.3.
  — Promoted all draft material to Experimental.
  — Promoted to Stable (TSG-SMIS-SCR00319).
  — Changed requirement to Mandatory and description for ProtocolVersions property in Tables 33-36.
  — Changed requirement to Mandatory for FileSharingProtocol property in Table 34.
  — Added material associated with the DMTF Simple Identity Management Profile (DS1034 rev 1.1.0 as it pertains to ACL manipulation on file shares. (TSG-SMIS-SCR00317).
  — Removed the deprecated LogicalFile, ConcreteDependency and FileStorage from the diagrams.
  — Fixed the duplicate entry for CIM_AccountManagementService (the second one was changed to CIM_AssociatedPrivilege).
  — Removed the deprecated CIM_ConcreteDependency, CIM_FileStorage and CIM_LogicalFile from the CIM Elements table.
  — Fixed the entries for CIM_ElementCapabilities in the CIM Elements table.
  — Added Key properties in the CIM_AccountManagementService CIM Elements table.
  — Added the method GetElementNameCapabilities to CIM_ExportedFileShareCapabilities.
  — Changed the FileShare reference in CIM_SAPAvailableForFileShare to ManagedElement to match the mof.
  — Added a Key property in the CIM_UserContact CIM Elements table.

— File Server Manipulation Profile

  — Changed CanConfigureNetworkVLSN in the class CIM_FileServerConfigurationCapabilities to CanConfigureNetworkVLAN to match the mof.
  — Fixed the PartComponent reference in CIM_SettingsDefineCapabilities (DNSSettingData) to refer to DNSSettingData.
  — Promoted to Stable (TSG-SMIS-SCR00319).

— File Storage Profile

  — Changed the Central Class from N/A to CIM_LogicalDisk (SMIS-180-Errata-SCR00003).
  — Changed the Scoping Class from ComputerSystem to CIM_LocalFileSystem (SMIS-180-Errata-SCR00003).

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— Filesystem Profile

— Added mandatory indications for LocalFileSystem (SMIS-170-Draft-SCR00004).
— Material related to ElementCapabilities (naming) incl 8.1.2.3: Promoted to Stable (TSG-SMISSCR00319).
— Removed the deprecated LogicalFile, ConcreteDependency and FileStorage from the diagrams.
— Removed the deprecated CIM_ConcreteDependency, CIM_FileStorage and CIM_LogicalFile from the CIM Elements table.
— Removed GetElementNameCapabilities from CIM_EnabledLogicalElementCapabilities (moved to the Filesystem Manipulation Profile).

— Filesystem Manipulation Profile

— Material related to ElementCapabilities (naming) in 9.1.3.1: Promoted to Stable (TSG-SMIS-SCR00319).
— Fixed the version numbers on the Related Profiles to match what the profiles claim.
— Removed the deprecated LogicalFile, ConcreteDependency and FileStorage from the diagrams.
— Fixed the description of the Capabilities reference in CIM_ElementCapabilities (Local Access Configuration Capabilities).
— Added descriptions to the references and property in CIM_ElementCapabilities (Default).
— Added descriptions to the references in CIM_ElementCapabilities (Non-Default).
— Added the GetElementNameCapabilities() method to CIM_FileSystemCapabilities.

— Filesystem Performance Profile

— Changed FileSystemStorageStatisticalData to FileSystemStatisticalData in a diagram and the CIM Element table for CIM_FileSystemStatisticalData.

— Filesystem Quotas Profile

— Fixed queries in CIM table 173.
— Changed the name of the Profile from FileSystem Quotas to Filesystem Quotas.
— Added a missing ElementCapabilities between CIM_FSQuotaCapabilities and CIM_FSQuotaManagementService (as depicted in the instance diagram).
— Added a definition for CIM_LogicalFile which is depicted in the instance diagram, but is not in the CIM Elements table.

— Filesystem Replication Services Profile

— Changed the name of the Clause to match the name of the Profile.
— Fixed the method named GetReplicationRelationshipInstance to be GetReplicationRelationshipInstances.
— Added DESC to references in CIM_ElementCapabilities, CIM_FileSystemSynchronized, CIM_HostedCollection, CIM_MemberOfCollection, CIM_OrderedMemberOfCollection and CIM_ReplicaPoolForStorage.
— Added a CIM Element table to describe properties for CIM_FileSystemGroupSynchronized.
— Changed the DESC for the ManagedElement in SettingsDefineState.

— Filesystem Quotas Profile

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— Changed the Central Class from LocalFileSystem to CIM_FSQuotaManagementService (TSG-SMISSCR00333).

— Host Filesystem Profile

— In the package diagram, changed Filesystem Copy Services to Filesystem Replication Services and deleted Experimental Indications.
— Added descriptions for references in CIM_HostedCollection (Remote Resources), NAS Head Profile (TSG-SMIS-SCR00333).
— Changed both the Central Class and Scoping Class from ComputerSystem to CIM_ComputerSystem (Top Level System).

— NAS Head Profile

— Promoted 12.1.3.8.1 to Stable (TSG-SMIS-SCR00319).
— Promoted the maturity level from DRAFT to EXPERIMENTAL: Updated profiles to remove SNIA_ classes and use DMTF CIM_ classes (TSG-SMIS-SCR00315.001).
— Revised CIM_AssociatedPrivilege; Added CIM_UserContact, CIM_Identity, CIM_AccountMapnagementService, CIM_AssignedIdentity.
— Fixed the version numbers on the Related Profiles to match what the profiles claim.
— In the package diagram, removed Cascading and added Filesystem Performance and Filesystem Replication Services.
— Removed the deprecated LogicalFile, ConcreteDependency and FileStorage from the instance diagram.

— NAS Network Port Profile

— Fixed the description of CIM_FSIPInterfaceSettingData in the CIM Elements table.
— Deleted the extra CIM_FSIPInterfaceSettingData from the CIM Elements table CIM_MemberOfCollection (Allocated Resources) and CIM_MemberOfCollection (Remote Resources).
— Changed the Central Class from ProtocolEndpoint to CIM_ProtocolEndpoint (CIFS or NFS) (TSG-SMISSCR00333).

— Self-Contained NAS Profile

— Promoted 13.1.3.1, 13.1.3. 2 (TSG-SMIS-SCR00319).
— Fixed the version numbers on the Related Profiles to match what the profiles claim.
— In the package diagram, changed Filesystem Copy Services to Filesystem Replication Services.
— Removed the deprecated LogicalFile, ConcreteDependency and FileStorage from the instance diagram.
— Added a CIM Element table for CIM_ElementCapabilities (ImplementationCapabilities to Service).
— Changed both the Central Class and Scoping Class from ComputerSystem to CIM_ComputerSystem (Top Level System) (TSG-SMIS-SCR00333).

— Annex A SMI-S Information Model

— Deleted “Most SMI-S Profiles are primarily based on the DMTF Final MOFs” per 5/22/15 TSG meeting consensus.
— DMTF’s CIM schema version changed to 2.45.0. (TSG meeting voice vote).

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— References

— Added DMTF DSP1054 v1.2.2, Indications Profile (and changed version to 1.2.2 throughout book).
— Updated reference to DMTF DSP1054 Indications Profile.
— Removed DSP0214.
— Removed year from DSP1034del.

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INTENDED AUDIENCE

This document is intended for use by individuals and companies engaged in developing, deploying, and promoting interoperable multi-vendor SANs through the Storage Networking Industry Association (SNIA) organization.

CHANGES TO THE SPECIFICATION

Each publication of this specification is uniquely identified by a three-level identifier, comprised of a version number, a release number and an update number. The current identifier for this specification is version 1.8.0. Future publications of this specification are subject to specific constraints on the scope of change that is permissible from one publication to the next and the degree of interoperability and backward compatibility that should be assumed between products designed to different publications of this standard. The SNIA has defined three levels of change to a specification:

- Major Revision: A major revision of the specification represents a substantial change to the underlying scope or architecture of the SMI-S API. A major revision results in an increase in the version number of the version identifier (e.g., from version 1.x.x to version 2.x.x). There is no assurance of interoperability or backward compatibility between releases with different version numbers.
- Minor Revision: A minor revision of the specification represents a technical change to existing content or an adjustment to the scope of the SMI-S API. A minor revision results in an increase in the release number of the specification's identifier (e.g., from x.1.x to x.2.x). Minor revisions with the same version number preserve interoperability and backward compatibility.
- Update: An update to the specification is limited to minor corrections or clarifications of existing specification content. An update will result in an increase in the third component of the release identifier (e.g., from x.x.1 to x.x.2). Updates with the same version and minor release levels preserve interoperability and backward compatibility.

TYPOGRAPHICAL CONVENTIONS

Maturity Level

In addition to informative and normative content, this specification includes guidance about the maturity of emerging material that has completed a rigorous design review but has limited implementation in commercial products. This material is clearly delineated as described in the following sections. The typographical convention is intended to provide a sense of the maturity of the affected material, without altering its normative content. By recognizing the relative maturity of different sections of the standard, an implementer should be able to make more informed decisions about the adoption and deployment of different portions of the standard in a commercial product.

This specification has been structured to convey both the formal requirements and assumptions of the SMI-S API and its emerging implementation and deployment lifecycle. Over time, the intent is that all content in the specification will represent a mature and stable design, be verified by extensive implementation experience, assure consistent support for backward compatibility, and rely solely on content material that has reached a similar level of maturity. Unless explicitly labeled with one of the subordinate maturity levels defined for this specification, content is assumed to satisfy these requirements and is referred to as "Finalized". Since much of the evolving specification

content in any given release will not have matured to that level, this specification defines three subordinate levels of implementation maturity that identify important aspects of the content's increasing maturity and stability. Each subordinate maturity level is defined by its level of implementation experience, its stability and its reliance on other emerging standards. Each subordinate maturity level is identified by a unique typographical tagging convention that clearly distinguishes content at one maturity model from content at another level.

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Experimental Maturity Level

No material is included in this document unless its initial architecture has been completed and reviewed. Some content included in this document has complete and reviewed design, but lacks implementation experience and the maturity gained through implementation experience. This content is included in order to gain wider review and to gain implementation experience. This material is referred to as "Experimental". It is presented here as an aid to implementers who are interested in likely future developments within the SMI specification. The contents of an Experimental profile may change as implementation experience is gained. There is a high likelihood that the changed content will be included in an upcoming revision of the specification. Experimental material can advance to a higher maturity level as soon as implementations are available. Figure 1 is a sample of the typographical convention for Experimental content.

EXPERIMENTAL

Experimental content appears here.

EXPERIMENTAL

Figure 1 - Experimental Maturity Level Tag

Implemented Maturity Level

Profiles for which initial implementations have been completed are classified as "Implemented". This indicates that at least two different vendors have implemented the profile, including at least one provider implementation. At this maturity level, the underlying architecture and modeling are stable, and changes in future revisions will be limited to the correction of deficiencies identified through additional implementation experience. Should the material become obsolete in the future, it must be deprecated in a minor revision of the specification prior to its removal from subsequent releases. Figure 2 is a sample of the typographical convention for Implemented content.

IMPLEMENTED

Implemented content appears here.

IMPLEMENTED

Figure 2 - Implemented Maturity Level Tag

Stable Maturity Level

Once content at the Implemented maturity level has garnered additional implementation experience, it can be tagged at the Stable maturity level. Material at this maturity level has been implemented by three different vendors, including both a provider and a client. Should material that has reached this maturity level become obsolete, it may only be deprecated as part of a minor revision to the specification. Material at this maturity level that has been deprecated may only be removed from the specification as part of a major revision. A profile that has reached this maturity level is guaranteed to preserve backward compatibility from one minor specification revision to the next. As a result, Profiles at or above the Stable

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maturity level shall not rely on any content that is Experimental. Figure 3 is a sample of the typographical convention for Implemented content.

STABLE

Stable content appears here.

STABLE

Figure 3 - Stable Maturity Level Tag

Finalized Maturity Level

Content that has reached the highest maturity level is referred to as “Finalized.” In addition to satisfying the requirements for the Stable maturity level, content at the Finalized maturity level must solely depend upon or refine material that has also reached the Finalized level. If specification content depends upon material that is not under the control of the SNIA, and therefore not subject to its maturity level definitions, then the external content is evaluated by the SNIA to assure that it has achieved a comparable level of completion, stability, and implementation experience. Should material that has reached this maturity level become obsolete, it may only be deprecated as part of a major revision to the specification. A profile that has reached this maturity level is guaranteed to preserve backward compatibility from one minor specification revision to the next. Over time, it is hoped that all specification content will attain this maturity level. Accordingly, there is no special typographical convention, as there is with the other, subordinate maturity levels. Unless content in the specification is marked with one of the typographical conventions defined for the subordinate maturity levels, it should be assumed to have reached the Finalized maturity level.

Deprecated Material

Non-Experimental material can be deprecated in a subsequent revision of the specification. Sections identified as “Deprecated” contain material that is obsolete and not recommended for use in new development efforts. Existing and new implementations may still use this material, but shall move to the newer approach as soon as possible. The maturity level of the material being deprecated determines how long it will continue to appear in the specification. Implemented content shall be retained at least until the next revision of the specialization, while Stable and Finalized material shall be retained until the next major revision of the specification. Providers shall implement the deprecated elements as long as it appears in the specification in order to achieve backward compatibility. Clients may rely on deprecated elements, but are encouraged to use non-deprecated alternatives when possible.

Deprecated sections are documented with a reference to the last published version to include the deprecated section as normative material and to the section in the current specification with the replacement. Figure 4 contains a sample of the typographical convention for deprecated content.

DEPRECATED

Content that has been deprecated appears here.

DEPRECATED

Figure 4 - Deprecated Tag

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FOREWORD

The Filesystems part of the *Storage Management Technical Specification* contains Profiles and other clauses for management of devices and programs that support filesystems. A filesystem is a specific formatting of storage for storing and accessing files on external storage. This part describes how filesystems are created, modified and deleted, as well as how they can be found and reported. This part also describe modeling for how filesystems are exported for access from remote systems. The filesystem profiles use information from other parts of the Storage Management Technical Specifications. Specifically, they reference profiles in the Common Profiles and the Block Devices parts of the specification. This part describes how these profiles are used in filesystem profiles.

Parts of this Standard

This standard is subdivided in the following parts:

- *Storage Management Technical Specification, Part 1 Overview, 1.8.0 Rev 4*
- *Storage Management Technical Specification, Part 2 Common Architecture, 1.8.0 Rev 4*
- *Storage Management Technical Specification, Part 3 Common Profiles, 1.8.0 Rev 4*
- *Storage Management Technical Specification, Part 4 Block Devices, 1.8.0 Rev 4*
- *Storage Management Technical Specification, Part 5 Filesystems, 1.8.0 Rev 4*
- *Storage Management Technical Specification, Part 6 Fabric, 1.8.0 Rev 4*
- *Storage Management Technical Specification, Part 7 Host Elements, 1.8.0 Rev 4*
- *Storage Management Technical Specification, Part 8 Media Libraries, 1.8.0 Rev 4*

SNIA Web Site

Current SNIA practice is to make updates and other information available through their web site at http://www.snia.org

SNIA Address

Requests for interpretation, suggestions for improvement and addenda, or defect reports are welcome. They should be sent via the SNIA Feedback Portal at http://www.snia.org/feedback/ or by mail to the Storage Networking Industry Association, 4360 ArrowsWest Drive, Colorado Springs, Colorado 80907, U.S.A.

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1 Scope

The Filesystems part of the *Storage Management Technical Specification* defines management profiles for Autonomous (top level) profiles for programs and devices whose central function is providing support and access to file data. In addition, it provides documentation of component profiles that deal with filesystems and management interface functions that may be used by other autonomous profiles not included in this part of the specification.

There is an informative annex that describes how storage is mapped from block storage to file shares exported by the filesystem and the mechanisms involved in that establishing those mappings. This annex is recommended for getting an overview of how the filesystem models work.

This version of the Filesystems part of the Storage Management Technical Specification includes two autonomous profiles:

- The NAS Head Profile

  This profile defines the model and functions of a NAS device that exports file shares to remote users and gets its storage from a SAN (array devices attached to the NAS Head device).

- The Self-Contained NAS Profile

  This profile defines the model and functions of a NAS device that exports file shares to remote users, but gets its storage from disk drives that are internal to the NAS device (instead of externally attached arrays).

In addition to these autonomous profiles, this part of the specification defines a number of component profiles, which are used by the autonomous NAS profiles and might also be used by other autonomous profiles that feature filesystem elements and services. The component profiles defined in this version of the specification include:

- The File Export (component) Profile

  This component profile defines the elements used to model the exporting of filesystems or directories for any autonomous profile that exports file data to remote systems.

- The File Export Manipulation (component) Profile

  This component profile defines the elements used to model the services for creating, modifying and deleting the file shares (the representation of exported filesystems or directories) for any autonomous profile that provides manipulation of exported filesystems or directories.

- The File Storage (component) Profile

  This component profile defines the elements used to model the storage of filesystems on logical disks. This profile does not have services for maintaining the mapping of filesystems to logical disks. These services are addressed in the Filesystem Manipulation Profile.

- The Filesystem (component) Profile

  This component profile defines the elements used to model filesystems and its related elements, such as logical files, directories and information on how the filesystem is addressed when mounted to a specific system. The services for defining and maintaining the information in the Filesystem Profile are contained in the Filesystem Manipulation Profile.

- The Filesystem Manipulation (component) Profile

  This component profile defines the elements used to model the services for creating, modifying and deleting filesystems and their related elements.

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- The Filesystem Quotas (component) Profile

  This component profile defines the elements used to model the elements associated with creating, maintaining and reporting on quotas on various filesystem elements.

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2 Normative References

2.1 General

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.2 References under development

Storage Management Technical Specification, Part 2 Common Architecture, 1.8.0 Rev 4

Storage Management Technical Specification, Part 3 Common Profiles, 1.8.0 Rev 4

Storage Management Technical Specification, Part 4 Block Devices, 1.8.0 Rev 4

2.3 Other references

DMTF DSP1034 Simple Identity Management Profile 1.1.0
http://dmtf.org/sites/default/files/standards/documents/DSP1034_1.1.0.pdf

DMTF DSP1054 Indications Profile 1.2.2
http://www.dmtf.org/sites/default/files/standards/documents/DSP1054_1.2.2.pdf

MS-SMB2: Server Message Block (SMB) Protocol Versions 2 and 3
https://msdn.microsoft.com/en-us/library/cc246482.aspx

IETF ISSN: 2070-1721, Network File System (NFS) Version 4 Minor Version 1 Protocol,
https://tools.ietf.org/html/rfc5661

ISO/IEC 14776-452, SCSI Primary Commands - 3 (SPC-3) [ANSI INCITS.351-2005]

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3 Terms, Definitions, Symbols, Abbreviations, and Conventions

3.1 General

For the purposes of this document, the terms, definitions, symbols, abbreviations, and conventions given in *Storage Management Technical Specification, Part 2 Common Architecture, 1.8.0 Rev 4* and the following apply.

3.2 Terms and Definitions

3.2.1
CIFS
Common Internet File System

3.2.2
Directory
A subtree within a filesystem

A directory may contain files or other directories.

3.2.3
File
A logical file in a filesystem

3.2.4
file server
a system configuration that supports the exporting of files and files systems

Note 1 to entry: A file server may be a virtual system element.

3.2.5
file share
sharing protocols applied to a directory. A directory is exported to remote users through a file share

3.2.6
filesystem
a filesystem in which files are named and placed logically for storage and retrieval

3.2.7
FS quota
a quota (hard or soft limit) placed on filesystem resource usage

3.2.8
logical disk
block storage on which filesystems are built

Note 1 to entry: A logical disk would be formatted for a particular filesystem.

3.2.9
NAS
Network Attached Storage

In the context of this specification this refers to devices that serve files to a network

3.2.10
NAS head
a NAS device that gets its physical storage from one or more arrays that are externally attached to the NAS device

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3.2.11
NFS
Network File System

3.2.12
Self-Contained NAS
a NAS device that has its own internal (to the NAS device) storage

3.2.13
quota
a hard or soft limit defined for users, user groups or resource collections on the amount of resources that may be consumed

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4 File Export Profile

4.1 Description

4.1.1 Synopsis

Profile Name: File Export (Component Profile)

Version: 1.7.0

Organization: SNIA

Central Class: FileShare

Scoping Class: ComputerSystem

Related Profiles: Table 337 describes the related profiles for File Export.

Table 337 - Related Profiles for File Export

Profile Name	Organization	Version	Requirement	Description
Indications	DMTF	1.2.2	Mandatory	See DSP1054, version 1.2.2

4.1.2 Overview

The File Export Profile is a component profile for autonomous profiles that support exporting of filesystems. Specifically, in this release of SMI-S, this includes the NAS Head and Self-Contained NAS Profiles. In some of these autonomous profiles the File Export is required. In others it may not be. See the parent profile to see if this profile is required or not.

4.1.3 Implementation

4.1.3.1 Instance Diagram

Figure 7: "File Export Instance" illustrates the classes mandatory for modeling the export of File Shares for the filesystem profiles. This profile is supported by the Self-contained NAS and the NAS Head Profiles. Figure 7 shows the ComputerSystem that hosts the LocalFileSystem (“filesystem host”) as different from the ComputerSystem hosting the FileShare (“File server”). While they may be different ComputerSystems, they may also be the same ComputerSystem instance.

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Instance Diagram

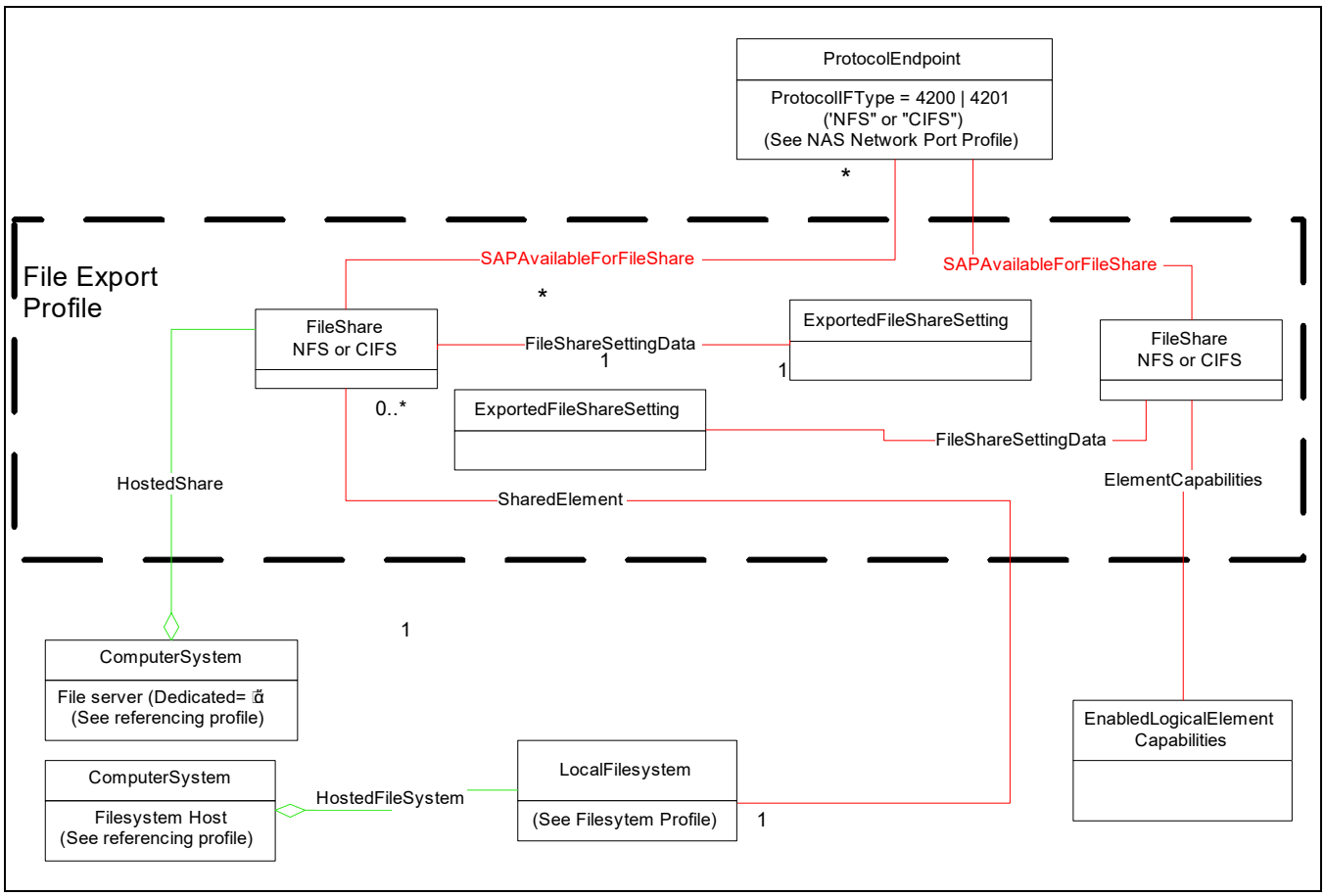

Figure 7 - File Export Instance

The referencing profile shall model any File Shares that have been exported to the network. A File Share shall be represented as a FileShare instance with associations to the ComputerSystem that hosts the share (via HostedShare), to the ExportedFileShareSetting (via FileShareSettingData) and to the ProtocolEndpoint (via SAPAvailableForFileShare) through which the Share can be accessed.

NOTE In Figure 7 the FileShare shown is intended to represent a subclass of CIM_FileShare (e.g., CIFSShare or NFSShare). It is not intended to imply that either should be represented by CIM_FileShare (which does not indicate the type of file share).

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The FileShare also has a SharedElement association to the LocalFileSystem on which the share is based.

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The FileShare may also have an ElementCapabilities association to an EnabledLogicalUnitCapabilities to identify naming and requested state change capabilities.

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4.1.3.2 Associations to FileShare

The SAPAvailableForFileShare is a many to many association. That is, multiple FileShares may be exported through the same ProtocolEndpoint and multiple ProtocolEndpoints may support the same FileShare (CIFSShare or NFSShare).

The SharedElement association between the FileShare (CIFSShare or NFSShare) and a LocalFileSystem is many to one association. Zero or more FileShares may be associated to one LocalFileSystem. But each FileShare (CIFSShare or NFSShare) shall only reference one LocalFileSystem.

The FileShareSettingData association between the FileShare (CIFSShare or NFSShare) and the ExportedFileShareSetting is a one to one association. That is, a FileShare (CIFSShare or NFSShare) shall have an ExportedFileShareSetting and that ExportedFileShareSetting shall be associated to exactly one FileShare (CIFSShare or NFSShare).

4.1.3.3 Element Naming

The name of a FileShare may be changed. The existence of the EnabledLogicalElementCapabilities instance associated to the FileShare indicates that the FileShare can be named. If ElementNameEditSupported is set to TRUE, then the ElementName of the associated FileShare may be modified. The ElementNameMask property provides the regular expression that expresses the limits of the name; see 4.7.x for the class definition for EnabledLogicalElementCapabilities for details for this property.

4.2 Health and Fault Management Consideration

4.2.1 State Information

The File Export Profile supports state information (e.g., OperationalStatus) on the following element of the model:

- FileShares that are exported (See section 4.2.2)

4.2.2 OperationalStatus for FileShares

Table 2 shows FileShare operationalStatus.

Table 2 - FileShare OperationalStatus

OperationalStatus	Description
OK	FileShare is online
Error	FileShare has a failure. This could be due to a filesystem failure.
Stopped	FileShare is disabled
Unknown	

4.3 Cascading Considerations

Not defined in this standard

4.4 Methods of the Profile

4.4.1 Extrinsic Methods of the Profile

Not defined in this standard

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4.4.2 Intrinsic Methods of the Profile

The profile supports read methods and association traversal. Specifically, the list of intrinsic operations supported are as follows:

- GetInstance
- Associators
- AssociatorNames
- References
- ReferenceNames
- EnumerateInstances
- EnumerateInstanceNames

4.5 Use Cases

To list existing FileShares on the system, a client shall be able to find FileShares attached to a system (e.g., a file server) by doing an association traversal from the ComputerSystem that represents the system using the HostedShare association.

4.6 CIM Elements

4.6.1 Overview

Table 3 describes the CIM elements for File Export.

Table 3 - CIM Elements for File Export

Element Name	Requirement	Description
4.6.2 CIM_CIFSShare (Exported File Share)	Optional	Represents the CIFS sharing characteristics of a particular file element.
4.6.3 CIM_ElementCapabilities (EnabledLogicalElementCapabilities to FileShare)	Conditional	Conditional Requirement: EnabledLogicalElementCapabilities. Expressed the ability for the file share to be named or have its state changed.
4.6.4 CIM_EnabledLogicalElementCapabilities (FileShare)	Optional	This class is used to express the naming and possible requested state change possibilities for file shares.
4.6.5 CIM_ExportedFileShareSetting (Setting)	Mandatory	The configuration settings for an Exported FileShare that is a setting for a FileShare (CIFSShare or NFSShare) available for exporting.
4.6.6 CIM_FileShare (Exported File Share)	Mandatory	Represents the sharing characteristics of a particular file element.
4.6.7 CIM_FileShareSettingData (FileShare)	Mandatory	Experimental. Associates a FileShare (CIFSShare or NFSShare) and ExportedFileShareSetting elements.
4.6.8 CIM_HostedShare	Mandatory	Represents that a shared element is hosted by a File Server Computer System.
4.6.9 CIM_NFSShare (Exported File Share)	Optional	Represents the NFS sharing characteristics of a particular file element.
4.6.10 CIM_SAPAvailableForFileShare	Mandatory	Represents the association between a ProtocolEndpoint to the file share that is being accessed through that SAP.

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Table 3 - CIM Elements for File Export

Element Name	Requirement	Description
4.6.11 CIM_SharedElement	Mandatory	Associates a FileShare (CIFSShare or NFSShare) to the LocalFileSystem on which it is based.
SELECT * FROM CIM_InstModification WHERE SourceInstance ISA CIM_FileShare AND SourceInstance.CIM_FileShare::OperationalStatus <> PreviousInstance.CIM_FileShare::OperationalStatus	Optional	CQL -Change of Status of a FileShare. PreviousInstance is optional, but may be supplied by an implementation of the Profile.
SELECT * FROM CIM_InstCreation WHERE SourceInstance ISA CIM_FileShare	Mandatory	CQL -Creation of a FileShare element.
SELECT * FROM CIM_InstDeletion WHERE SourceInstance ISA CIM_FileShare	Mandatory	CQL -Deletion of a FileShare element.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity = 'SNIA' AND MessageID='FSM16'	Conditional	FileShare is degraded (if hardware implementation can support).
SELECT * FROM CIM_AlertIndication WHERE OwningEntity = 'SNIA' AND MessageID='FSM17'	Mandatory	FileShare issues have been cleared (if FSM16 is supported).

4.6.2 CIM_CIFSShare (Exported File Share)

The CIM_CIFSShare is a subclass of CIM_FileShare. It is optional, since an implementation may instantiate either (or both) of CIM_CIFSShare or CIM_NFSShare.

Created By: External
Modified By: External
Deleted By: External
Requirement: Optional

Table 4 describes class CIM_CIFSShare (Exported File Share).

Table 4 - SMI Referenced Properties/Methods for CIM_CIFSShare (Exported File Share)

Properties	Flags	Requirement	Description & Notes
InstanceID		Mandatory	See the InstanceID definition in section 4.6.6 CIM_FileShare (Exported File Share).
ElementName		Mandatory	See the ElementName definition in section 4.6.6 CIM_FileShare (Exported File Share).
Name		Mandatory	See the Name definition in section 4.6.6 CIM_FileShare (Exported File Share).
SharingDirectory		Mandatory	See the SharingDirectory definition in section 4.6.6 CIM_FileShare (Exported File Share).
OperationalStatus		Mandatory	See the OperationalStatus definition in section 4.6.6 CIM_FileShare (Exported File Share).
Description	N	Optional	See the Description definition in section 4.6.6 CIM_FileShare (Exported File Share).

4.6.3 CIM_ElementCapabilities (EnabledLogicalElementCapabilities to FileShare)

Experimental.

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Created By: Static
Modified By: Static
Deleted By: Static
Requirement: Optional

Table 5 describes class CIM_ElementCapabilities (EnabledLogicalElementCapabilities to FileShare).

Table 5 - SMI Referenced Properties/Methods for CIM_ElementCapabilities (EnabledLogicalElementCapabilities to FileShare)

Properties	Flags	Requirement	Description & Notes
Capabilities		Mandatory	The capabilities object associated with the file share.
ManagedElement		Mandatory	The FileShare.

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4.6.4 CIM_EnabledLogicalElementCapabilities (FileShare)

Created By: Static
Modified By: Static
Deleted By: Static
Requirement: Optional

Table 6 describes class CIM_EnabledLogicalElementCapabilities (FileShare).

Table 6 - SMI Referenced Properties/Methods for CIM_EnabledLogicalElementCapabilities (FileShare)

Properties	Flags	Requirement	Description & Notes
InstanceID		Mandatory	
ElementName		Mandatory	The moniker for the instance.
ElementNameEditSupported		Mandatory	Denotes whether a file share can be named.
MaxElementNameLen		Mandatory	Specifies the maximum length in glyphs (letters) for the name. See MOF for details.
ElementNameMask		Mandatory	The regular expression that specifies the possible content and format for the element name. See MOF for details.
RequestedStatesSupported		Optional	Expresses the states to which this file share may be changed using the RequestStateChange method. If this property, it may be assumed that the state may not be changed.

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4.6.5 CIM_ExportedFileShareSetting (Setting)

Created By: External
Modified By: External
Deleted By: External

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Requirement: Mandatory

Table 7 describes class CIM_ExportedFileShareSetting (Setting).

Table 7 - SMI Referenced Properties/Methods for CIM_ExportedFileShareSetting (Setting)

Properties	Flags	Requirement	Description & Notes
InstanceID		Mandatory	A unique ID for the setting.
ElementName		Mandatory	A user-friendly name for the Setting.
FileSharingProtocol		Mandatory	The file sharing protocol supported by this share. NFS (2) and CIFS (3) are the supported values.
ProtocolVersions		Mandatory	An array of the versions of the supported file sharing protocol. A share may support multiple versions of the same protocol.
InitialEnabledState	N	Optional	Valid values are '1|2|3|7|8|9' for ('Other' | 'Enabled' | 'Disabled' | 'In Test' | 'Deferred' | 'Quiesce').
OtherEnabledState	N	Optional	This should be filled in if the InitialEnabledState is '1'.
DefaultUserIdSupported	N	Optional	Valid values are '2|3|4' for ('No Default User Id' | 'System-Specified Default User Id' | 'Share-Specified Default User Id').
RootAccess	N	Optional	Valid values are '2|3' for ('No Root Access' | 'Allow Root Access').
AccessPoints	N	Optional	Valid values are '2|3|4|5' for ('None' | 'Service Default' | 'All' | 'Named Points').

4.6.6 CIM_FileShare (Exported File Share)

SMI-S treats CIM_FileShare as an abstract class. It is mandatory because an implementation shall instantiate either (or both) CIM_CIFSShare or CIM_NFSShare.

Created By: External
Modified By: External
Deleted By: External
Requirement: Mandatory

Table 8 describes class CIM_FileShare (Exported File Share).

Table 8 - SMI Referenced Properties/Methods for CIM_FileShare (Exported File Share)

Properties	Flags	Requirement	Description & Notes
InstanceID		Mandatory	A unique id for the FileShare element.
ElementName		Mandatory	This shall be a user friendly name for the FileShare.
Name		Mandatory	This shall be an opaque string that uniquely identifies the path to the directory or file.
SharingDirectory		Mandatory	Indicates if the shared element is a file or a directory. This is useful when importing but less so when exporting.
OperationalStatus		Mandatory	The OperationalStatus of the FileShare as defined in section 4.2.1.
Description	N	Optional	This a comment describing the file share.

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4.6.7 CIM_FileShareSettingData (FileShare)

Experimental.

Created By: External
Modified By: Static
Deleted By: External
Requirement: Mandatory

Table 9 describes class CIM_FileShareSettingData (FileShare).

Table 9 - SMI Referenced Properties/Methods for CIM_FileShareSettingData (FileShare)

Properties	Flags	Requirement	Description & Notes
ManagedElement		Mandatory	The FileShare (CIFSShare or NFSShare).
SettingData		Mandatory	The settings define on creation of the FileShare.

4.6.8 CIM_HostedShare

Created By: External
Modified By: External
Deleted By: External
Requirement: Mandatory

Table 10 describes class CIM_HostedShare.

Table 10 - SMI Referenced Properties/Methods for CIM_HostedShare

Properties	Flags	Requirement	Description & Notes
Dependent		Mandatory	The Share that is hosted by a Computer System.
Antecedent		Mandatory	The Computer System that hosts the FileShare. This can be the top level or non-top level system, or a virtual file server. But it shall be a File Server (Dedicated='16').

4.6.9 CIM_NFSShare (Exported File Share)

The CIM_NFSShare is a subclass of CIM_FileShare. It is optional, since an implementation may instantiate either (or both) of CIM_CIFSShare or CIM_NFSShare.

Created By: External
Modified By: External
Deleted By: External
Requirement: Optional

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Table 11 describes class CIM_NFSShare (Exported File Share).

Table 11 - SMI Referenced Properties/Methods for CIM_NFSShare (Exported File Share)

Properties	Flags	Requirement	Description & Notes
InstanceID		Mandatory	See the InstanceID definition in section 4.6.6 CIM_FileShare (Exported File Share).
ElementName		Mandatory	See the ElementName definition in section 4.6.6 CIM_FileShare (Exported File Share).
Name		Mandatory	See the Name definition in section 4.6.6 CIM_FileShare (Exported File Share).
SharingDirectory		Mandatory	See the SharingDirectory definition in section 4.6.6 CIM_FileShare (Exported File Share).
OperationalStatus		Mandatory	See the OperationalStatus definition in section 4.6.6 CIM_FileShare (Exported File Share).
Description	N	Optional	See the Description definition in section 4.6.6 CIM_FileShare (Exported File Share).

4.6.10 CIM_SAPAvailableForFileShare

Created By: External
Modified By: Static
Deleted By: External
Requirement: Mandatory

Table 12 describes class CIM_SAPAvailableForFileShare.

Table 12 - SMI Referenced Properties/Methods for CIM_SAPAvailableForFileShare

Properties	Flags	Requirement	Description & Notes
FileShare		Mandatory	The file share that is made available through a SAP. In the File Export profile, these are FileShares configured for either export.
AvailableSAP		Mandatory	The Service Access Point that is available to this FileShare. This shall have a value of '4200' (NFS) or '4201' (CIFS).

4.6.11 CIM_SharedElement

Created By: External
Modified By: Static
Deleted By: External
Requirement: Mandatory

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Table 13 describes class CIM_SharedElement.

Table 13 - SMI Referenced Properties/Methods for CIM_SharedElement

Properties	Flags	Requirement	Description & Notes
SystemElement		Mandatory	The LocalFileSystem that is exporting some contained file or directory as a FileShare.
SameElement		Mandatory	The FileShare (CIFSShare or NFSShare) that exposes a contained file or directory of the LocalFileSystem as an exported object.

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5 File Export Manipulation Profile

5.1 Description

5.1.1 Synopsis

Profile Name: File Export Manipulation (Component Profile)

Version: 1.7.0

Organization: SNIA

Central Class: FileExportService

Scoping Class: File server ComputerSystem element (with Dedicated property containing ”16”)

Related Profiles: Table 14 describes the related profiles for File Export Manipulation.

Table 14 - Related Profiles for File Export Manipulation

Profile Name	Organization	Version	Requirement	Description
Job Control	SNIA	1.5.0	Optional	
File Export	SNIA	1.7.0	Mandatory	
Simple Identity Management	DMTF	1.1.0	Mandatory	See DSP1034, version 1.1.0.
Indications	DMTF	1.2.2	Mandatory	See DSP1054, version 1.2.2

5.1.2 Overview

The File Export Manipulation Profile is a component profile of autonomous profiles that support filesystems. It makes use of elements of the Filesystem profiles and supports creation, modification and deletion of FileShares that are exported by the File Export Profile. A number of other profiles also make use of elements of the filesystem profile and will be referred to in this specification as “filesystem related profiles” -- these include but are not limited to the Filesystem Profile, the Filesystem Manipulation Profile, the File Export Profile, the NAS Head Profile, the Self-Contained NAS Profile, and so on.

In this release of SMI-S, the autonomous profiles that use the File Export Manipulation Profile are the NAS Head and Self-Contained NAS Profiles.

Annex B, "(Informative) State Transitions from Storage to File Shares" describes the states that a storage element, initially an unused LogicalDisk, goes through before it can be exported as a CIFS or NFS file share. The Filesystem Manipulation Profile provides the methods to create the filesystem as a LocalFileSystem and make it locally accessible at a file server ComputerSystem (associated to the file server ComputerSystem via the LocalAccessAvailableToFS association). This profile (the File Export Manipulation Profile) provides the methods to "Export a file share" from the file server that allows the file server to share its contents with remote operational users. Sharing the contents of a LocalFileSystem can be from the root directory or some contained internal directory, or some contained internal file. When a directory (root or otherwise) is shared, all files and sub-directories of that directory are also automatically shared (recursively). The semantics of sharing are ultimately controlled by the Authorization profiles and by the filesystem implementation, so sharing cannot violate the access rules specified internally to the filesystem. In addition to specifying the object (file or directory) to be shared, the filesystem implementation shall specify the protocol to use (CIFS, NFS, or other protocol) for sharing.

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SMI-S uses a FileShare (CIFSShare or NFSShare) element to represent the externally accessible file share. A SharedElement association will exist between the FileShare (CIFSShare or NFSShare) and the LocalFileSystem. The FileShare.Name property indicates the shared object (it is the filesystem-specific path to the contained file or directory that is being shared). The format of Name is specific to the filesystem type indicated by the associated FileSystemSetting.ActualFileSystemType property; the LocalFileSystem.PathnameSeparatorString property indicates the "separator string" that may be used to split the PathName into the components of a hierarchical path name from the root of the associated filesystem (indicated by the LocalFileSystem).

5.1.3 Instance Diagrams

5.1.3.1 File Export Creation classes and associations

Figure 8 illustrates the constructs involved with creating a FileShare (CIFSShare or NFSShare) for a File

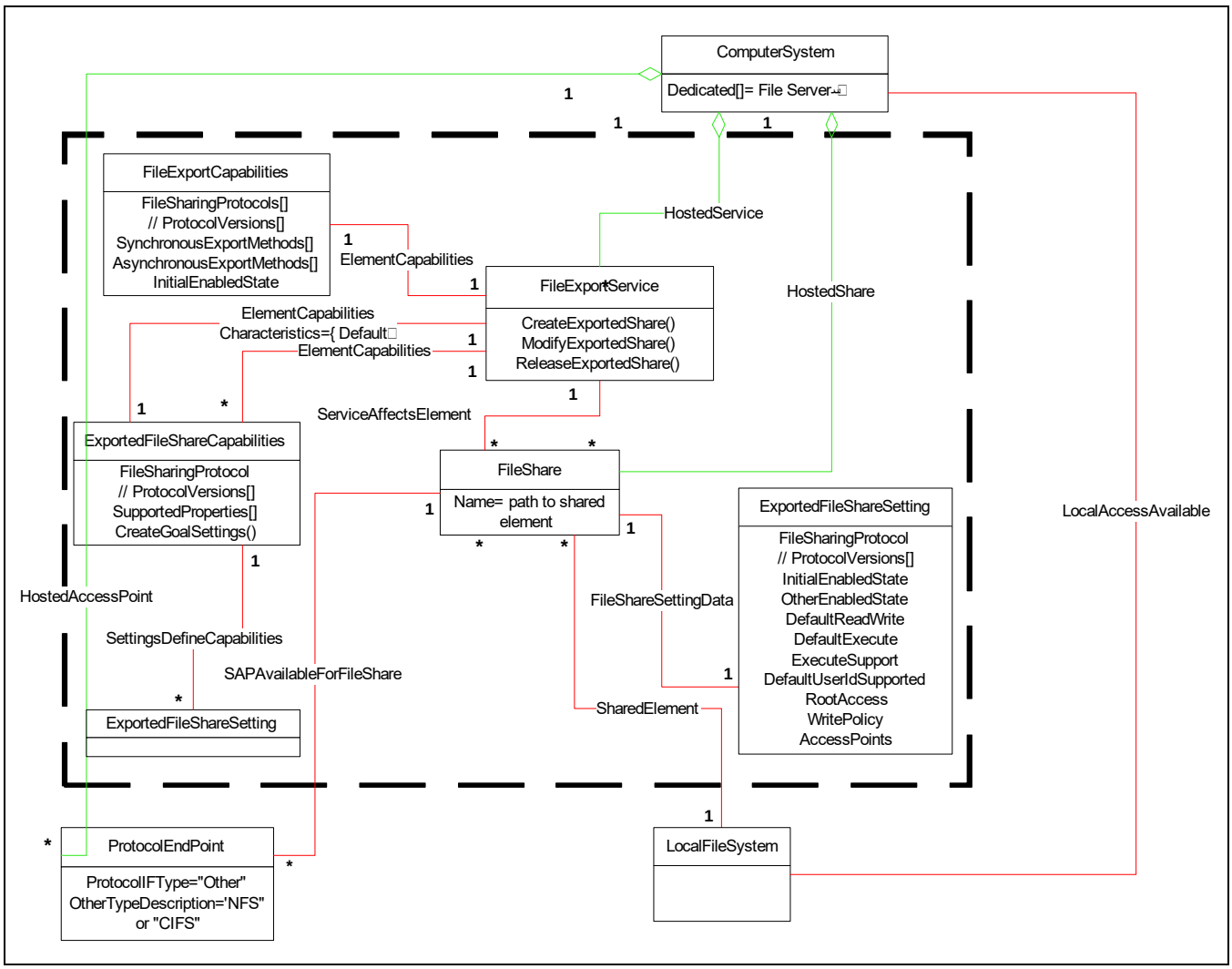

Figure 8 - File Export Manipulation Profile Instance

Export Profile. This summarizes the mandatory classes and associations for this profile. Specific areas are discussed in later sections.

The FileExportService provides configuration support for exporting elements ('files' and 'directories') of a LocalFileSystem as FileShare (CIFSShare or NFSShare) elements. A FileExportService is hosted by the

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file server ComputerSystem that exports the directories/files (these would be the file server ComputerSystems in the Filesystem profile that were given local access to the filesystem). FileShares are accessed through ServiceAccessPoint(s) hosted by the file server ComputerSystem. FileShares are associated with the FileExportService via ServiceAffectsElement and with the ServiceAccessPoint(s) via SAPAvailableToElement.

If a filesystem-related profile supports the File Export Manipulation Profile, it shall have at least one FileExportService element. This FileExportService shall be hosted on the top level ComputerSystem of the File Export Profile (which shall be a file server ComputerSystem element in the filesystem related profiles). The methods offered are CreateFileShare, ModifyFileShare, and ReleaseFileShare.

Associated to the FileExportService (via ElementCapabilities) shall be one FileExportCapabilities element that describes the capabilities of the service. It identifies the methods supported, whether the methods support Job Control or not, the protocols that the created file share can support, and whether or not the file share shall be made available after creation.

For each file sharing protocol that is supported, there shall be one ExportedFileShareCapabilities element that defines the range of capabilities supported for that particular file sharing protocol. The ExportedFileShareCapabilities elements shall be associated via ElementCapabilities to the FileExportService. One of the ExportedFileShareCapabilities may be identified as a default (by setting the property ElementCapabilities.IsDefault). The default ExportedFileShareCapabilities element also indicates the default file sharing protocol to be supported. These defaults apply if any of the extrinsic methods of the FileExportService are invoked with a NULL value for the Capabilities parameter.

Each ExportedFileShareCapabilities element is defined by a set of ExportedFileShareSettings that are associated to it by the SettingsDefineCapabilities association. These ExportedFileShareSettings may be structured to indicate a range of supported and unsupported property values and shall have the same value for the FileSharingProtocol property as the ExportedFileShareCapabilities element.

For the convenience of clients the File Export Manipulation Profile shall populate a set of “pre-defined” ExportedFileShareSettings for each of the ExportedFileShareCapabilities. These shall be associated to the ExportedFileShareCapabilities via the SettingsDefineCapabilities association -- the association shall have its SettingsDefineCapabilities.PropertyPolicy property set to "Correlated" and theSettingsDefineCapabilities.ValueRole property set to "Supported".

NOTE That they are pre-defined and therefore exist at all times does not imply that these ExportedFileShareSettings must be made persistent by the implementation.

The ExportedFileShareCapabilities instance supports the CreateGoalSettings method, described in detail in , "Table 16 shows methods and instances for FileExportManipulation.". This method supports establishing one client-defined ExportedFileShareSettings (as a goal).

CreateGoalSettings takes an array of embedded SettingData elements as the input TemplateGoalSettings and SupportedGoalSettings parameters and may generates an array of embedded SettingData elements as the output SupportedGoalSettings parameter. However, this profile only uses a single embedded ExportedFileShareSettings element in the input parameters (both TemplateGoalSettings and SupportedGoalSettings) and generate a single valid embedded ExportedFileShareSettings element as output (SupportedGoalSettings). If a client supplies a NULL ExportedFileShareSettings (i.e., the empty string) as input to this method, the returned ExportedFileShareSettings structure shall be a default setting for the parent ExportedFileShareCapabilities. If the input (the embedded ExportedFileShareSettings) is not NULL, the method may return a “best fit” to the requested setting. The client may iterate on the CreateGoalSettings method until it acquires a setting that suits its needs. This embedded settings structure may then be used when the CreateFileShare or ModifyFileShare methods are invoked. The details of how iterative negotiation can work are discussed in 5.4.1.2, "ExportedFileShareCapabilities.CreateGoalSettings". Note that the file sharing protocol indicated by the FileSharingProtocol property is invariant in all of these interactions. It is an error if the client changes the FileSharingProtocol property for a Setting and submits it as a goal to the Capabilities element that provided the original Setting.

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Note that it is not possible to guarantee that negotiation will terminate with an agreed upon setting and therefore a fall-back mechanism is needed. This profile does not require negotiation – an implementation may support only a set of pre-defined correlated point settings that a client can preload and use without modification. The implementation could also support the only settings whose properties are selectable from an arithmetic progression or from a fixed enumeration, so that the client may construct a goal setting that is guaranteed to be supported without negotiation.

NOTE That a client has obtained a goal setting supported by the implementation does not guarantee that a create or modify request will succeed. Such a setting only specifies a supported static configuration not that the current dynamic environment has the resources to implement a specific request.

Armed with the goal (the embedded ExportedFileShareSettings element), a reference to a LocalFileSystem, and a path to a file or directory contained within that LocalFileSystem, the client can now use the CreateFileShare method to create the file share for export. The CreateFileShare method creates a FileShare element, and a new ExportedFileShareSettings instance as well as several necessary associations. These associations are:

- HostedFileShare association between the FileShare and the file server ComputerSystem that hosts it.
- SharedElement association between the FileShare and the LocalFileSystem. In addition, the FileShare element specifies the pathname for the shared element (file or directory) relative to the root of the LocalFileSystem (using the Name property).

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- FileShareSettingData to associate the FileShare to the ExportedFileShareSetting defined for it

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- In addition, optional parameters to the method can cause other classes to be created:
  - DefaultUserId could create a Privilege (see 5 File Export Manipulation Profile of *Storage Management Technical Specification, Part 3 Common Profiles, 1.8.0 Rev 4*) associated to the FileShare as AuthorizationTarget and to a UserIdentity as AuthorizationSource
  - RootAccessHosts array parameter could create root access Privileges from a number of remote Host ComputerSystems to the FileShare (also using the Simple Identity Management Profile)
  - AccessPointPorts array parameter could create SAPAvailableForFileShare associations to a number of ProtocolEndPoints representing TCP/IP ports through which access is provided to this FileShare.

To determine if the implementation supports supplying the ElementName during the creation of a FileShare and to determine the supported methods to modify the ElementName of the existing FileShare, invoke the method ExportedFileShareCapabilities.GetElementNameCapabilities.

The ReleaseFileShare method is straightforward -- it deletes the FileShare and the ExportedFileShareSetting, and the associations to those elements (HostedFileShare, the FileShareSettingData element, SharedElement, all the SAPAvailableForFileShare associations and all Privileges that reference this FileShare as an AuthorizationTarget). Any ComputerSystem elements created to represent remote hosts with root access to this FileShare that have no further references may also be removed. A ProtocolEndPoint created as a result of being specified in the AccessPointPorts parameter may not be deleted. If the element has no associations other than the scoping one (HostedAccessPoint to ComputerSystem for ProtocolEndPoint) the provider may stop surfacing it at any time.

The ModifyFileShare method modifies an existing FileShare -- this requires a new ExportedFileShareSetting element to be used as a goal. But not any ExportedFileShareSetting will do;

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