



Swordfish Scalable Storage Management API Users Guide

Version: 1.2.4

Abstract: The Swordfish Scalable Storage Management API defines a RESTful interface and a standardized data model to provide a scalable, customer-centric interface for managing storage and related data services.

Working Draft

Publication of this Working Draft for review and comment has been approved by the Scalable Storage Management Technical Work Group. This draft represents a 'best effort' attempt by the Scalable Storage Management Technical Work Group to reach preliminary consensus, and it may be updated, replaced, or made obsolete at any time. This document should not be used as reference material or cited as other than a 'work in progress.' Suggestions for revision should be directed to <http://www.snia.org/feedback>.

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USAGE

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This document is intended for use by individuals and companies engaged in storage management.

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This document is versioned material. Versioned material shall have a three-level revision identifier, comprised of a version number 'v', a release number 'r' and an errata number 'e'. Future publications of this document are subject to specific constraints on the scope of change that is permissible from one revision to the next and the degree of interoperability and backward compatibility that should be assumed between products designed to this standard. This versioning policy applies to all SNIA Swordfish versioned materials.

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Revision History

The evolution of this document is summarized in Table 1.

Table 1: Revision history

Date	Rev	Notes
19 September 2016	1.0.0	Initial Release
12 October 2016	1.0.1	General clean up and formatting consistency A discussion of unused CoS and LoS entries in ServiceCatalog Improve purpose for many use cases
1 November 2016	1.0.2	Corrected XREF link formatting
24 January 2017	1.0.3	Additional use cases and new document section addressing client considerations
25 April 2017	1.0.4	Update cross-references
3 October 2017	1.0.5	Minor updates and corrections
13 February 2018	1.0.6	Added on-demand replication use cases
12 October 2018	1.0.7	Editorial cleanup of JSON
22 August 2019	1.1.0	Restructured to add features and feature cross references, and many new use cases added: Create Volume for multiple scenarios (including Redfish Storage)

Date	Rev	Notes
		Create Storage Pool for multiple scenarios
		Replication use cases using single Volume
		Replication use cases using Consistency Groups
12 November 2019	1.1.0	Released as Technical Position
12 November 2019	1.1.0a	Released as Corrected Technical Position
		Formatting fixes – word wrap in pdf doc format to fix truncated lines
		Added cross referencing of Features to use cases
		Editorial changes and cleanup
18 August 2020	1.2.1	Added NVMe-specific use cases
31 October 2020	1.2.1c	Released as SNIA Approved Publication
2 March 2021	1.2.2	Added cross-references to NVMe mapping document Added new use cases for StoragePool actions. Errata fixes.
14 June 2021	1.2.2a	Released as SNIA Approved Publication
30 August 2021	1.2.3	Update references in examples Add use cases for ChangeRAIDType, ChangeSpanCount.
5 December 2021	1.2.3	Release as SNIA Approved Publication

Date	Rev	Notes
12 April 2022	1.2.4	Release as Working Draft. Add multiple new use cases for access management and volume creation through capabilities. Enhance language and examples responses throughout. Add use of content-type headers.

About SNIA

The Storage Networking Industry Association (SNIA) is a non-profit organization made up of member companies spanning information technology. A globally recognized and trusted authority, SNIA's mission is to lead the storage industry in developing and promoting vendor-neutral architectures, standards and educational services that facilitate the efficient management, movement and security of information.

Acknowledgements

The SNIA Scalable Storage Management Technical Work Group, which developed and reviewed this work in progress, would like to recognize the significant contributions made by the following members listed in Table 2.

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1 Introduction

1.1 Audience

This guide is intended to provide a common repository of best practices, common tasks and education for the users of the Swordfish API. Each use case includes an indication of the classes of API users who are most likely to find the case useful.

1.2 Documentation structure

This document begins with a set of information intended to provide a solid foundation for readers new to restful APIs in general and Swordfish in particular. While this material is no replacement for a thorough understanding of the Swordfish specification and the material that it references, it is intended as a stand alone document that can provide a solid introduction to Swordfish.

Based on that foundational material, this document then presents a set of Use Cases intended to capture common tasks and best practices that can be used to exercise the breadth and strength of the Swordfish API. In general, the guide is structured to provide more basic use cases first, and examine common refinements and options at the same time. More advanced tasks are handled later in the guide, and assume the prior skills and assumptions have been mastered.

For each use case, this guide will use a common template. Table 3 lists each field of the template and its description.

Table 3: Guidelines for the Use Case Template

Name	Description
Title	A description of the high-level scope of the Use Case
Summary	A high-level summary of the use case
Purpose	The intended goals or motivations for the use case
Who	The Actor(s) who are likely to use this use case. The actor description also includes a list of other use cases of interest for a named actor
Management Domain	The Management Domain(s) applicable to this use case. The domain description also includes a list of other use cases of interest for the named management domains
Triggers	A description of likely business conditions or goals that would make this use case useful
Detailed Context	A detailed description of the operations environment and configuration assumptions for this use case
Preconditions	Pre-existing knowledge, configurations or capabilities
Inputs	A set of parameters and values that are used to adapt a generic use case to a specific business needs. Where appropriate, the parameter description will include a data type (e.g., {CAPACITY}: desired storage capacity (int64))
Basic Course of Events	A sequence of API requests, including required headers, the body of the request, and the expected reply
Configuration Impacts	Changes to the storage configurations caused by the use case
Failure Scenario	Common failure conditions encountered in this use case
See Also	Other Use Cases that may be of interest

1.3 Implementation scope assumptions

The precise scope of a given Swordfish implementation can vary widely. Some installations will opt to deploy a basic level of the API that only extends the Redfish standard slightly. Others will decide to implement a number of features, providing

a broader range of functionality. While this guide cannot provide examples of all possible configurations and situations, it does attempt to cover a range of possible functionality options. Use cases that assume functionality that correspond to specific features are clearly identified.

In the same vein, the example query responses are not intended to perfectly reproduce what would be returned from any given implementation. Rather, they focus on illustrating a particular functionality or approach, and include only the information that is essential to that end.

1.4 Base implementation assumptions

This document assumes that some fundamental configuration issues have been properly implemented, and will not need to be addressed in any detail. In particular, this document assumes:

- An appropriate security infrastructure (e.g., TLS 1.2)
- A functional Swordfish/Redfish installation, in either a standalone, aggregator, or distributed configuration
- Any required login credentials

1.5 Knowledge assumptions

The Swordfish API conforms to the standards defined in the Redfish API. More generally, it provides a RESTful interface. The reader is assumed to be familiar with common conventions for RESTful APIs. Those readers who are interested in additional background information are encouraged to refer to the following sources:

- For RESTful APIs: Wikipedia
- For Redfish standards: Redfish Specification
- For HTTP standards: Wikipedia

1.6 Related documents

This User's Guide is part of the documentation suite for the Swordfish API. Readers are encouraged to refer to the following for additional information: - Swordfish API Specification - Swordfish Tutorials - Swordfish NVMe Mapping Guide - Swordfish Profile Bundle

2 General query syntax

2.1 Query method

Swordfish queries support four query methods. Each query URL must include exactly one of the query methods listed in Table 4.

Table 4: Query methods

Method	Action
GET	Retrieve the current state or settings of the named Resource Path as seen through the Service Root
POST	Create a new object under the named Resource Path
PUT	Replace the object referenced by the named Resource Path
DELETE	Delete the object referenced by the named Resource Path
PATCH	Update the object referenced by the named Resource Path
HEAD	Validates a GET request against the named Resource Path without returning the HTML headers for the response without the result of the query

2.2 Query Headers

All HTTP requests and responses in a compliant Swordfish implementation support the HTTP headers required by the Redfish Protocol Specification. The supported headers are reproduced here for convenience.

2.2.1 Request headers

HTTP request headers that are commonly used in Swordfish queries are summarized in Table 5.

Table 5: Request headers

Header	Supported Values	Notes
Accept	RFC 7231	Indicates to the server what media type(s) this client is prepared to accept. Services shall support requests for resources with an Accept header including application/json or application/json;charset=utf-8. Services shall support requests for metadata with an Accept header including application/xml or application/xml;charset=utf-8.
Content-Type	RFC 7231	Describes the type of representation used in the message body. Content-Type shall be required in requests that include a request body. Services shall accept Content-Type values of application/json or application/json;charset=utf-8.

Header	Supported Values	Notes
OData-Version	4.0	Services shall reject requests which specify an unsupported OData version. If a service encounters a version that it does not support, the service should reject the request with status code 412. If client does not specify an Odata-Version header, the client is outside the boundaries of this specification.
Authorization	RFC 7235, Section 4.2	Required for Basic Authentication
User-Agent	RFC 7231	Required for tracing product tokens and their version. Multiple product tokens may be listed.
Host	RFC 7230	Required to allow support of multiple origin hosts at a single IP address.
Origin	W3C CORS, Section 5.7	Used to allow web applications to consume Redfish Service while preventing CSRF attacks.
If-Match	RFC 7232	If-Match shall be supported on PUT and PATCH requests for resources for which the service returns ETags, to ensure clients are updating the resource from a known state.

Header	Supported Values	Notes
X-Auth-Token	Opaque encoded octet strings	Used for authentication of user sessions. The token value shall be indistinguishable from random.

2.2.2 Response headers

HTTP response headers that are commonly used in Swordfish queries are summarized in Table 6.

Table 6: Response headers

Header	Supported Values	Notes
OData-Version	4.0	Describes the OData version of the payload that the response conforms to.
Content-Type	RFC 7231	Describes the type of representation used in the message body. Services shall specify a Content-Type of application/json when returning resources as JSON, and application/xml when returning metadata as XML. ;charset=utf-8 shall be appended to the Content-Type if specified in the chosen media-type in the Accept header for the request.
ETag	RFC 7232	An identifier for a specific version of a resource, often a message digest. Etags shall be included on responses to GETs of ManagerAccount objects.

Header	Supported Values	Notes
Server	RFC 7231	Required to describe a product token and its version. Multiple product tokens may be listed.
Link		Link headers shall be returned as described in the clause on Link Headers
Location	RFC 7231	Indicates a URI that can be used to request a representation of the resource. Shall be returned if a new resource was created. Location and X-Auth-Token shall be included on responses which create user sessions.
Cache-Control	RFC 7234	This header shall be supported and is meant to indicate whether a response can be cached or not.
Access-Control-Allow-Origin	W3C CORS, Section 5.7	Prevents or allows requests based on originating domain. Used to prevent CSRF attacks.
Allow	POST, PUT, PATCH, DELETE, GET, HEAD	Shall be returned with a 405 (Method Not Allowed) response to indicate the valid methods for the specified Request URI. Should be returned with any GET or HEAD operation to indicate the other allowable operations for this resource.
WWW-Authenticate	RFC 7234, Section 4.1	Required for Basic and other optional authentication mechanisms. See the Security clause for details.

Header	Supported Values	Notes
X-Auth-Token	Opaque encoded octet strings	Used for authentication of user sessions. The token value shall be indistinguishable from random.

2.3 Service root

This is the base of all Swordfish URL's. A GET request to the Service Root will return an overview of the services provided by a given Swordfish service. In addition, the Service Root will include versioning information.

All Service Root URLs that are compliant with the Swordfish specification will be of the form `https://hostName/redfish/v1`, where **hostName** specifies the system (and optionally port number), of the Swordfish service provider.

2.4 Resource path

The Resource Path identifies the specific object (or collection of objects) that is the target of the Swordfish query. Swordfish Resource Paths can identify:

- A singleton object (e.g., a specific storage LUN or Volume)
- A collection of objects (e.g., the list of all LUNs provided by a specific storage array)

At the highest level, Swordfish systems are discoverable in the Storage Systems collection in the ServiceRoot.

2.5 Query options

Swordfish queries can include arbitrary sets of query options to further refine the target of given query or the actions being requested of that target. These general query options are summarized in Table 7.

Note: Additional query options may be supported (or constrained) for a specific query target or resource path. These target-specific query options will be addressed in specific use case descriptions, as required.

Table 7: Query Options

Parameter		
Name	Arguments	Notes
<code>\$skip=<i>n</i></code>	Integer	Omit the first <i>n</i> entries in the collection from the returned set of objects (required by redfish)
<code>\$top=<i>n</i></code>	Integer	Return, at most, the first <i>n</i> entries in the returned set of objects (required by redfish)

Parameter		
Name	Arguments	Notes
\$filter=collection	Filter Expression	Returns only the members of the named collection that match the provided logical expression (required by swordfish)
\$expand=property	Expand Expression	Expand additional detail on the target property(s) in the returned result set (required by swordfish)

Parameter		
Name	Arguments	Notes
<code>\$select=property</code>	Comma-separated list of object properties	Return the named properties for each object in the result set, rather than the entire object (required by swordfish)
<code>\$orderby=filter</code>	Filter Expression	sort the result set by the output values from the filter expression (required by swordfish)

2.6 Filter expressions

Simple example:

```
$filter=(age gt 30) A group of people never to trust.
```

For more information see Filter Expression in the OData specification.

2.7 HTTP status codes

Swordfish clients may receive any of the standard HTTP status codes. Both the Redfish specification and the Swordfish specification define a detailed mapping from the generic HTTP codes to domain-specific situations, and probable causes. In addition, the server can return extended status information as a simple JSON object to further clarify the handling and outcome of a particular API request. For more information, see the Swordfish Specification and the Redfish Specification.

3 Actors

3.1 Overview

This document covers a broad range of common use cases and storage management operations.

In an attempt to serve as both a introductory text and as a reference tool, the use cases have been grouped in a number of different ways:

- Alphabetically. Each use case is ordered according to a self-explanatory title, to make it easier for an experienced user to find a specific piece of guidance.
- By management domain. While each organization will allocate responsibilities differently, there are general broad classes of storage management that share tasks. These are called management domains.
- By actor. Similarly, the precise titles and responsibilities within storage management organizations will differ from one organization to the next, but this guide has identified three broad functional roles, and identified the use cases that are most applicable to those roles:
 - Cloud Admin: tasked with managing all aspects of cloud-based infrastructure including storage;
 - Storage Admin: tasked with operational storage tasks, such as storage lifecycle planning and day-to-day storage administration;
 - DevOps: tasked with leveraging storage configurations to automate and scale business operations.

3.2 CloudAdmin

3.2.1 Overview

A Cloud Administrator (CloudAdmin) is a converged infrastructure administrator, working with systems that are:

- Hyper-converged
- Rack-converged
- Hyper-scale

The CloudAdmin role in an enterprise or service provider is the individual or group primarily responsible for managing the operational lifecycle of a cloud, virtualization,

converged environment that consists of the workloads, resource abstractions, storage, networking, and compute.

Also referred to as a “cloud architect”, this role:

- designates a group of people to build and maintain a virtualized, converged, and/or cloud environment
- spans compute, storage, and networking disciplines as their job is to manage the operational lifecycle of the entire environment
- focuses on automation that involves scripting and potentially formal programming
- This role’s value is to keep the environment that hosts applications available and responding. Deep subject matter expertise is less valuable unless it helps solve an issue.
- The focus for this role is to streamline the deployment of applications into the infrastructure including all the network and storage configuration.
- This role gets involved in the physical deployment of capacity in the datacenter.
- This role deals with software defined infrastructure deployment and management.
- Applications can span physical, virtual machine, container, PaaS building blocks. This role is expected to know how to best configure the “stack” to consume the underlying physical infrastructure.

3.2.2 Use Cases

- Attach a Namespace
- Can a new Namespace be created?
- Can a new Volume be created?
- Confirm valid LBA formats
- Create a new connection to an existing volume
- Create an on-demand snapshot of a Volume
- Create file share
- Create StorageGroup
- Create Volume from an Existing Storage Pool
- Create Volume specifying Class of Service
- Create Volume using Default Class of Service
- Deprovision a Namespace
- Detach a Namespace
- Provision a Namespace from NVM Set

- Provision a Namespace
- Report Namespace Capacity
- Report Remaining Life for a Namespace
- Subscribe to Threshold Events
- Update access rights on an existing volume

3.3 DevOps

3.3.1 Overview

A member of the DevOps group:

- Consumes infrastructure capacity offered as a service/building blocks.
- Develops and deploys programmatic requests for capacity (fully automated, no ticketing or human intervention)
- Provisions storage as a virtual appliance on-premises or in the cloud as part of a larger application deployment
- Deploys ‘cloud born apps’ to consume object storage APIs (S3, Swift)

This role is typically aligned with the business unit. Their focus is the delivery, deployment, and maintenance of apps on IaaS and PaaS resources. This role is not typically a deep subject matter expert in compute, storage, or networking. From a development perspective, their desire is to treat the infrastructure as a programmable subsystem that presents resources on-demand.

This role:

- does not get involved in the physical deployment of capacity in the datacenter
- is responsible for automating infrastructure provisioning as part of the E2E deployment and management of an application with minimal or no human intervention
- consumes higher level services and protocols from the infrastructure; understanding how the device works is not interesting
- expects to consume the programmable interfaces of a device using their existing tools (REST, Python, Ansible, Puppet, Chef, Ruby etc.)

3.3.2 Use Cases

- Can a new Namespace be created?
- Can a new Volume be created?

- Create a New Replication Relationship by Assigning a Target Volume
- Create a New Replication Relationship by Assigning an existing Target Consistency Group
- Create an on-demand snapshot of a Volume
- Create file share
- Create Volume from an Existing Storage Pool
- Create Volume specifying Class of Service
- Create Volume using Default Class of Service
- Health updates
- Make a New Replication Relationship by Creating a Target Consistency Group
- Make a New Replication Relationship by Creating a Target Volume
- Remove Replication Relationship for a Consistency Group
- Remove Replication Relationship
- Resume the Replication Synchronization Activity for a Consistency Group
- Resume the Replication Synchronization Activity
- Reverse a Replication Relationship for Consistency Groups
- Reverse a Replication Relationship
- Split a Replica
- Split a set of Replicas in Consistency Groups
- Subscribe to Threshold Events
- Suspend Replication Synchronization Activity between Consistency Groups
- Suspend Replication Synchronization Activity
- Use Features Registry to confirm functionality

3.4 StorageAdmin

3.4.1 Overview

A storage administrator designs storage solutions for modern environments, including:

- Virtualization (traditional virtualization VMware, Hyper-V)
- private cloud (self-service portal)
- hybrid cloud (can span private, colo, hosted, and public cloud)
- IaaS/PaaS stacks (modern app/devops)

The storage admin role in an enterprise or service provider can have responsibility for managing the operational lifecycle of storage in the datacenter. In particular:

- Organizations can have one or more people exclusively assigned to operating lifecycle of storage in the datacenter.

- The storage admin role is typically tasked with “figuring out” storage needs for the company
- The admin role can consist of level 2 operators and level 3 engineers and architects.
- The admin role deals with multiple storage devices from multiple vendors across one or more datacenters.
- Storage devices attached to multiple operating systems (Linux, Windows, Mainframe, Unix, virtualized, bare metal).
- The Admin role consists of deep storage subject matter expertise, may or may have general practitioners across all disciplines
- Members of this role are typically skilled at scripting and formal programming
- In a converged environment (storage, compute, and networking converged in to a rack), the storage admin role may choose to avoid/minimize involvement in the support of storage WITHIN the rack. (e.g. in virtualization, a single physical port can host 1000s of VMs).

3.4.2 Use Cases

- Add Multiple Drives to an Existing Storage Pool
- Attach a Namespace
- Can a new Namespace be created?
- Can a new Volume be created?
- Change only the RAID Type of an Existing Volume
- Change only the span count of an existing volume
- Confirm valid LBA formats
- Create a new connection to an existing volume
- Create a New Replication Relationship by Assigning a Target Volume
- Create a New Replication Relationship by Assigning an existing Target Consistency Group
- Create an on-demand snapshot of a Volume
- Create class of service
- Create file share
- Create file system
- Create file system
- Create line of service
- Create storage pool and specify a pool type
- Create storage pool using Specified Set of Drives and RAIDTypes

- Create storage pool using specified set of drives
- Create storage pool
- Create Volume from an Existing Storage Pool
- Create Volume specifying Class of Service
- Create Volume using Default Class of Service
- Delete Multiple Drives from an Existing Storage Pool
- Deprovision a Namespace
- Detach a Namespace
- Expand capacity of a storage volume
- Health updates
- Make a New Replication Relationship by Creating a Target Consistency Group
- Make a New Replication Relationship by Creating a Target Volume
- Provision a Namespace from NVM Set
- Provision a Namespace
- Remove Replication Relationship for a Consistency Group
- Remove Replication Relationship
- Report Namespace Capacity
- Report Remaining Life for a Namespace
- Resume the Replication Synchronization Activity for a Consistency Group
- Resume the Replication Synchronization Activity
- Reverse a Replication Relationship for Consistency Groups
- Reverse a Replication Relationship
- Split a Replica
- Split a set of Replicas in Consistency Groups
- Subscribe to Threshold Events
- Suspend Replication Synchronization Activity between Consistency Groups
- Suspend Replication Synchronization Activity
- Update access rights on an existing volume

4 Management Domains

4.1 Management Domain Overview

This document covers a broad range of common use cases and storage management operations.

In an attempt to serve as both a introductory text and as a reference tool, the use cases have been grouped in a number of different ways:

- Alphabetically. Each use case is ordered according to a self-explanatory title, to make it easier for an experienced user to find a specific piece of guidance.
- By actor. While the precise titles and responsibilities within storage management organizations will differ from one organization to the next, this guide has identified three broad functional roles, known as actors and identified the use cases that are most applicable to those roles;
- By management domain. Similarly, while each organization will allocate responsibilities differently, there are general broad classes of storage management that share tasks. This guide has identified four management domains:
 - Application Storage Management: which manages the interface between applications and the storage that they rely upon;
 - Block Storage Management: focused on the management of resources that provide block-based access to storage;
 - Service Catalog Management: which supports access to, and management of, a catalog of service options;
 - File system storage management domain: which supports file system management and manipulation, and file-based access to storage.

4.2 Application storage management domain

4.2.1 Overview

This domain manages the interface between applications and the storage that they rely upon.

StorageGroups provide a means to collectively manage the Volumes and FileShares utilized by an Application. The StorageGroup specifies whether the collected resources are managed so that storage is updated or replicated consistently across all members.

Additionally, the StorageGroup provides the means to atomically expose (or hide) the collected resources to (or from) host endpoints.

4.2.2 Use Cases

- Subscribe to Threshold Events
- Use Features Registry to confirm functionality

4.3 Block storage management domain

4.3.1 Overview

Many devices and services provide their storage capacity to external devices and applications through block-based protocols to storage devices. This domain includes the management of resources that provide block-based access to storage.

Block-based storage is represented by a Volume. This domain provides for the discovery and provisioning of Volumes and for maintaining relationships to Device, Endpoint, StorageService, StorageGroup, StoragePool, and ComputerSystem resources.

4.3.2 Use Cases

- Add Multiple Drives to an Existing Storage Pool
- Attach a Namespace
- Can a new Namespace be created?
- Can a new Volume be created?
- Change only the RAID Type of an Existing Volume
- Change only the span count of an existing volume
- Confirm valid LBA formats
- Create a new connection to an existing volume
- Create a New Replication Relationship by Assigning a Target Volume
- Create a New Replication Relationship by Assigning an existing Target Consistency Group
- Create an on-demand snapshot of a Volume
- Create class of service
- Create line of service
- Create storage pool and specify a pool type
- Create storage pool using Specified Set of Drives and RAIDTypes

- Create storage pool using specified set of drives
- Create storage pool
- Create StorageGroup
- Create Volume from an Existing Storage Pool
- Create Volume specifying Class of Service
- Create Volume using Default Class of Service
- Delete Multiple Drives from an Existing Storage Pool
- Deprovision a Namespace
- Detach a Namespace
- Expand capacity of a storage volume
- Make a New Replication Relationship by Creating a Target Consistency Group
- Make a New Replication Relationship by Creating a Target Volume
- Provision a Namespace from NVM Set
- Provision a Namespace
- Remove Replication Relationship for a Consistency Group
- Remove Replication Relationship
- Report Namespace Capacity
- Report Remaining Life for a Namespace
- Resume the Replication Synchronization Activity for a Consistency Group
- Resume the Replication Synchronization Activity
- Reverse a Replication Relationship for Consistency Groups
- Reverse a Replication Relationship
- Split a Replica
- Split a set of Replicas in Consistency Groups
- Subscribe to Threshold Events
- Suspend Replication Synchronization Activity between Consistency Groups
- Suspend Replication Synchronization Activity
- Update access rights on an existing volume

4.4 Service catalog management domain

4.4.1 Overview

Swordfish supports access to, and management of, a catalog of service options, (see ITIL glossary and abbreviations), supported by storage services.

When the Swordfish Class of Service Feature is implemented, the ClassOfService resource represents a service option that may be used to specify requirements for utility or warranty when provisioning a resource. Currently ClassOfService is defined

for use in the Block Storage, File System, and ApplicationStorage domains.

The service catalog for each StorageService is represented by a collection of references to supported ClassOfService resources. Each ClassOfService is known minimally by a Name and a unique Identifier. When a ClassOfService is specified for a resource, the StorageService shall attempt to maintain that resource in compliance to the requirements of that ClassOfService. The requirements may be specified informally by text in the Description property or may be specified formally by the property values of embedded options related to specific lines of service.

The embedded service options are described by values of complex types representing lines of service.

Over time, as the service catalog is continually updated to match evolving user needs and service provider offerings, it is expected that the catalog will contain entries (one or more ClassOfService or LineOfService instances) that are not currently active.

4.4.2 Data protection

The primary storage is described by a ClassOfService resource. That ClassOfService may aggregate any number of data protection service options. Each instance of a data protection service option describes the characteristics a replication session that shall be maintained for the containing primary storage resource.

For additional information, see the definitions for DataProtectionLineOfService and DataProtectionLoSCapabilities.

4.4.3 Data security

An instance of a data security service option describes an optional set of data security requirements. A data security Service option is typically aggregated into a ClassOfService resource that is associated with storage. At most one data security service option may be aggregated into a ClassOfService resource. When storage is provisioned with that ClassOfService, it will provide the currently specified data security characteristics.

A data security service option may specify data security characteristics that enable the storage system to be used in an environment where compliance with an externally-specified security standard or standards is required. Examples of such standards include FIPS-140, HIPAA and PCI. In this case, the names of the standard or standards can usefully be included in the user/admin-visible name of the instance. With the notable exception of FIPS-140, compliance requires measures well beyond the means

of a storage system to provide (e.g., both HIPAA and PCI impose significant requirements on administration and operation of the data center), so this approach promises that the storage system will do its part in supporting compliance, but does not (and cannot) promise that the storage system will deliver full compliance by itself.

The description attribute value may include human readable information including:

- Whether encryption keys are drive or array resident or externally managed (e.g., via KMIP).
- Information on how the array supports compliance to a standard identified in the name of the Service option. (e.g., specific algorithms employed that are FIPS-140 compliant, information about the validated cryptographic module and its validation certificate, relationship of the security functionality to specific PCI or HIPAA requirements).

NOTE For comparable cryptographic strengths, (see NIST SP 800-57 part 1)

NOTE For symmetric encryption algorithm key sizes, 112 bits is the 3DES key size and 128, 192, and 256 bits are options for AES key sizes.

NOTE MediaEncryptionStrength includes the case where metadata about the data must be encrypted. (e.g. data presence vs. absence in a thin volume, array filesystem metadata) The implementation may be self-encrypting drives or encryption in the storage system's drive controller. Keys may be drive or array resident or externally managed (e.g., via KMIP).

For additional information, see the definitions for DataSecurityLineOfService and DataSecurityLoSCapabilities.

4.4.4 Data storage

Each data storage service option describes characteristics of the storage at a particular location. A class of service will have at most one data storage service option, which describes the storage specified by that class of Service.

For additional information, see the DataStorageLineOfService and DataProtection-LoSCapabilities.

4.4.5 IO connectivity

An IO connectivity service option specifies the characteristics of storage connectivity. For each value of AccessProtocol, at most one IO connectivity service option may be aggregated into a class of service.

NOTE: If used within a ClassOfService for Storage Provisioning, this value constrains the set of connections used to expose that storage.

For additional information, see the IOConnectivityLineOfService and IOConnectivity-LoSCapabilities.

4.4.6 IO performance

An IO performance service option specifies a choice of performance characteristics as viewed through the data path to the storage. This is affected by choices of storage and connection technologies.

At most one IO performance service option may be aggregated into a ClassOfService for a storage resource. When storage is provisioned with that ClassOfService, it should provide at least the specified performance.

For additional information, see the IOConnectivityLineOfService and IOConnectivity-LoSCapabilities.

4.4.7 Use Cases

- Create class of service
- Create line of service

4.5 File system storage management domain

4.5.1 Overview

FileSystems provide access to byte-accessible storage through file-based protocols. This domain includes the management of resources that provide file-based access to storage.

File-based storage is represented by a FileSystem resources. Remote access to portions of a FileSystem is provided by FileShare resources.

4.5.2 Use Cases

- Create file share
- Create file system
- Create file system

5 User Guidance

Swordfish supports a range of possible features. Clients use the Features registry to determine what SupportedFeatures a specific instance of an implementation is capable of. These range from discovery (read-only functionality), to event notification, to performance instrumentation, to multiple levels of block and file provisioning capabilities.

Supporting the granular feature definition is a detailed profile description that includes precise definitions of what functionality must be implemented in order to advertise support for each feature.

For use cases specified in this document, there is an expectation that specific features have been implemented to support the corresponding use case. For example, the “AssignReplicaTarget” use case highlights functionality for either local or remote replication, depending on the selected target volume’s system (either the same or different than the source volume). In either case, the client is working with the presumption that the feature has been advertised.

6 Features

6.1 Overview

This guide covers use cases for both installations that have opted to deploy a basic level of the API, and only extends the Redfish standard slightly, and those that implement a number of advanced features, providing a broader range of functionality. Use cases that assume functionality or features beyond a basic Swordfish implementation are clearly identified below, and are group with one another.

This version of the Users' Guide incorporates the functionality defined in v1.1.0 of the Swordfish specification, which defines a number of features. In addition to basic use cases, this document includes cases that rely on the implementation of each of those features:

- Access management
- Block capacity management
- Block IO performance
- Block provisioning
- Discovery
- EnergyStar
- Event notification
- File provisioning
- File capacity management
- Mapping and masking
- NVMe
- Replication (both local and remote)

6.2 Access management feature

6.2.1 Overview

This feature provides access management configuration and control.

6.2.2 Feature-specific Guidance

None defined.

6.2.3 Use Cases

- Create a new connection to an existing volume
- Create StorageGroup

6.3 Block provisioning feature

6.3.1 Overview

This feature provides basic, block-based storage provisioning.

6.3.2 Feature-specific Guidance

None defined.

6.3.3 Use Cases

- Add Multiple Drives to an Existing Storage Pool
- Can a new Namespace be created?
- Can a new Volume be created?
- Change only the RAID Type of an Existing Volume
- Change only the span count of an existing volume
- Create Volume from an Existing Storage Pool
- Delete Multiple Drives from an Existing Storage Pool

6.4 Capacity management feature

6.4.1 Overview

This feature provide the management and alteration of storage once it has been allocated.

6.4.2 Feature-specific Guidance

None defined.

6.4.3 Use Cases

- Expand capacity of a storage volume

6.5 Class of Service Features

6.5.1 Overview

This feature provides support for automated storage management based on ClassOfService and LineOfService modeling.

6.5.2 Feature-specific Guidance

6.5.2.1 Default Class of Service If a pool, storage volume or other construct is created with no specified class of service when a class of service exists, the implementation will attempt to apply the DefaultClassOfService.

6.5.3 Use Cases

- Create an on-demand snapshot of a Volume
- Create class of service
- Create file system
- Create line of service
- Create storage pool
- Create Volume specifying Class of Service
- Create Volume using Default Class of Service

6.6 Event notification feature

6.6.1 Overview

This feature provides basic eventing.

6.6.2 Feature-specific Guidance

None defined.

6.6.3 Use Cases

- Subscribe to Threshold Events

6.7 File provisioning feature

6.7.1 Overview

This feature provides file-based storage provisioning.

6.7.2 Feature-specific Guidance

None defined.

6.7.3 Use Cases

- Create file share
- Create file system

6.8 Block IO performance feature

6.8.1 Overview

This feature provides basic performance metrics.

6.8.2 Feature-specific Guidance

None defined.

6.8.3 Use Cases

- Health updates

6.9 Block mapping and masking feature

6.9.1 Overview

This feature provides block-based mapping and assignment of storage volumes.

6.9.2 Feature-specific Guidance

None defined.

6.9.3 Use Cases

6.10 NVMe Support feature

6.10.1 Overview

This feature provides NVMe-specific use cases.

6.10.2 Feature-specific Guidance

The detailed mapping between Swordfish objects and the NVMe object model can be found in [Swordfish NVMe Model Overview and Mapping Guide](#).

6.10.3 Use Cases

- Attach a Namespace
- Confirm valid LBA formats
- Deprovision a Namespace
- Detach a Namespace
- Provision a Namespace from NVM Set
- Provision a Namespace
- Report Namespace Capacity
- Report Remaining Life for a Namespace
- Update access rights on an existing volume

6.11 Replication Feature

6.11.1 Overview

This set of features (local replication and remote replication) provides support for a broad range of storage redundancy protections.

6.11.2 Feature-specific Guidance

Replication can be implemented many ways. The use cases defined for this feature illustrate two possible approaches, one using volumes and the other using consistency groups. Those use cases employing consistency groups will include “CG” in their titles, to avoid confusion.

6.11.3 Use Cases

- Create a New Replication Relationship by Assigning a Target Volume
- Create a New Replication Relationship by Assigning an existing Target Consistency Group
- Make a New Replication Relationship by Creating a Target Consistency Group
- Make a New Replication Relationship by Creating a Target Volume
- Remove Replication Relationship for a Consistency Group
- Remove Replication Relationship
- Resume the Replication Synchronization Activity for a Consistency Group
- Resume the Replication Synchronization Activity
- Reverse a Replication Relationship for Consistency Groups
- Reverse a Replication Relationship
- Split a Replica
- Split a set of Replicas in Consistency Groups
- Suspend Replication Synchronization Activity between Consistency Groups
- Suspend Replication Synchronization Activity

6.12 Uncategorized Use Cases

The use cases that don't align with a particular feature are summarized in Table 8.

Table 8: Uncategorized use cases

Title	Description
Create Storage Pool	Create a StoragePool
Create Storage Pool by drives	Create a StoragePool using a specific set of drives
Create Storage Pool with drives and RAIDType	Create storage pool using Specified Set of Drives and RAIDTypes
Subscribe to thresholds events	Subscribe to Threshold Events

Title	Description
Use Features Registry to confirm functionality	Use Features Registry to confirm functionality

7 Use cases

7.1 Alphabetic list of use cases

7.1.1 Add Multiple Drives to an Existing Storage Pool

Summary: Add multiple drives to an Storage Pool.

Purpose: Add multiple drives to an Storage Pool to provide additional capacity.

Who: StorageAdmin

Management Domain: Block storage management

Triggers: Expand resources available to a pool; this could be performance, capacity or application triggered.

Detailed Context: The storage admin needs to increase the underlying available capacity within an existing pool. This use case makes the following assumptions about the “implementation” servicing the request:

- The implementation manages, or does not have any, constraints on the inclusion of multiple drives into the target storage pool.

Preconditions: User has already selected a Pool.

Feature(s): Block provisioning

Inputs:

- URL for Storage Pool: /redfish/v1/Storage/1/StoragePools/PrimaryPool
- Drives to add:

```
[{"@odata.id": "/redfish/v1/Chassis/1/Drives/1"}, {"@odata.id":  
↔ "/redfish/v1/Chassis/1/Drives/2"}]
```

Basic Course of Events:

1. Use the “AddDrives” Action on the PrimaryPool storage pool, passing the selected drives as input.

Request: POST /redfish/v1/Storage/1/StoragePools/PrimaryPool.AddDrives

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "Drives" : [
    {"@odata.id": "/redfish/v1/Chassis/1/Drives/1"},
    {"@odata.id": "/redfish/v1/Chassis/1/Drives/2"}
  ]
}
```

Response: Response is dependent on implementation's capability.

If the implementation is able to return immediately:

- **HTTP Status:** 200 (OK)
- **Headers:** None.
- **Body:** None.

If the implementation requires a background task (using the Redfish task service) to return status:

- **HTTP Status:** 202 (Accepted)
- **Headers:** Location : /redfish/v1/TaskService/Tasks/TaskID2
- **Body:** None.

Postconditions: The new drives have been added to a capacity source (chosen by the implementation) used by the selected storage pool.

Failure Scenario: None defined

See also: None defined.

7.1.2 Attach a Namespace

Summary: Attach a Namespace

Purpose: Provide visibility to a namespace by attaching it to an IO Controller.

Who: StorageAdmin; CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: Attach a Namespace to an IO Controller to make it visible to the hosts that connect to that IO Controller, and accessible for block storage operations.

Preconditions: The IO Controller and Namespaces need to exist, and be fully defined.

Feature(s): NVMe

Inputs:

- URL for Namespace.

Basic Course of Events:

1. PATCH the AttachedVolumes array in the IO Controller with the Namespace.

Request:

```
PATCH /redfish/v1/Systems/Sys-1/Storage/SimplestNVMeSSD/
      Controllers/NVMeIOController/
```

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "Links": {
    "AttachedVolumes": [
      {
        "@odata.id": "/redfish/v1/Systems/Sys-
        ↪ 1/Storage/SimplestNVMeSSD/Volumes/SimpleNamespace"
      }
    ]
  }
}
```

Response:

- **HTTP Status:** 200 (Success)
- **Headers:** Content-type : application/json
- **Body**

```
{
  "@Redfish.Copyright": "Copyright 2015-2021 SNIA. All rights reserved.",
  "@odata.id": "/redfish/v1/Systems/Sys-
  ↪ 1/Storage/SimplestNVMeSSD/Controllers/NVMeIOController",
  "@odata.type": "#StorageController.v1_1_0.StorageController",
  "Id": "NVMeIOController",
  "Name": "NVMe I/O Controller",
  "Description": "An NVM IO controller is a general-purpose controller that
  ↪ provides access to logical block data and metadata stored on an NVM
  ↪ subsystem's non-volatile storage medium. IO Controllers may also
  ↪ support management capabilities.",
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "Manufacturer": "Best NVMe Vendor",
  "Model": "Simple NVMe Device",
  "SerialNumber": "NVME123456",
  "PartNumber": "NVM44",
  "FirmwareVersion": "1.0.0",
  "SupportedControllerProtocols": [
    "PCIe"
  ],
  "SupportedDeviceProtocols": [
    "NVMe"
  ],
  "NVMeControllerProperties": {
    "NVMeVersion": "1.3",
    "NVMeControllerAttributes": {
      "ReportsUUIDList": false,
      "SupportsSQAssociations": false,
      "ReportsNamespaceGranularity": false,
      "SupportsTrafficBasedKeepAlive": false,
      "SupportsPredictableLatencyMode": false,
      "SupportsEnduranceGroups": false,
      "SupportsReadRecoveryLevels": false,
      "SupportsNVMSets": false,
    }
  }
}
```

```
        "SupportsExceedingPowerOfNonOperationalState": false,  
        "Supports128BitHostId": false  
    }  
},  
"Links": {  
    "AttachedVolumes": [  
        {  
            "@odata.id": "/redfish/v1/Systems/Sys-  
↔ 1/Storage/SimplestNVMeSSD/Volumes/SimpleNamespace"  
        }  
    ]  
}  
}
```

Postconditions: The Namespace has been configured as an AttachedVolume to the IO Controller. This means that the Namespace is visible to hosts connected to the IO Controller.

Failure Scenario: None defined.

See also: None defined.

7.1.3 *Can a new Namespace be created?*

Summary: Confirm that a new Namespace can be created.

Purpose: Check VolumeCollection settings before attempting to create a new entry.

Who: CloudAdmin, StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to create a new Namespace.

Detailed Context: Before attempting to create a new Namespace, the users wants to confirm that creation is allowed against a given StoragePool. The `Allow` header returned for the VolumeCollection will indicate whether Namespace creation is permitted or not.

Preconditions: None.

Feature(s): Block provisioning

Inputs:

- URL for Volumes collection: `/redfish/v1/Storage/1/Volumes`

Basic Course of Events:

1. Request the header information of the Volumes resource collection. > Note: This example use the HTTP verb `HEAD`, though a request using `GET` would also return the required headers.

Request:

`HEAD /redfish/v1/Storage/1/Volumes`

- **Headers:** No additional headers required.
- **Body:** None.

Response: Response contains the header.

- **HTTP Status:** 200 (OK)
- **Headers:** `Allow` : GET, POST, HEAD
- **Body:** None.

Postconditions: None defined.

Failure Scenario: None defined

See also: Can a new Volume be created?

7.1.4 *Can a new Volume be created?*

Summary: Confirm that a new Volume can be created.

Purpose: Check VolumeCollection settings before attempting to create a new Volume.

Who: CloudAdmin, StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to create a new Volumes.

Detailed Context: Before attempting to create a new Volume, the users wants to confirm that creation is allowed against a given StoragePool. The Allow header returned for the VolumeCollection will indicate whether Volume creation is permitted or not.

Preconditions: None.

Feature(s): Block provisioning

Inputs:

- URL for Volumes collection: `/redfish/v1/Storage/1/Volumes`

Basic Course of Events:

1. Request the header information of the Volumes resource collection. > Note: This example use the HTTP verb HEAD, though a request using GET would also return the required headers.

Request:

HEAD `/redfish/v1/Storage/1/Volumes`

- **Headers:** No additional headers required.
- **Body:** None.

Response: Response contains the header.

- **HTTP Status:** 200 (OK)
- **Headers:** Allow : GET, POST, HEAD
- **Body:** None.

Postconditions: None defined.

Failure Scenario: None defined

See also: Can a new Namespace be created?

7.1.5 Change only the RAID Type of an Existing Volume

Summary: Change only the RAID type of an existing Volume

Purpose: Change the RAID type of an existing Volume to meet new protection requirements, without a change to the underlying Drives collection.

Who: StorageAdmin

Management Domain: Block storage management

Triggers: Change the RAID protection level of a Volume; this could be performance, capacity or application triggered.

Detailed Context: The storage admin needs to alter the underlying RAID layout for an existing Volume.

Preconditions: Volume already exists, and employs drives sufficient to satisfy the requested RAID geometry.

Feature(s): Block provisioning

Inputs:

- URL for Volume: `/redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1`

Basic Course of Events:

1. Use the `ChangeRAIDLAYOUT` Action on the Volume, passing the requested RAID-Type as input.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/Actions/ChangeRAIDLAYOUT
```

- **Headers:** Content-type: application/json

- **Body:**

```
{
  "RAIDType" : "RAID5"
}
```

Response: Response is dependent on implementation's capability.

Case 1: If the implementation is able to return immediately:

- **HTTP Status:** 204 (No Content)
- **Headers:**

Location :

/redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

- **Body:** None.

A GET on volume will show the updated RAIDType.

Request:

GET /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

Response:

- **HTTP Status:** 200 (OK)

- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
Content-type: application/json

- **Body:**

```
{
  "@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights
  reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id": "/red-
  fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1",
  "@odata.type": "#Volume_1_6_0.Volume",
  "Name": "MyVolume",
  "Id": "1",
  "Description": "Default Volume Description",
  "RAIDType": "RAID5",
  "Identifiers": [
    {
      "DurableNameFormat": "NAA",
      "DurableName": "65456765456761001234076100123487"
    }
  ],
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "CapacityBytes": 1099511627776,
  "Links": {
    "StoragePool": "/redfish/v1/Storage/1/StoragePools/1"
  }
}
```

Case 2: If the implementation requires a background task (using the Redfish task service) to return status:

- **HTTP Status:** 202 (Accepted)
- **Headers:** Location : /redfish/v1/TaskService/Tasks/TaskID2
- **Body:** None.

A GET on volume while task is pending will indicate the in-process change to RAIDType, and that the transition to the new RAID layout is not complete, using Status.State and Status.Health:

Request: GET /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
Content-type: application/json
- **Body:**

```
{
  "@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights
  ↪ reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id": "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1",
  "@odata.type": "#Volume_1_6_0.Volume",
  "Name": "MyVolume",
  "Id": "1",
  "Description": "Default Volume Description",
  "RAIDType": "RAID5",
  "Identifiers": [
    {
      "DurableNameFormat": "NAA",
      "DurableName": "65456765456761001234076100123487"
    }
  ],
  "Status": {
    "State": "Updating",
    "Health": "Warning"
  },
  "CapacityBytes": 1099511627776,
  "Links": {
```

```
"StoragePool":  
  ↪ "/redfish/v1/Storage/1/StoragePools/PrimaryPool"  
}  
}
```

A subsequent GET on the Volume, once the task has completed, will reflect the new values:

Request:

GET /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

Response:

- **HTTP Status:** 200 (OK)

- **Headers:**

Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

Content-type: application/json

- **Body:**

```
{  
  "@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights  
  ↪ reserved.",  
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",  
  "@odata.id": "/red-  
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1",  
  "@odata.type": "#Volume_1_6_0.Volume",  
  "Name": "MyVolume",  
  "Id": "1",  
  "Description": "Default Volume Description",  
  "RAIDType": "RAID5",  
  "Identifiers": [  
    {  
      "DurableNameFormat": "NAA",  
      "DurableName": "65456765456761001234076100123487"  
    }  
  ],  
  "Status": {  
    "State": "Enabled",  
    "Health": "OK"  
  },  
  "CapacityBytes": 1099511627776,  
  "Links": {  
    "StoragePool":  
      ↪ "/redfish/v1/Storage/1/StoragePools/PrimaryPool"
```

```
    }  
  }  
}
```

Postconditions: None defined.

Failure Scenario: If the system is unable to complete the requested change to the RAID layout for some reason (e.g., insufficient Drives in the underlying StoragePool to support the requested RAID type), the initial POST will result in an error. For example:

1. Use the ChangeRAIDLAYOUT Action on the Volume, passing the requested RAID-Type as input, as in the initial scenario.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/  
Actions/ChangeRAIDLAYOUT
```

- **Headers:** Content-type : application/json

- **Body:**

```
{  
  "RAIDType" : "RAID5"  
}
```

Response:

- **HTTP Status:** 400 (Bad Request)

- **Headers:**

Content-type: application/json

- **Body:**

```
{  
  "error": {  
    "code": "Base.1.6.ActionParameterMissing",  
    "message": "The action ChangeRAIDLAYOUT requires the parameter Drives to  
    ↪ be present in the request body.",  
    "@Message.ExtendedInfo" : [  
      {  
        "MessageId" : "Base.1.6.ActionParameterMissing",  
        "Message" : "The Drives paramter must be included in this request",  
        "RelatedProperties" : "Drives"  
      }  
    ]  
  }  
}
```

See also: None defined.

7.1.6 *Change only the span count of an existing volume*

Summary: Change only the span count of an existing Volume

Purpose: Change the span count RAID type of an existing Volume, without a change to the underlying Drives collection.

Who: StorageAdmin

Management Domain: Block storage management

Triggers: Change the span count of a Volume; this could be performance, capacity or application triggered.

Detailed Context: The storage admin needs to alter the underlying RAID layout for an existing Volume.

Preconditions: Volume already exists, and employs drives sufficient to satisfy the requested RAID geometry.

Feature(s): Block provisioning

Inputs:

- URL for Volume: /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

Basic Course of Events:

1. Use the ChangeRAIDLAYOUT Action on the Volume, passing the requested MediaSpanCount as input.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
     Actions/ChangeRAIDLAYOUT
```

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "MediaSpanCount" : 10
}
```

Response:

Response is dependent on implementation's capability.

If the implementation is able to return immediately:

- **HTTP Status:** 204 (No Content)

- **Headers:**

- Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

- **Body:** None.

A GET on volume will show the updated RAIDType.

Request:

```
`GET /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1`
```

- **Response:** 200 (OK)

- **Headers:**

- Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

- Content-type : application/json

- **Body:**

```
{
  "@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id":
  ↪ "/redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1",
  "@odata.type": "#Volume_1_6_0.Volume",
  "Name": "MyVolume",
  "Id": "1",
  "Description": "Default Volume Description",
  "RAIDType": "RAID50",
  "MediaSpanCount": 10,
  "Identifiers": [
    {
      "DurableNameFormat": "NAA",
      "DurableName": "65456765456761001234076100123487"
    }
  ],
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "CapacityBytes": 1099511627776,
  "Links": {
    "StoragePool": "/redfish/v1/Storage/1/StoragePools/PrimaryPool"
```



```
}
}
```

If the implementation requires a background task (using the Redfish task service) to return status:

Response:

- **HTTP Status:** 202 (Accepted)
- **Headers:**
 - Location : /redfish/v1/TaskService/Tasks/TaskID2
- **Body:** None.

A GET on volume while task is pending will indicate the in-process change to RAIDType, and that the transition to the new RAID layout is not complete, using Status.State and Status.Health:

Request:

```
`GET /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1`
```

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/
Content-type : application/json

- **Body:**

```
{
  "@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights
  ↪ reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id": "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1",
  "@odata.type": "#Volume_1_6_0.Volume",
  "Name": "MyVolume",
  "Id": "1",
  "Description": "Default Volume Description",
  "RAIDType": "RAID50",
  "MediaSpanCount": 10,
  "Identifiers": [
    {
      "DurableNameFormat": "NAA",
```

```
"DurableName": "65456765456761001234076100123487"
}
],
"Status": {
  "State": "Updating",
  "Health": "Warning"
},
"CapacityBytes": 1099511627776,
"Links": {
  "StoragePool": "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1"
}
}
```

A subsequent GET on the Volume, once the task has completed, will reflect the new values:

Request:

```
`GET /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1`
```

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/
Content-type : application/json
- **Body:**

```
{
"@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights
  ↪ reserved.",
"@odata.context": "/redfish/v1/$metadata#Volume.Volume",
"@odata.id": "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1",
"@odata.type": "#Volume_1_6_0.Volume",
"Name": "MyVolume",
"Id": "1",
"Description": "Default Volume Description",
"RAIDType": "RAID50",
"MediaSpanCount": 10,
"Identifiers": [
  {
    "DurableNameFormat": "NAA",
    "DurableName": "65456765456761001234076100123487"
```

```
    }
  ],
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "CapacityBytes": 1099511627776,
  "Links": {
    "StoragePool": "/redfish/v1/Storage/1/StoragePools/PrimaryPool"
  }
}
```

Postconditions: None defined.

Failure Scenario: If the system is unable to complete the requested change to the RAID layout for some reason (e.g., insufficient Drives in the underlying StoragePool to support the requested MediaSpanCount), the initial POST will result in an error. For example:

1. Use the ChangeRAIDLAYOUT Action on the Volume, passing the requested MediaSpanCount as input, as in the initial scenario.

Request:

POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
Actions/ChangeRAIDLAYOUT

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "MediaSpanCount": 10
}
```

Response:

- **HTTP Status:** 400 (Bad Request)
- **Headers:** Content-type : application/json

- **Body:**

```
{
  "error": {
    "code": "Base.1.6.ActionParameterMissing",
    "message": "The action ChangeRAIDLAYOUT requires the parameter Drives
    ↪ to be present in the request body.",
  }
}
```

```
"@Message.ExtendedInfo" : [  
  "MessageId" : "Base.1.6.ActionParameterMissing",  
  "Message" : "The Drives paramter must be included in this  
↔ request",  
  "RelatedProperties" : "Drives"  
]  
}  
}
```

See also: None defined.

7.1.7 Confirm valid LBA formats

Summary: Confirm valid LBA formats

Purpose: Verify that a given LBA format is supported by a Volume collection.

Who: StorageAdmin CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: Querying the CollectionCapabilities object defined within the Controllers collection, allows a user to confirm that a particular LBA format is supported, even if the collection itself is empty due to the ephemeral nature of NVMe Controllers.

Preconditions: None defined.

Feature(s): NVMe

Inputs:

- URL for Controller collection: /redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Controllers

Basic Course of Events:

1. Get the ControllerCollection and find the CapabilitiesObject property within the returned JSON data:

Request:

GET /redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/Capabilities

- ****Headers:**** No additional headers required.

- ****Body:**** None.

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Content-type : application/json
- **Body:**

```
{
  "@odata.type": "#StorageControllerCollection.StorageControllerCollection",
  "Name": "Storage Controller Collection",
  "Description": "Storage Controller Collection",
```

```
"Members@odata.count": 0,
"Members": [],
"@Redfish.CollectionCapabilities": {
  "@odata.type": "#CollectionCapabilities.v1_3_0.CollectionCapabilities",
  "Capabilities": [{
    "CapabilitiesObject": {
      "@odata.id":
        ↪ "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/Capabilities"
    },
    "Links": {
      "TargetCollection": {
        "@odata.id":
          ↪ "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Controllers"
      }
    }
  }]
},
"@odata.id": "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Controllers",
"@Redfish.Copyright": "Copyright 2022 SNIA. All rights reserved."
}
```

2. Get the CollectionCapabilities, and confirm that the desired LBA format is included in the collection of supported formats.

****Request:****

```
`GET /redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/Capabilities`
```

- ****Headers:**** No additional headers required.
- ****Body:**** None.

****Response:****

- ****HTTP Status:**** 200 (OK)
- ****Headers:**** `Content-type : application/json`
- ****Body:****

````json

```
{
"@odata.type": "#Volume.v1_7_0.Volume",
"Id": "Capabilities",
"Name": "Capabilities for the Volume",
"Name@Redfish.RequiredOnCreate": true,
"Name@Redfish.SetOnlyOnCreate": true,
"Description@Redfish.OptionalOnCreate": true,
"Description@Redfish.SetOnlyOnCreate": true,

"NVMeNamespaceProperties": {
 "LBAFormatsSupported@Redfish.AllowableValues": [
 "LBAFormat0",
 "LBAFormat1",
 "LBAFormat2",
 "LBAFormat3"
]
},

"@odata.id": "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/Capabilities",
"@Redfish.Copyright": "Copyright 2022 SNIA. All rights reserved."
}

...

```

**Postconditions:** None.

**Failure Scenario:** None defined.

**See also:** None defined.

### 7.1.8 Create a new connection to an existing volume

**Summary:** Create a new connection to an existing Volume, using a pre-existing Endpoint to grant read/write access to the Volume.

**Purpose:** Use existing Endpoints to provide a new access path to an existing volume.

**Who:** StorageAdmin CloudAdmin

**Management Domain:** Block storage management

**Triggers:** None defined.

**Detailed Context:** Create a new connection to an existing Volume, to allow it to be accessed from a given host by way of the selected Endpoints.

**Preconditions:** User has already identified the Endpoints that will be used for the new Connection.

**Feature(s):** Access Management

#### Inputs:

- Name for new connection: "Connection info for host 1"
- Volume Id: "/redfish/v1/Storage/IPAttachedDrive1/Volumes/SimpleNamespace"
- Initiator endpoint: /redfish/v1/Fabrics/NVMeoF/Endpoints/Initiator1
- Target endpoint: /redfish/v1/Fabrics/NVMeoF/Endpoints/D1-E1
- Volume access information:

```
{
 "AccessCapabilities": [
 "Read",
 "Write"
],
 "Volume": {
 "@odata.id":
 ↪ "/redfish/v1/Storage/IPAttachedDrive1/Volumes/SimpleNamespace"
 },
}
```

#### Basic Course of Events:

1. Create the new Connection

##### Request:

```
POST /redfish/v1/Fabrics/NVMeoF/Connections
```



- **Headers:** Content-type : application/json

- **Body:**

```
{
 "Name": "Connection info for host 1",
 "VolumeInfo": [
 {
 "AccessCapabilities": [
 "Read",
 "Write"
],
 "Volume": {
 "@odata.id": "/red-
 ↪ fish/v1/Storage/IPAttachedDrive1/Volumes/SimpleNamespace"
 }
 },
],
 "Links": {
 "InitiatorEndpoints": [
 {
 "@odata.id":
 ↪ "/redfish/v1/Fabrics/NVMeoF/Endpoints/Initiator1"
 }
],
 "TargetEndpoints": [
 {
 "@odata.id": "/redfish/v1/Fabrics/NVMeoF/Endpoints/D1-E1"
 }
]
 },
}
```

**Response:**

- **HTTP Status:** 201 (Created)

- **Headers:**

Content-type: application/json

- **Body:**

```
{
 "@odata.type": "#ConnectionCollection.ConnectionCollection",
 "Name": "NVMeoF Connection Collection",
 "Members@odata.count": 2,
```

```
"Members": [
 {
 "@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections/1"
 },
 {
 "@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections/3"
 }
],
"@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections",
"@Redfish.Copyright": "Copyright 2015-2021 SNIA. All rights
↔ reserved."
}
```

**Postconditions:** None defined.

**Failure Scenario:** None defined

**See also:** None defined.

### 7.1.9 Create a New Replication Relationship by Assigning a Target Volume

**Summary:** Establish a replication relationship by assigning an existing volume to serve as a target replica for an existing source volume.

**Purpose:** Leverage an existing volume resource to provide expanded data protection through a replica relationship with the specified source volume.

**Who:** StorageAdmin, DevOps

**Management Domain:** Block storage management

**Triggers:** Need to provide expanded data protection through a replica relationship with the specified source volume.

**Detailed Context:** The admin needs to provide expanded data protection for the specified source volume, and the configuration includes pre-existing volume that can be repurposed as a replication target.

**Preconditions:** User has already identified an existing volume to use for the target replica (including the target system and storage pool properties), the type of replica, and the replica update mode (sync vs async).

**Feature(s):** Replication (both local and remote)

**Inputs:**

- URL for target volume: `/redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/65097`
- Requested replica type: `Mirror`
- `ReplicaUpdateMode`: `Synchronous`

**Basic Course of Events:**

1. Post (as an Action) the request on the source Volume.

This instructs the service to use the identified Volume as the source Volume for the specified replication relationship. For any additional details required, the service will rely on default values.

**Request:**

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
Volume.AssignReplicaTarget
```

- **Headers:** `Content-type : application/json`

- **Body:**

```
```\json
```

```
{“ReplicaUpdateMode”: “Synchronous”, “TargetVolume”: “/redfish/v1/Storage/1/StoragePools/PrimaryP  
“ReplicaType”: “Mirror” }“
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/
- **Body:** None.

Postconditions: The selected volume has an updated ReplicaTargets entry for the new relationship. Elsewhere, there is a volume “650973452245” in the system that has a ReplicaInfo which points back to this volume and which contains all of the Replica configuration information.

Failure Scenario: None defined

See also: Assign Replica Target (CG).

7.1.10 *Create a New Replication Relationship by Assigning an existing Target Consistency Group*

Summary: Establish a replication relationship by assigning an existing consistency group to serve as the target in the replication relationship for an existing consistency group.

Purpose: Leverage an existing consistency group resource to provide expanded data protection by creating a replication relationship with the specified source consistency group.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to provide expanded data protection through a replica relationship with the specified source consistency group.

Detailed Context: The admin needs to provide expanded data protection for the specified source consistency group, and the configuration includes a pre-existing consistency group that can be repurposed as the replication target.

Preconditions: User has already identified an existing consistency group to use for the target replicas (including the target system and storage pool properties), the type of replica(s), and the replica update mode (sync vs async).

Feature(s): Replication (both local and remote)

Inputs:

- URL for target volume: /redfish/v1/Storage/1/ConsistencyGroup/CG_DB2
- Requested replica type: Mirror
- ReplicaUpdateMode: Synchronous

Basic Course of Events:

1. Post (as an Action) the request on the source ConsistencyGroup.

This instructs the service to use the identified ConsistencyGroup as the source ConsistencyGroup for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

POST

/redfish/v1/Storage/1/ConsistencyGroup/CG_DB1/

ConsistencyGroup.AssignReplicaTarget

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "ReplicaUpdateMode": "Synchronous",
  "TargetConsistencyGroup":
  ↔ "/redfish/v1/Storage/1/ConsistencyGroup/CG_DB2",
  "ReplicaType": "Mirror"
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/ConsistencyGroup/CG_DB1
- **Body:** None.

Postconditions: The selected ConsistencyGroup has an updated ReplicaTargets entry for the new relationship. Elsewhere, there is a ConsistencyGroup “CG_DB2” in the system that has a ReplicaInfo which points back to this ConsistencyGroup and which contains all of the Replica configuration information.

Failure Scenario: None defined

See also: Assign Replica Target.

7.1.11 *Create an on-demand snapshot of a Volume*

Summary: Create an on-demand snapshot of a volume

Purpose: Create a snapshot of an existing volume. The resulting snapshot can then be used either as a backup or as a separate copy to test against.

Who: CloudAdmin, StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need an on-demand snapshot of a Volume

Detailed Context: To take a snapshot of a volume, we need to find a DataProtection-LineOfService that can describe the new Snapshot.

The DataProtectionLineOfService must have no schedule set to be able to provide on-demand behavior.

Preconditions: None.

Feature(s): Class of Service

Inputs:

- URL for storage service: /redfish/v1/StorageServices/1
- URL for the volume: /redfish/v1/StorageServices/1/StoragePools/BasePool/AllocatedVolumes/1

Basic Course of Events:

1. The first step is to get the current supported DataProtectionLineOfService entries, and find one that provides appropriate snapshot support (i.e., has no schedule set, and meets any other criteria the client may have).

Request:

```
GET /redfish/v1/StorageServices/1/Links/DataProtectionLoSCapabilities/SupportedLinesOfService
```

- **Headers:**
No additional headers required.
- **Body:**
None

Response:

- **HTTP Status:** 200 (Success)

- **Headers:**

Content-type : application/json

- **Body:**

```
{
  "SupportedLinesOfService": [
    {
      "@odata.id": "/redfish/v1/StorageServices/1/Links/DataProtectionLoSCapabilities/SupportedLinesOfService/OnDemandSnapshot",
      "Name": "OnDemandSnapshot",
      "RecoveryGeographicObjective": "Server",
      "ReplicaType": "Snapshot",
    }
  ]
}
```

2. This looks like the right line of service for an on-demand snap. Note that since this is an on-demand snapshot, it has no schedule specified. So, let's use this to create the snapshot. We'll copy by value.

Request:

POST /redfish/v1/StorageServices/1/Links/DataProtectionLoSCapabilities/SupportedLinesOfService/OnDemandSnapshot.CreateReplicas

- **Headers:**

Content-type : application/json

- **Body:**

```
{
  "ReplicaRequests": [{
    "ReplicaSource": {"@odata.id": "/redfish/v1/StorageServices/1/StoragePools/BasePool/AllocatedVolumes/1"},
    "ReplicaName": "MySnapshot"
  }]
}
```

Response:

- **HTTP Status:** 200 (Success)
- **Headers:** Content-type : application/json

- **Body:**

```
[ {
  "ReplicaPriority": "Same",
  "ReplicaReadOnlyAccess": "ReplicaElement",
  "UndiscoveredElement": null,
  "WhenSynced": "20171024T142000-00500",
  "SyncMaintained": null,
  "ReplicaRecoveryMode": null,
  "ReplicaUpdateMode": "Synchronous",
  "PercentSynced": 100,
  "FailedCopyStopsHostIO": null,
  "WhenActivated": "20171024T142000-00500",
  "WhenDeactivated": null,
  "WhenEstablished": "20171024T142000-00500",
  "WhenSuspended": null,
  "WhenSynchronized": null,
  "ReplicaSkewBytes": null,
  "ReplicaType": "Snapshot",
  "ReplicaProgressStatus": "Completed",
  "ReplicaState": "Synchronized",
  "ConsistencyEnabled": false,
  "ConsistencyType": null,
  "ConsistencyState": null,
  "ConsistencyStatus": null,
  "ReplicaRole": "Target",
  "Replica": {"odata.id": "/redfish/v1/StorageServices/1/StoragePools/BasePool/AllocatedVolumes/MySnapshot"},
  "DataProtectionLineOfService": "/redfish/v1/StorageServices/1/Links/DataProtectionLoScapabilities/SupportedLinesOfService/"}
]
```

Postconditions:

The original Volume (/redfish/v1/StorageServices/1/StoragePools/BasePool/AllocatedVolumes/1) now has a snapshot volume (/redfish/v1/StorageServices/1/StoragePools/BasePool/AllocatedVolumes/MySnapshot) that is available through its ReplicaTargets collection. All replication information (ReplicaInfo) is available on the snapshot (/redfish/v1/StorageServices/1/Volumes/MySnapshot) volume to describe the relationship.

Failure Scenario:

None defined.

See also:

None defined.

7.1.12 Create class of service

Summary: Create a class of service

Purpose: Create a new class of service in the service catalog to match a newly available type of storage

Who: StorageAdmin

Management Domain: Block storage management, Service catalog management

Triggers: The administrator has determined that a new class of service needs to be created to reflect a new class of SSD storage in the infrastructure.

Detailed Context: This is a simple scenario where the primary characteristic is the enhanced performance available from SSD drives.

Preconditions: None defined.

Feature(s): Class of Service

Inputs:

- URL for Storage Service: `/redfish/v1/StorageServices(1)`
- New class of service characteristics
 - Name: "SSD"
 - Description: "Minimal SSD class of service."
 - IOPerformanceLineOfService
 - * "Name": "SSDLoS"
 - * "IOOperationsPerSecondIsLimited": false
 - * "MaxIOOperationsPerSecondPerTerabyte": 100000
 - * "AverageIOOperationLatencyMicroseconds": 10

Basic Course of Events:

1. Create ClassOfService

Request: `POST /redfish/v1/StorageServices(1)/ClassesOfService/Members`

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "Name": "SSD",
  "Description": "Minimal SSD class of service.",
```

```
"LinesOfService": {
  "IOPerformanceLinesOfService": [ {
    "Name": "SSDLos",
    "I0operationsPerSecondIsLimited": false,
    "MaxI0operationsPerSecondPerTerabyte": 100000,
    "AverageI0operationLatencyMicroseconds": 10
  ]
}
```

Response:

- **HTTP Status:** 201 (Created)
- **Headers:**

Location : /redfish/v1/StorageServices(1)/ClassesOfService(SSD)

Postconditions: The requested class of service is added to the ClassesOfService collection.

Failure Scenario: None defined.

See also: None defined.

7.1.13 Create file share

Summary: Create a file share

Purpose: Share an existing file system as /Shares/MyShare

Who: CloudAdmin, StorageAdmin, DevOps

Management Domain: File system storage management

Triggers: None defined.

Detailed Context: Create a share starting at /Shares/MyShare.

Preconditions: None defined.

Feature(s): File provisioning

Inputs:

- URL for the filesystem: /redfish/v1/StorageServices/1/FileSystems/QuickFiles
- The path to the shared file: "/Shares/MyShare"
- Description: "Share of files under MyShare."

Basic Course of Events:

1. Create a file share

Request:

POST /redfish/v1/StorageServices/1/FileSystems/QuickFiles/ExportedShares

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "Name" : "MyShare",
  "Description" : "Share of files under MyShare.",
  "SharedFilePath" : "/Shares/MyShare"
}
```

Response:

- **HTTP Status:** 201 (Created)
- **Headers:**

Location : /redfish/v1/StorageServices/1/FileSystems/QuickFiles/ExportedShares/MyShare
Content-type : application/json

- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2015-2021 SNIA. All rights reserved.",
  "@odata.id": "/redfish/v1/StorageServices/1/FileSystems/QuickFiles/ExportedShares/MyShare",
  "@odata.type": "#FileShare.v1_0_0.FileShare",
  "Id": "MyShare",
  "Name": "MyShare",
  "Description": "My File Share.",
  "FileSharePath": "/Shares/MyShare",
  "FileSharingProtocols": [
    "SMBv3_1_1"
  ],
  "Status": {
    "State": "Enabled",
    "Health": "OK",
    "HealthRollup": "OK"
  },
  "DefaultAccessCapabilities": [
    "Read",
    "Write",
    "Execute"
  ],
  "ExecuteSupport": true,
  "RootAccess": true,
  "CASupported": true,
  "EthernetInterfaces": {
    "@odata.id": "/redfish/v1/Systems/FileServer/EthernetInterfaces/1"
  },
  "Links": {
    "FileSystem": {
      "@odata.id": "/redfish/v1/StorageServices/1/FileSystems/QuickFiles"
    }
  }
}
```

Postconditions: The requested file share is added to the ExportedShares collection for the file system.

Failure Scenario: None defined.

See also: None defined.

7.1.14 Create file system

Summary: Create a file system

Purpose: Create a file system with a given capacity and performance level.

Who: StorageAdmin

Management Domain: File system storage management

Triggers: None defined.

Detailed Context: Create a 100 TB file system based on SSD class storage.

Preconditions: None defined.

Feature(s): Class of Service

Inputs:

- URL for storage service: /redfish/v1/StorageServices/1
- Name for the new file system: "QuickFiles"
- Description: "100 TB FileSystem having SSD class storage."
- URL for class of service: /redfish/v1/StorageServices/1/Links/ClassesOfService/SSD
- File system capacity:

```
{
  "Data":
  {
    "ProvisionedBytes": 100000000000000,
    "IsThinProvisioned": true
  }
}
```

Basic Course of Events:

1. Create FileSystem

Request: POST /redfish/v1/StorageServices/1/FileSystems

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "Name": "QuickFiles",
  "Description": "100 TB FileSystem having SSD class storage.",
}
```

```
"Capacity": {
  "Data": {
    "ProvisionedBytes": 1000000000000000
  },
  "IsThinProvisioned": true
},
"Links" : {
  "ClassOfService": {"odata.id":
    "/redfish/v1/StorageServices/1/Links/ClassesOfService/SSD"}
}
}
```

Response:

- **HTTP Status:** 201 (Created)

- **Headers:**

Location : /redfish/v1/StorageServices/1/FileSystems/QuickFiles

Postconditions: The requested file system is added to the FileSystems collection for the Storage Service.

Failure Scenario: None defined.

See also: None defined.

7.1.15 Create file system

Summary: Create a file system

Purpose: Create a file system with a given capacity and performance level.

Who: StorageAdmin

Management Domain: File system storage management

Triggers: None defined.

Detailed Context: Create a 100 TB file system based on SSD class storage.

Preconditions: None defined.

Feature(s): File provisioning

Inputs:

- URL for storage service: /redfish/v1/StorageServices/1
- Name for the new file system: "QuickFiles"
- Description: "100 TB FileSystem having SSD class storage."
- URL for class of service: /redfish/v1/StorageServices/1/Links/ClassesOfService/SSD
- File system capacity:

```
{
  "Data":
  {
    "ProvisionedBytes": 100000000000000;
    "IsThinProvisioned": true;
  }
}
```

Basic Course of Events:

1. Create FileSystem

Request: POST /redfish/v1/StorageServices/1/FileSystems

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "Name": "QuickFiles",
  "Description": "100 TB FileSystem having SSD class storage.",
  "Capacity": {
```



```

        "Data": {
            "ProvisionedBytes": 1000000000000000
        },
        "IsThinProvisioned": true
    },
    "Links" : {
        "ClassOfService": {"odata.id":
            "/redfish/v1/StorageServices/1/Links/ClassesOfService/SSD"}
    }
}

```

Response:

- **HTTP Status:** 201 (Created)

- **Headers:**

Location : /redfish/v1/StorageServices/1/FileSystems/QuickFiles

Content-type : application/json

- **Body:**

```

{
  "@Redfish.Copyright": "Copyright 2015-2022 SNIA. All rights reserved.",
  "@odata.id":
  ↪ "/redfish/v1/StorageServices/FileService/FileSystems/QuickFiles",
  "@odata.type": "#FileSystem.v1_1_0.FileSystem",
  "Id": "QuickFiles",
  "Name": "QuickFiles",
  "Description": "QuickFiles FileSystem, not replicated.",
  "BlockSizeBytes": 8192,
  "Capacity": {
    "Data": {
      "ConsumedBytes": 0
      "AllocatedBytes": 0
      "ProvisionedBytes": 1000000000000000
    },
    "Metadata": {
      "ConsumedBytes": 0,
      "AllocatedBytes": 0,
      "ProvisionedBytes": 0
    },
    "Snapshot": {
      "ConsumedBytes": 0,
      "AllocatedBytes": 0,

```

```
        "ProvisionedBytes": 0
    }
},
"CapacitySources": [
    {
        "@odata.id": "/red-
↪ fish/v1/StorageServices/FileService/FileSystems/QuickFiles/CapacitySources/Source1"
    }
],
"LowSpaceWarningThresholdPercents": [
    60,
    90
],
"AccessCapabilities": [
    "Read",
    "Write"
],
"CaseSensitive": false,
"CasePreserved": false,
"CharacterCodeSet": [
    "ASCII",
    "Unicode"
],
"MaxFileNameLengthBytes": 256,
"ClusterSizeBytes": 256,
"Links": {
    "ClassOfService": {
        "@odata.id": "/red-
↪ fish/v1/StorageServices/FileService/ClassesOfService/GoldDallas"
    }
}
}
```

Postconditions: The requested file system is added to the FileSystems collection for the Storage Service.

Failure Scenario: None defined.

See also: None defined.

7.1.16 Create line of service

Summary: Create a line of service to reflect the performance characteristics of SSD storage

Purpose: The definition is created here in preparation of creating ClassOfService instances that include a requirement for SSD storage performance.

Who: StorageAdmin

Management Domain: Block storage management, Service catalog management

Triggers: None defined.

Detailed Context: SSD storage is introduced and need a new performance line of service to reflect their capability.

Preconditions: None defined.

Feature(s): Class of Service

Inputs:

- URL for Storage Service: /redfish/v1/StorageServices/1
- New IO performance line of service

```
{
  "Name": "NewSSDLoS",
  "IoOperationsPerSecondIsLimitedBoolean": false,
  "MaxIoOperationsPerSecondPerTerabyte": 100000,
  "AverageIoOperationLatencyMicroseconds": 10
}
```

Basic Course of Events:

1. Get existing supported lines of service

Request:

GET /redfish/v1/StorageServices/1/Links/IOPerformanceLoSCapabilities/
SupportedIOPerformanceLinesOfService

- **Headers:** No additional headers required.

Response:

- **HTTP Status:** 200 (OK)

- **Headers:**

Etag: "123-a" Content-type : application/json

- **Body:**

```
{
  "Value": [{
    "Name": "LoS1",
    "IoOperationsPerSecondIsLimitedBoolean": false,
    "SamplePeriodSeconds": 60,
    "MaxIoOperationsPerSecondPerTerabyte": 83,
    "AverageIoOperationLatencyMicroseconds": 8000,
  },
  {
    "Name": "LoS2",
    "IoOperationsPerSecondIsLimitedBoolean": "false",
    "SamplePeriodSeconds": 60,
    "MaxIoOperationsPerSecondPerTerabyte": 133,
    "AverageIoOperationLatencyMicroseconds": 5000,
    "IOWorkload": {
      "Name": "Duplicon: OLTP"
    }
  }
  ]
}
```

2. Create new line of service

Request:

PATCH /redfish/v1/StorageServices/1/Links/IOPerformanceLoSCapabilities

- **Headers:**

If-Match: "123-a" Content-type : application/json

- **Body:**

```
{
  "SupportedIOPerformanceLinesOfService": [{
    "Name": "LoS1",
    "IoOperationsPerSecondIsLimitedBoolean": false,
    "SamplePeriodSeconds": 60,
    "MaxIoOperationsPerSecondPerTerabyte": 83,
    "AverageIoOperationLatencyMicroseconds": 8000
  },
  {
```

```
    "Name": "LoS2",
    "IoOperationsPerSecondIsLimitedBoolean": "false",
    "SamplePeriodSeconds": 60,
    "MaxIoOperationsPerSecondPerTerabyte": 133,
    "AverageIoOperationLatencyMicroseconds": 5000,
    "IOWorkload": {
      "Name": "Duplicon: OLTP"
    }
  },
  {
    "Name": "NewSSDLoS",
    "IoOperationsPerSecondIsLimitedBoolean": "false",
    "MaxIoOperationsPerSecondPerTerabyte": 100000,
    "AverageIoOperationLatencyMicroseconds": 10
  }
]
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** None defined.
- **Body:** None defined.

Postconditions: The requested line of service is added to the SupportedIOPerformanceLinesOfService of the Storage Service.

Failure Scenario: None defined.

See also: None defined.

7.1.17 Create storage pool and specify a pool type

Summary: Create a StoragePool and select SupportedPoolTypes

Purpose: In addition to creating a StoragePool, this query sets a value for the optional property SupportedPoolTypes.

Who: StorageAdmin

Management Domain: Block storage management

Triggers: Users need to allocate storage.

Detailed Context: Create a storage pool containing an amount of storage that can be used to create volumes. In this case, the query includes a value for Supported-PoolTypes, which can only be set by a client during pool creation.

Preconditions: The user has the information about the set of drives.

Feature(s): None.

Inputs:

- URL for storage pool collection:
 - /redfish/v1/Storage/1/StoragePools
 - Alternate: /redfish/v1/StorageServices/1/StoragePools
- Name for the new storage pool: "Storage Pool 1"
- Id for the new storage pool: "SP1"
- Description: "Storage Pool for block storage"
- Set of Drives, and additional parameter to indicate supported pool type(s):

```
{
  "Drives": [
    {"odata.id": "/redfish/v1/Chassis/1/Drives/1"}
  ],
  "SupportedPoolTypes": [ "Block" ]
}
```

Basic Course of Events:

1. Create StoragePool

Request: POST /redfish/v1/Storage/1/StoragePools/

- **Headers:** No additional headers required.

- **Body:**

```
{
  "Name": "Storage Pool 1",
  "Id": "SP1",
  "Description": "Storage Pool for block storage",
  "Drives": [
    {"odata.id": "/redfish/v1/Chassis/1/Drives/1"}
  ],
  "SupportedPoolTypes": [
    "Block"
  ]
}
```

Response:

- **HTTP Status:** 201 (Created)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/SP1
- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2015-2022 SNIA. All rights
  ↪ reserved.",
  "@odata.id": "/redfish/v1/Storage/1/StoragePools/SP1",
  "@odata.type": "#StoragePool.v1_6_0.StoragePool",
  "Id": "SP1",
  "Name": "SSD",
  "Description": "Storage Pool 1",
  "RemainingCapacityPercent": 100,
  "Capacity": {
    "Data": {
      "AllocatedBytes": 600135780272,
      "ConsumedBytes": 0
    }
  },
  "CapacitySources": [
    {
      "@odata.id": "/red-
      ↪ fish/v1/Storage/1/StoragePools/SP1/CapacitySources/Source1"
    }
  ],
  "Links": {
    "OwningStorageResource": {
      "@odata.id": "/redfish/v1//Storage/1"
    }
  }
}
```

```
    }  
  }  
}
```

Post-Conditions: The requested StoragePool is added to the collection for Storage.

Failure Scenario: None defined.

See also: Create storage pool using specified set of drives

7.1.18 Create storage pool using Specified Set of Drives and RAIDTypes

Summary: Create a StoragePool

Purpose: Create a StoragePool using a specified set of drives and a specified set of supported RAIDTypes

Who: StorageAdmin

Management Domain: Block storage management

Triggers: Users need to allocate storage.

Detailed Context: Create a storage pool containing an amount of storage that can be used to create volumes with the specified set of RAIDTypes. This use case expects that the implementation will automatically create the CapacitySource object specified as part of the StoragePool object creation process.

Preconditions: The user has the information about the set of drives. These will be used to create a new CapacitySource named "CapacitySource1".

Feature(s): None.

Inputs:

- URL for storage pool collection:

- /redfish/v1/Storage/1/StoragePools

- Name for the new storage pool: "SSD"

- Description: "SSD Storage Pool"

- Set of Drives:

```
“json { “CapacitySource1”: [{ “ProvidingDrives”: [ {“odata.id”: “/redfish/v1/Storage/1/Drive/1”}, {“odata.id”: “/redfish/v1/Storage/1/Drive/2”}, {“odata.id”: “/redfish/v1/Storage/1/Drive/3”}, {“odata.id”: “/redfish/v1/Storage/1/Drive/4”}, {“odata.id”: “/redfish/v1/Storage/1/Drive/5”}, {“odata.id”: “/redfish/v1/Storage/1/Drive/6”}, {“odata.id”: “/redfish/v1/Storage/1/Drive/7”}, {“odata.id”: “/redfish/v1/Storage/1/Drive/8”} ]}] }
```

- Set of Supported RAIDTypes:

```
```json
{
 "SupportedRAIDTypes": ["RAID1", "RAID5", "RAID50"]
}
```

```

}
...

```

**\*\*Basic Course of Events:\*\***

#### 1. Create StoragePool

**\*\*Request:\*\*** `POST /redfish/v1/Storage/1/StoragePools/`

- **\*\*Headers:\*\*** No additional headers required.

- **\*\*Body:\*\***

```json

```

{
  "Name": "SSD",
  "Description": "Storage Pool for RAID1, 5 or 50.",
  "RAIDTypes": ["RAID1", "RAID5", "RAID50"],
  "CapacitySource1": [{
    "ProvidingDrives": [
      {"odata.id": "/redfish/v1/Storage/1/Drive/1"},
      {"odata.id": "/redfish/v1/Storage/1/Drive/2"},
      {"odata.id": "/redfish/v1/Storage/1/Drive/3"},
      {"odata.id": "/redfish/v1/Storage/1/Drive/4"},
      {"odata.id": "/redfish/v1/Storage/1/Drive/5"},
      {"odata.id": "/redfish/v1/Storage/1/Drive/6"},
      {"odata.id": "/redfish/v1/Storage/1/Drive/7"},
      {"odata.id": "/redfish/v1/Storage/1/Drive/8"}
    ]
  }]
}

```

Response:

- **HTTP Status:** 201 (Created)
- **Headers:** Location : redfish/v1/Storage/1/StoragePools/SP111
- **Body:**

```

{
  "@Redfish.Copyright": "Copyright 2015-2022 SNIA. All rights reserved.",

```

```
"@odata.id": "/redfish/v1/Storage/1/StoragePools/SP111",
"@odata.type": "#StoragePool.v1_6_0.StoragePool",
"Id": "SP111",
"Name": "SSD",
"Description": "Storage Pool for RAID1, 5 or 50.",
"SupportedRAIDTypes": [
  "RAID1",
  "RAID5",
  "RAID50"
],
"RemainingCapacityPercent": 100,
"Capacity": {
  "Data": {
    "AllocatedBytes": 600135780272,
    "ConsumedBytes": 0
  }
},
"CapacitySources": [
  {
    "@odata.id": "/red-
    ↪ fish/v1/Storage/1/StoragePools/SP111/CapacitySources/CapacitySource1"
  }
],
"Links": {
  "OwningStorageResource": {
    "@odata.id": "/redfish/v1//Storage/1"
  }
}
}
```

Post-Conditions: The requested StoragePool is added to the collection for Storage.

Failure Scenario: None defined.

See also: None defined.

7.1.19 Create storage pool using specified set of drives

Summary: Create a StoragePool

Purpose: Create a StoragePool using a specified set of drives

Who: StorageAdmin

Management Domain: Block storage management

Triggers: Users need to allocate storage.

Detailed Context: Create a storage pool containing an amount of storage that can be used to create volumes with the specified set of RAIDTypes.

Preconditions: The user has the information about the set of drives.

Feature(s): None.

Inputs:

- URL for storage pool collection:
 - NSB: /redfish/v1/Storage/1/StoragePool
 - (Also applicable to SB: /redfish/v1/StorageServices/1/StoragePool)
- Name for the new storage pool: "SP1"
- Description: "Storage Pool 1"
- Set of Drives:

```
{
  "Drives": [
    {"odata.id": "/redfish/v1/Storage/1/Drive/1"}
  ]
}
```

Basic Course of Events:

1. Create StoragePool

Request: POST /redfish/v1/Storage/1/StoragePools/

- **Headers:** No additional headers required.
- **Body:**

```
{
  "Name": "SSD",
```

```
    "Description": "Storage Pool 1",
    "Drives": [
      {"odata.id": "/redfish/v1/Storage/1/Drive/1"}
    ]
  }
}
```

Response:

- **HTTP Status:** 201 (Created)

- **Headers:**

Location : /redfish/v1/Storage/1/StoragePools/SP111

- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2015-2022 SNIA. All rights
  ↪ reserved.",
  "@odata.id": "/redfish/v1/Storage/1/StoragePools/SP111",
  "@odata.type": "#StoragePool.v1_6_0.StoragePool",
  "Id": "SP111",
  "Name": "SSD",
  "Description": "Storage Pool 1",
  "RemainingCapacityPercent": 100,
  "Capacity": {
    "Data": {
      "AllocatedBytes": 600135780272,
      "ConsumedBytes": 0
    }
  },
  "CapacitySources": [
    {
      "@odata.id": "/red-
      ↪ fish/v1/Storage/1/StoragePools/SP111/CapacitySources/Source1"
    }
  ],
  "Links": {
    "OwningStorageResource": {
      "@odata.id": "/redfish/v1//Storage/1"
    }
  }
}
```

Post-Conditions: The requested StoragePool is added to the collection for Storage.

Failure Scenario: None defined.

See also: None defined.

7.1.20 Create storage pool

Summary: Create a StoragePool

Purpose: Create a StoragePool

Who: StorageAdmin

Management Domain: Block storage management

Triggers: Users need to allocate storage with characteristics satisfied by a class of service.

Detailed Context: Create a storage pool containing an amount of storage that can be used to create a requested class of service. The storage pool implementation will attempt to find and allocate enough storage that will satisfy the request. No metadata or snapshot storage is reserved.

Preconditions: None defined.

Feature(s): Class of Service

Inputs:

- URL for storage service: /redfish/v1/StorageServices/1
- Name for the new storage pool: "SSD"
- Description: "100 TB pool of SSD class storage."
- URL for class of service: /redfish/v1/StorageServices/1/ClassesOfService/SSD
- Storage pool capacity

```
{
  "Data": {
    "ProvisionedBytes": 1000000000000000,
    "IsThinProvisioned": false
  }
}
```

Basic Course of Events:

1. Create StoragePool

Request: POST /redfish/v1/StorageServices/1/StoragePools/Members

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "Name": "SSD",
  "Description": "100 TB pool of SSD class storage.",
  "Capacity": {
    "Data": {
      "ProvisionedBytes": 1000000000000000
    },
    "IsThinProvisioned": false
  },
  "ClassesOfService": {
    "Members": [{
      "@odata.id":
        ↪ "/redfish/v1/StorageServices/1/ClassesOfService/SSD"
    }]
  }
}
```

Response:

- **HTTP Status:** 201 (Created)
- **Headers:**

Location : redfish/v1/StorageServices/1/StoragePools/SSD

Post-Conditions: The requested StoragePool is added to the collection for the Storage Service.

Failure Scenario: None defined.

See also: None defined.

7.1.21 Create StorageGroup

Summary: Create a StorageGroup

Purpose: Create a StorageGroup

Who: CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: Create a collection of application storage that is exposed to an application and managed as a unit.

Preconditions: None defined.

Feature(s): Mapping and masking

Inputs:

- URL for storage service: `/redfish/v1/StorageService`
- The proposed name of the new StorageGroup (string): "HillofBeans1"
- A description of the new StorageGroup (string): "New storage group to support accounting"
- A consistency requirement for the new StorageGroup (boolean). When TRUE, all copies of data within a StorageGroup must be kept in sync: `true`

Basic Course of Events:

1. Create StorageGroup

Request:

POST `/redfish/v1/StorageService/StorageGroups/Members`

- **Headers:** `Content-type : application/json``

- **Body:**

```
```json
{
 "Name" : "HillofBeans1",
 "Description" : "New storage group to support accounting",
 "MembersAreConsistent" : true
}
```
```

Response:

- **HTTP Status:** 204 (No Content)

Postconditions: The requested StorageGroup is added to the Members collection for the Storage Service.

Failure Scenario: None defined.

See also: None defined.

7.1.22 Create Volume from an Existing Storage Pool

Summary: Create a new Volume from a Storage Pool.

Purpose: Create a new volume, with a specified capacity, from a previously created StoragePool.

Who: CloudAdmin, StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to allocate storage for a new application.

Detailed Context: The admin needs to satisfy a user or application request to provide a given amount of capacity with a specified RAIDType, and wants to leverage a preconfigured Storage Pool.

Preconditions: User has already selected a Pool and checked the supported RAIDType properties.

Feature(s): Block provisioning

Inputs:

- URL for Storage Pool: /redfish/v1/Storage/1/StoragePools/PrimaryPool
- Requested volume size in bytes (1 TiB, here): 1099511627776
- Requested name of volume: "MyVolume"
- RAIDType: RAID1

Basic Course of Events:

1. Post the definition of the new volume to the Volumes resource collection.

This instructs the service to use the identified StoragePool to allocate a new volume of the requested size that meets the requirements of the specified protection level. Since additional details are not provided, the service will rely on default values as required.

Request:

POST /redfish/v1/Storage/1/StoragePools/PrimaryPool

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "Name" : "MyVolume",
  "CapacityBytes" : 1099511627776,
  "RAIDType" : "RAID1"
}
```

Response: Response contains the details of the created volume.

- **HTTP Status:** 201 (Created)

- **Headers:**

Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1

Content-type : application/json

- **Body:**

```
{
  "@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights
  ↪ reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id": "/redfish/v1/Storage/1/Volumes/1",
  "@odata.type": "#Volume_1_6_0.Volume",
  "Name": "MyVolume",
  "Id": "1",
  "Description": "Default Volume Description",
  "RAIDType": "RAID1",
  "Identifiers": [
    {
      "DurableNameFormat": "NAA",
      "DurableName": "65456765456761001234076100123487"
    }
  ],
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "CapacityBytes": 1099511627776,
  "Links": {
    "StoragePool": "/redfish/v1/Storage/1/StoragePools/1"
  }
}
```

Postconditions: The selected volume is added to the AllocatedVolumes collection within the selected storage pool.

Failure Scenario: None defined

See also: None defined.

7.1.23 Create Volume specifying Class of Service

Summary: Create a Volume

Purpose: Create a Volume with a known capacity and class of service.

Who: CloudAdmin, StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to allocate storage for a new application.

Detailed Context: The admin needs to satisfy a service request to provide a given amount of storage to an application, and to assure a given class of service.

Preconditions: None.

Feature(s): Class of Service

Inputs:

- URL for Storage Service: `/redfish/v1/StorageServices/1`
- Requested volume size in bytes (for 1TiB in this example): `1099511627776`
- URL for requested class of service:
`/redfish/v1/StorageServices/1/ClassesofService/BostonBunker`
- Requested name of volume (string): `"Snapshot1"`

Basic Course of Events:

1. Post the definition of the new volume to the Volumes resource collection.

This instructs the service to allocate a new volume of the requested size that meets the requirements of the specified class of service. Since additional details are not provided, the service is free to allocate the storage from any of its storage pools that can satisfy the request.

Request: `POST /redfish/v1/StorageServices/1/Volumes/Members`

- **Headers:** `Content-type : application/json`
- **Body:**

```
{
  "Name": "Snapshot1",
  "CapacityBytes": 1099511627776,
  "Links": {
    "ClassOfService": {"odata.id":
```

```
"/redfish/v1/StorageServices/1/ClassesofService/BostonBunker"}
}
}
```

Response:

- **HTTP Status:** 201 (Created)
- **Headers:**

Location : /redfish/v1/StorageServices/1/Volumes/3 Content-type : application/json

- **Body:**

```
{
  "@@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights
  reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id": "/redfish/v1/StorageServices/1/Volumes/3",
  "@odata.type": "#Volume_1_0_0.Volume",
  "Name": "Snapshot1",
  "Id": "3",
  "Description": "",
  "Identifiers": [
    {
      "DurableNameFormat": "NAA6",
      "DurableName": "65456765456761001234076100123487"
    }
  ],
  "Manufacturer": "SuperDuperSSD",
  "Model": "Drive Model string",
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "AccessCapabilities": [
    "Read",
    "Write",
    "Append",
    "Streaming"
  ],
  "BlockSizeBytes": 512,
  "CapacitySources": [
    {
```

```

    "ConsumedBytes": 0,
    "AllocatedBytes": 10737418240,
    "GuaranteedBytes": 536870912,
    "ProvisionedBytes": 1099511627776,
    "Links": {
      "ClassOfService": {
        "@odata.id": "/redfish/v1/StorageServices/1/Links/ClassesOfService/SilverBoston"
      },
      "ProvidingPool": {
        "@odata.id": "/redfish/v1/StorageServices/1/StoragePools/SpecialPool"
      }
    }
  ]],
  "CapacityBytes": 1099511627776,
  "Capacity": {
    "Data": {
      "ConsumedBytes": 0,
      "AllocatedBytes": 10737418240,
      "GuaranteedBytes": 1099511627776,
      "ProvisionedBytes": 1099511627776
    },
    "Metadata": {
      "ConsumedBytes": 536870912,
      "AllocatedBytes": 536870912
    }
  },
  "Links": {
    "ClassOfService": {
      "@odata.id": "/redfish/v1/StorageServices/1/Links/ClassesOfService/BostonBunker"
    }
  }
}

```

Postconditions: The selected volumes are added to the collection for the Storage Group.

Failure Scenario: None defined

See also: None defined.

7.1.24 Create Volume using Default Class of Service

Summary: Create a Volume using the Default Class of Service

Purpose: Create a Volume with a known capacity and without specifying the class of service, invoking the DefaultClassOfService.

Who: CloudAdmin, StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to allocate storage for a new application.

Detailed Context: The admin needs to satisfy a service request to provide a given amount of storage to an application, but does not specify a given class of service. The system will attempt to provision the system with the specified ClassOfService in DefaultClassOfService in either the given StoragePool or the StorageService as available.

Preconditions: The DefaultClassOfService property is set in either the StoragePool or StorageService.

Feature(s): Class of Service

Inputs:

- URL for Storage Service: `/redfish/v1/StorageServices/1`
- Requested volume size in bytes (for 1 TiB, here) : `1099511627776`
- Requested name of volume: `"Snapshot1"`

Basic Course of Events:

1. Post the definition of the new volume to the Volumes resource collection.

This instructs the service to allocate a new volume of the requested size that meets the requirements of the specified class of service. Since additional details are not provided, the service is free to allocate the storage from any of its storage pools that can satisfy the request.

Request: `POST /redfish/v1/StorageServices/1/Volumes`

- **Headers:** `Content-type : application/json`
- **Body:**

```
{
  "Name": "Snapshot1",
  "CapacityBytes": 1099511627776
}
```


Response:

- **HTTP Status:** 201 (Created)

- **Headers:**

Location : /redfish/v1/StorageServices/1/Volumes/3 Content-type : application/json

- **Body:**

```
```json
{
 "@SSM.Copyright": "Copyright (c) 2014-2022 SNIA. All rights reserved.",
 "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
 "@odata.id": "/redfish/v1/StorageServices/1/Volumes/3",
 "@odata.type": "#Volume_1_0_0.Volume",
 "Name": "Snapshot1",
 "Id": "3",
 "Description": "",
 "Identifiers": [
 {
 "DurableNameFormat": "NAA6",
 "DurableName": "65456765456761001234076100123487"
 }
],
 "Manufacturer": "SuperDuperSSD",
 "Model": "Drive Model string",
 "Status": {
 "State": "Enabled",
 "Health": "OK"
 },
 "AccessCapabilities": [
 "Read",
 "Write",
 "Append",
 "Streaming"
],
 "BlockSizeBytes": 512,
 "CapacitySources": [{
```

```
“ConsumedBytes”: 0,
“AllocatedBytes”: 10737418240,
“GuaranteedBytes”: 536870912,
“ProvisionedBytes”: 1099511627776,
“Links”: {
“ClassOfService”: {
“@odata.id”: “/redfish/v1/StorageServices/1/Links/ClassesOfService/SilverBoston”},
“ProvidingPool”: {
“@odata.id”: “/redfish/v1/StorageServices/1/StoragePools/SpecialPool”
}
}
}],
“Capacity”: {
“Data”: {
“ConsumedBytes”: 0,
“AllocatedBytes”: 10737418240,
“GuaranteedBytes”: 1099511627776,
“ProvisionedBytes”: 1099511627776
},
“Metadata”: {
“ConsumedBytes”: 536870912,
“AllocatedBytes”: 536870912
}
},
“Links”: {
“ClassofService”: {
“@odata.id”: “/redfish/v1/StorageServices/1/Links/ClassesofService/BostonBunker”
}
}
}
```

**\*\*Postconditions:\*\*** The selected volumes are added to the collection for the Storage Group.

**\*\*Failure Scenario:\*\*** None defined

**\*\*See also:\*\*** None defined.

\pagebreak

### \_Delete Multiple Drives from an Existing Storage Pool\_

\*\*Summary:\*\* Delete multiple drives from an Storage Pool.

\*\*Purpose:\*\* Remove multiple drives from a Storage Pool

\*\*Who:\*\* [StorageAdmin](#storageadmin)

\*\*Management Domain:\*\* [Block storage management](#blockstoragemanagementdomain)

\*\*Triggers:\*\* Re-assign resources in a pool; this could be performance, capacity or applicati

\*\*Detailed Context:\*\* The storage admin needs to decrease the underlying available capacity w

- The implementation manages, or does not have any, constraints on the removal of multiple

\*\*Preconditions:\*\* User has already selected a Pool, and the Drives to be removed.

\*\*Feature(s):\*\* [Block provisioning](#block-provisioning-feature)

\*\*Inputs:\*\*

- URL for Storage Pool: `~/redfish/v1/Storage/1/StoragePools/PrimaryPool``
- Drives to remove: ``[{"@odata.id": /redfish/v1/Chassis/1/Drives/1}, {"@odata.id": /redfish`

\*\*Basic Course of Events:\*\*

1. Use the "RemoveDrives" Action on the ``PrimaryPool`` storage pool, passing the selected dri

\*\*Request:\*\*

`~POST /redfish/v1/Storage/1/StoragePools/PrimaryPool.RemoveDrives``

- \*\*Headers:\*\* `~Content-type : application/json``

- \*\*Body:\*\*

`````json`

```
{
  "Drives" : [
    {"@odata.id": "/redfish/v1/Chassis/1/Drives/1"},
    {"@odata.id": "/redfish/v1/Chassis/1/Drives/2"}
  ]
}
```

Response: Response is dependent on implementation's capability.

If the implementation is able to return immediately:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool
- **Body:** None.

If the implementation requires a background task (using the Redfish task service) to return status:

- **HTTP Status:** 202 (Accepted)
- **Headers:** Location : /redfish/v1/TaskService/Tasks/TaskID2
- **Body:** None.

Postconditions: The identified drives have been removed from a capacity source used by the selected storage pool.

Failure Scenario: None defined

See also: None defined.

7.1.25 *Deprovision a Namespace*

Summary: Deprovision a Namespace

Purpose: Deprovision (delete) a Namespace that is no longer needed.

Who: StorageAdmin CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: Delete the namespace and free resources reserved for it. This can happen regardless of the controller attachment state of the namespace.

Preconditions: None defined.

Feature(s): NVMe

Inputs:

- URL for the namespace, either within the containing NVM set (a storage pool) or directly from the containing subsystem.

Basic Course of Events:

1. Delete the Namespace.

Request:

...

```
DELETE /redfish/v1/Systems/Sys-1/Storage/SimplestNVMeSSD/Volumes/  
SimpleNamespace
```

- ****Headers:**** No additional headers required.

- ****Body:**** None defined.

****Response:****

- ****HTTP Status:**** 204 (No Content)

- ****Headers:**** No additional headers required.

- ****Body:**** None defined.

****Postconditions:**** The requested namespace has been deprovisioned.

****Failure Scenario:**** None defined.

****See also:**** None defined.

\pagebreak

Detach a Namespace

****Summary:**** Detach a Namespace

****Purpose:**** Remove visibility to a namespace by detaching it from an IO Controller.

****Who:**** [StorageAdmin](#storageadmin "StorageAdmin") [CloudAdmin](#cloudadmin "CloudAdmin")

****Management Domain:**** [Block storage management](#blockstoragemanagementdomain "Block storag

****Triggers:**** None defined.

****Detailed Context:**** Need to detach a namespace from an IO Controller. The user no longer w

****Preconditions:**** The IO Controller and Namespace need to exist and be fully defined. The N

****Feature(s):**** [NVMe](#nvme-feature)

****Inputs:****

- URL for Namespace.
- IO Controller.

****Basic Course of Events:****

1. Get the list of all Attached Namespaces attached to the given IO Controller.

****Request:****

GET /redfish/v1/Systems/Sys-1/Storage/SimplestNVMeSSD/Volumes/ SimpleNames-
pace ““

- **Headers:** No additional headers required.
- **Body:** None.

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Content-type : application/json
- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2014-2022 SNIA. All rights reserved.",
  "@odata.id": "/redfish/v1/Systems/Sys-
  ↪ 1/Storage/SimplestNVMeSSD/Controllers/NVMeIOController",
  "@odata.type": "#StorageController.v1_0_0.StorageController",
  "Id": "NVMeIOController",
  "Name": "NVMe I/O Controller",
  "Description": "Single NVMe I/O Controller presented to host.",
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "Manufacturer": "Best NVMe Vendor",
  "Model": "Simple NVMe Device",
  "SerialNumber": "NVME123456",
  "PartNumber": "NVM44",
  "FirmwareVersion": "1.0.0",
  "SupportedControllerProtocols": [
    "PCIe"
  ],
  "SupportedDeviceProtocols": [
    "NVMe"
  ],
  "NVMeControllerProperties": {
    "NVMeVersion": "1.3",
    "NVMeControllerAttributes": {
      "ReportsUUIDList": false,
      "SupportsSQAssociations": false,
      "ReportsNamespaceGranularity": false,
      "SupportsTrafficBasedKeepAlive": false,
      "SupportsPredictableLatencyMode": false,
      "SupportsEnduranceGroups": false,
      "SupportsReadRecoveryLevels": false,
      "SupportsNVMSets": false,
    }
  }
}
```

```
        "SupportsExceedingPowerOfNonOperationalState": false,
        "Supports128BitHostId": false
    },
    "Links": {
        "AttachedVolumes": [
            {
                "@odata.id": "/redfish/v1/Systems/Sys-
                ↪ 1/Storage/SimplestNVMeSSD/Volumes/SimpleNamespace"
            }
        ]
    }
}
```

2. Delete the Attached Namespace from the AttachedVolumes array by PATCHing the IO Controller with an edited set of AttachedVolumes. (Note: This example shows an AttachedVolumes array with only one namespace; therefore the patch command is sent with an empty array.)

Request:

```
PATCH /redfish/v1/redfish/v1/Systems/Sys-1/Storage/SimplestNVMeSSD/Controllers/
      NVMeIOController/
```

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "Links": {
    "AttachedVolumes": [
      { }
    ]
  }
}
```

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Content-type : application/json
- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2014-2022 SNIA. All rights
  ↪ reserved.",
}
```



```
"@odata.id": "/redfish/v1/Systems/Sys-
↪ 1/Storage/SimplestNVMeSSD/Controllers/NVMeIOController",
"@odata.type": "#StorageController.v1_0_0.StorageController",
"Id": "NVMeIOController",
"Name": "NVMe I/O Controller",
"Description": "Single NVMe I/O Controller presented to host.",
"Status": {
    "State": "Enabled",
    "Health": "OK"
},
"Manufacturer": "Best NVMe Vendor",
"Model": "Simple NVMe Device",
"SerialNumber": "NVME123456",
"PartNumber": "NVM44",
"FirmwareVersion": "1.0.0",
"SupportedControllerProtocols": [
    "PCIe"
],
"SupportedDeviceProtocols": [
    "NVMe"
],
"NVMeControllerProperties": {
    "NVMeVersion": "1.3",
    "NVMeControllerAttributes": {
        "ReportsUUIDList": false,
        "SupportsSQAssociations": false,
        "ReportsNamespaceGranularity": false,
        "SupportsTrafficBasedKeepAlive": false,
        "SupportsPredictableLatencyMode": false,
        "SupportsEnduranceGroups": false,
        "SupportsReadRecoveryLevels": false,
        "SupportsNVMSets": false,
        "SupportsExceedingPowerOfNonOperationalState": false,
        "Supports128BitHostId": false
    }
},
"Links": {
    "AttachedVolumes": [
    ]
}
}
```

Postconditions: The Namespace has been removed from the AttachedVolumes array.

Failure Scenario: None defined.

See also: None defined.

7.1.26 *Expand capacity of a storage volume*

Summary: Retrieve storage capacity information for a storage pool to check available capacity before expanding a storage volume.

Purpose:

- Application monitoring tool warns the admin that a storage volume used by a critical application is at 80% capacity
- Storage volumes can be expanded during the week without approval during non-business hours
- Administrator checks the available capacity on the storage pool based on the class of service required to ensure the storage volume expansion is possible
- During proper maintenance window, administrator expands storage volume based on predefined SLA established with application owner

Who: StorageAdmin at an enterprise

Management domain: Block storage management

Trigger: Low available capacity warning

Detailed context: The enterprise administrator offers managed storage services to business units in her organization. The administrator has established an SLA with application owners for storage volume expansion:

- Low storage capacity warning and critical alerts only apply to storage volumes with application data (the storage administrator is not responsible for the OS disks of the servers)
- Administrator can expand the storage volume by 25% up to 3 times without additional approvals for a maintenance window as long as the work is done during non-business hours (business hours are 7AM - 7PM local).
- Storage volumes for this application cannot exceed 2TB.
- Storage volume will be tagged with metadata to indicate the original size of the volume.
- Administrator is responsible for informing the application owner if the storage system is running low and overall capacity putting the SLA at risk. Administrator and application owner must plan for a migration of the application if waiting for additional storage disks/shelves to arrive is not feasible.

The application monitoring tool sends a warning alert to the administrator's datacenter monitoring tool indicating that a storage volume's capacity is at 80% and must be increased to ensure the application does not experience unplanned downtime.

The administrator first checks the available capacity on the storage pool for a given storage class of service. Since the storage system is new, there is sufficient capacity available. Next the administrator figures out that the storage volume has never been expanded based on the original size tag. At the start of the maintenance window, non-business hours, the administrator initiates the expand action. For this particular storage system, the expand is a long running action so the administrator tracks the progress using the associated task.

Preconditions:

- Storage system has at least one storage pool with at least one storage volume
- Storage pool has enough available capacity to expand the storage volume by 25%

Feature(s): Block capacity management**Inputs:**

- URL for the Swordfish service: /redfish/v1/StorageService/1
- Storage pool name: BasePool
- Storage volume name: 61001234876545676100123487654567

Basic Course of Events:

1. Use GET operations to look at information about storage volume and confirm low capacity and the current size is less than 2TB

Request:

```
GET /redfish/v1/StorageServices/1/Volumes/61001234876545676100123487654567
```

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Content-type : application/json
- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2015-2022 SNIA. All rights reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id": "/redfish/v1/StorageServices/1/Volumes/61001234876545676100123487654567",
  "@odata.type": "#Volume_1_0_0.Volume",
  "Id": "61001234876545676100123487654567",
  "Name": "Volume 1",
```

```
"Description": "application storage",
"Identifiers": [
{
  "DurableNameFormat": "NAA6",
  "DurableName": "61001234876545676100123487654567"
}
],
"Manufacturer": "SuperDuperStorageProvider",
"Status": {
"State": "Enabled",
"Health": "OK"
},
"BlockSizeBytes": 512,
"LowSpaceWarningThresholdPercent": [
80,
null,
null,
null,
null
],
"Capacity": {
"Data": {
  "ConsumedBytes": 879609302221,
  "AllocatedBytes": 879609302221,
  "GuaranteedBytes": 549755813888,
  "ProvisionedBytes": 1099511627776
},
}
}
```

2. Use GET operations to look at information about storage pool to confirm it has more than 25% available capacity

Request:

```
GET /redfish/v1/StorageServices/1/StoragePools/BasePool
```

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Content-type : application/json
- **Body:**

```
{
"@Redfish.Copyright": "Copyright 2015-2016 SNIA. All rights reserved.",
```

```
"@odata.context": "/redfish/v1/$metadata#StoragePool.StoragePool",
"@odata.id": "/redfish/v1/StorageServices/1/StoragePools/BasePool",
"@odata.type": "#StoragePool.1_0_0.StoragePool",
"Id": "BasePool",
"Name": "BasePool",
>Description": "Base storage pool for this storage service",
>Status": {
  "State": "Enabled",
  "Health": "OK",
  "HealthRollUp": "Degraded"
},
"BlockSizeBytes": 8192,
"Capacity": {
  "Data": {
    "ConsumedBytes": 824633720832,
    "AllocatedBytes": 1099511627776
  },
  "Metadata": null,
  "Snapshot": null
},
"CapacitySources": [
  {
    "ProvidedCapacity": {
      "ConsumedBytes": 70368744177664,
      "AllocatedBytes": 140737488355328,
      "GuaranteedBytes": 17592186044416,
      "ProvisionedBytes": 562949953421312
    },
    "Links": {
      "ClassOfService": {
        "@odata.id":
          ↪ "/redfish/v1/StorageServices/1/ClassesOfService/GoldBoston"
      },
      "ProvidingPool": null,
      "ProvidingVolume": null
    }
  }
],
"LowSpaceWarningThresholdPercent": [
  70,
  80,
  90
],
```

```
"Links": {
  "AllocatedPools": [],
  "AllocatedVolumes": [
    {
      "@odata.id": "/redfish/v1/StorageServices/1/Volumes/61001234876545676100123487654567"
    }
  ],
  "SupportedClassesOfService": [
    {
      "@odata.id":
        "/redfish/v1/StorageServices/1/ClassesOfService/GoldBoston"
    },
    {
      "@odata.id":
        "/redfish/v1/StorageServices/1/ClassesOfService/SilverBoston"
    }
  ]
}
```

3. Use expand action to increase size of storage volume by 25%.

Note that there are two different properties that can be used to report available capacity, depending on the implementation - either CapacityBytes or Capacity->Data->AllocatedBytes. This use case shows how to do this function using the latter property, but would work equally if the implementation supported this function using the CapacityBytes property instead.

Request:

PATCH /redfish/v1/StorageServices/1/Volumes/61001234876545676100123487654567

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "Capacity": {
    "Data": {
      "AllocatedBytes": 1374389534720
    }
  }
}
```

Response:

- **HTTP Status:** 202 (Accepted)
- **Headers:**

Location : redfish/v1/TaskService/Tasks//ExpandTask123`

Postconditions: The volume's capacity expands by 25%. Administrator needs to track the associated task to know when the volume expansion completes.

See also: None defined.

7.1.27 *Health updates*

Summary: Retrieve storage metrics information for a storage volume.

Purpose:

- Application monitoring tool warns devops that the application is processing less requests based on a predefined threshold
- Devops has a simple script that queries Redfish capable infrastructure and pulls performance metrics
- Devops collect infrastructure performance metrics as part of an end-to-end diagnostics workflow to help identify potential bottlenecks

Who: DevOps at an enterprise

Management domain: Block storage management

Trigger: Lower than expected application requests completed per second

Detailed context: Devops creates diagnostics scripts that retrieve performance information from multiple layers in the application stack, including infrastructure, to help identify potential bottlenecks during production hours. Devops already understand that the issue is not in the application layers so now they have to dig deeper. Members of devops are typically not experts in infrastructure compute, storage, and networking so they need simple scripts that can provide the information they require without a deep understanding of underlying hardware. With the storage administrator's help, devops use a few simple GETs on storage objects related to their application. To help simplify the query, the storage administrator tags the volumes associated with the application. Devops can use stack wide performance metrics to quickly isolate potential bottlenecks that may be contributing to the slow down in the application.

Preconditions:

- Storage system has at least one storage pool with at least one storage volume
- Storage volume is exposed to at least one initiator
- Initiator is driving I/O to the volume

Feature(s): Block IO performance

Inputs:

- URL of the Swordfish storage service: `/redfish/v1/StorageServices/1`
- Storage pool volume name: 4

Basic course of events:

1. uses GET operations to look at metrics of the storage volume

Request: GET /redfish/v1/StorageServices/1/Volumes/4/Metrics

- **Headers:** No additional headers required.
- **Body:** None defined.

Response:

- **HTTP Status:** 200 (Success)
- **Headers:** Content-type : application/json
- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2015-2022 SNIA. All rights reserved.",
  "@odata.context": "/redfish/v1/$metadata#VolumeMetrics.VolumeMetrics",
  "@odata.id": "/redfish/v1/StorageServices/1/Volumes/4/Metrics",
  "@odata.type": "#VolumeMetrics.v1_0_0.VolumeMetrics",
  "Id": "Metrics",
  "Name": "Volume 1 Metrics",
  "CurrentPeriod": {
    "BlocksRead": 125534,
    "BlocksWritten": 542653
  },
  "Lifetime": {
    "BlocksRead": 125534,
    "BlocksWritten": 542653
  },
  "PerformanceData": {
    "AverageSecondsPerRead": 1,
    "AverageSecondsPerWrite": 1,
    "AverageSecondsPerTransfer": 1,
    "ReadsPerSecond": 2134,
    "WritesPerSecond": 4325,
    "TransfersPerSecond": 6459,
    "WriteBlocksPerSecond": 3085784,
    "ReadBlocksPerSecond": 9257350,
    "BlocksPerSecond": 12343134
  },
  "Actions": {
    "#Volume.ClearCurrentPeriod": {
      "target": "/red-
↪ fish/v1/StorageServices/1/Volumes/4/Actions/Volume.ClearCurrentPeriod"
```

```
  },  
  "Oem": {}  
  },  
  "Oem": {}  
}
```

Postconditions: None defined.

See also: None defined.

7.1.28 *Make a New Replication Relationship by Creating a Target Consistency Group*

Summary: Create a new Consistency Group to serve as the target in the replication relationship for an existing source Consistency Group.

Purpose: Create a new ConsistencyGroup resource to provide expanded data protection through a replica relationship with the specified source ConsistencyGroup.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to create a replication relationship for a source ConsistencyGroup when there are no existing ConsistencyGroups that can be assigned as the target.

Detailed Context: The admin needs to satisfy a user or application request for a copy of some sort of the original ConsistencyGroup.

Preconditions: User has already selected the type of replica, the replica update mode (sync vs async), and the target system and storage pool from which to create the new ConsistencyGroup to serve as the replica.

Feature(s): Replication (both local and remote)

Inputs:

- URL for Storage Pool: /redfish/v1/Storage/1/StoragePools/PrimaryPool
- Requested replica type: Mirror
- Requested name of ConsistencyGroup (string): CG_DB2
- ReplicaUpdateMode: Synchronous

Basic Course of Events:

1. Post (as an Action) the request on the source ConsistencyGroup.

This instructs the service to use the identified ConsistencyGroup as the source ConsistencyGroup for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/ConsistencyGroups/CG_DB1/  
ConsistencyGroup.CreateReplicaTarget
```

```
- **Headers:** `Content-type : application/json`
```

```
- **Body:**
```

```
```json
```

```
{ "ConsistencyGroupName": "CG_DB2", "ReplicaUpdateMode": "Synchronous", "TargetStoragePool": "/redfish/v1/Storage/1/StoragePools/PrimaryPool", "ReplicaType": "Mirror" }
```

```
```
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/ConsistencyGroups/CG_DB1
- **Body:** None.

Postconditions: The selected ConsistencyGroup has a new ReplicaTargets property with the link to the new ConsistencyGroup. Elsewhere, there is a new ConsistencyGroup in the system (Name == "CG_DB2", the id set by the system to 23423) that has a ReplicalInfo pointing back to this ConsistencyGroup and which contains all of the replication properties.

Failure Scenario: None defined

See also: Create Replica Target

7.1.29 *Make a New Replication Relationship by Creating a Target Volume*

Summary: Create a new volume to serve as a target replica for an existing source volume.

Purpose: Create a new volume resource to provide expanded data protection through a replica relationship with the specified source volume.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to create a replication relationship for a source volume when there are no existing volumes that can be assigned as the target.

Detailed Context: The admin needs to satisfy a user or application request for a copy of some sort of the original volume.

Preconditions: User has already selected the type of replica, the replica update mode (sync vs async), and the target system and storage pool from which to create the new volume to serve as the replica.

Feature(s): Replication (both local and remote)

Inputs:

- URL for Storage Pool: `/redfish/v1/Storage/1/StoragePools/PrimaryPool`
- Requested replica type: `Mirror`
- Requested name of volume (string): `Mirror of Volume 65`
- `ReplicaUpdateMode`: `Synchronous`

Basic Course of Events:

1. Post (as an Action) the request on the source Volume.

This instructs the service to use the identified Volume as the source Volume for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
      Volume.CreateReplicaTarget
```

- **Headers:** `Content-type : application/json`

- **Body:**

```
{
  "VolumeName" : "Mirror of Volume 65",
  "ReplicaUpdateMode" : "Synchronous",
  "TargetStoragePool" :
  ↪ "/redfish/v1/Storage/1/StoragePools/PrimaryPool",
  "ReplicaType" : "Mirror"
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
- **Body:** None.

Postconditions: The selected volume has a new ReplicaTargets property with the link to the new volume. Elsewhere, there is a new volume in the system (Name == “Mirror of Volume 65”, the id set by the system to 2345) that has a ReplicaInfo pointing back to this volume and which contains all of the replication properties.

Failure Scenario: None defined

See also: Create Replica Target (CG)

7.1.30 Provision a Namespace from NVM Set

Summary: Provision a Namespace from an NVM Set

Purpose: Provision a Namespace from an NVMe device that supports Endurance Groups and NVM Sets.

Who: StorageAdmin CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: Create a namespace, and allocate resources reserved for it, from an NVMe device that supports Endurance Groups and NVM Sets. The Create Namespace request is performed on the NVM Set in this configuration. The admin needs to satisfy a user or application request to provide a given amount of capacity by creating a new Namespace. Note that this specific use case does not include the assignment of this namespace to an IO Controller.

Preconditions: User has already selected the appropriate NVM Set and the desired capacity.

Feature(s): NVMe

Inputs:

- URL for Storage Pool: `/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/StoragePools/DefaultSet0`
- Requested volume size in bytes (1 TiB, here): `1099511627776`
- Requested name of volume: `"MyNamespace"`

Basic Course of Events:

1. Post the definition of the new Namespace to the NVM Set resource collection, which is of type `StoragePoolCollection`.

This instructs the service to use the identified NVMeSet (`StoragePool`) to allocate a new Namespace of the requested size. Any additional protection properties will be inherited from the NVM Set.

Request:

POST `/redfish/v1/Storage/1/StoragePools/NVMeSet`

- **Headers:** `Content-type : application/json`
- **Body:**


```
{
  "Name" : "MyNamespace",
  "Capacity": {
    "Data": {
      "AllocatedBytes": 1099511627776,
      "ProvisionedBytes": 1099511627776
    }
  }
}
```

Response:

Response contains the details of the created volume.

- **HTTP Status:** 201 (Created)
- **Headers:**

```
`Location : /redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/MyNamespace"
Content-type : application/json`
```

- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2014-2022 SNIA. All rights
  ↪ reserved.",
  "@odata.id": "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-
  ↪ EG/Volumes/MyNamespace",
  "@odata.type": "#Volume.v1_5_0.Volume",
  "Id": "1",
  "Name": "MyNamespace",
  "LogicalUnitNumber": 1,
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "Identifiers": [
    {
      "DurableNameFormat": "NQN",
      "DurableName": "nqn.2014-08.org.nvmexpress:uuid:6c5fe566-10e6-
      ↪ 4fb6-aad4-8b4159029384"
    }
  ],
  "Capacity": {
```

```
"Data": {
  "ConsumedBytes": 0,
  "AllocatedBytes": 1099511627776,
  "ProvisionedBytes": 1099511627776
},
"CapacitySources": [
  {
    "@odata.id": "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-
    ↪ EG/Volumes/MyNamespace/CapacitySources/Source1"
  }
],
"NVMeNamespaceProperties": {
  "NamespaceId": "0x224",
  "NamespaceFeatures": {
    "SupportsThinProvisioning": false,
    "SupportsAtomicTransactionSize": false,
    "SupportsDeallocatedOrUnwrittenLBError": false,
    "SupportsNGUIDReuse": false,
    "SupportsIOPerformanceHints": false
  },
  "NumberLBAFormats": 0,
  "FormattedLBASize": "LBAFormat0Support",
  "MetadataTransferredAtEndOfDataLBA": false,
  "NVMeVersion": "1.4"
}
}
```

Postconditions: The selected Namespace has been created and is added to the NVM Set.

Failure Scenario: None defined.

See also: NVMe use case to Attach a Namespace, and to Provision a Namespace without and NVMeSet.

7.1.31 Provision a Namespace

Summary: Provision a Namespace

Purpose: Provision a Namespace from a simple NVMe device that does not support Endurance Groups and NVM Sets.

Who: StorageAdmin CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: Create a namespace, and allocate resources reserved for it, from an NVMe device that does not support Endurance Groups and NVM Sets. The Create Namespace request is performed on the Volume Collection in this configuration. The admin needs to satisfy a user or application request to provide a given amount of capacity by creating a new Namespace. Note that this specific use case does not include the assignment of this namespace to an IO Controller.

Preconditions: User has already selected the desired capacity.

Feature(s): NVMe

Inputs:

- URL for Volume Collection: `/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes`
- Requested volume size in bytes (1 TiB, here):
 - 1099511627776 (Provisioned Capacity)
 - 1099511627776 (Allocated Capacity)
- Requested name of volume: "MyNamespace"

Basic Course of Events:

1. Post the definition of the new Namespace to the Volume resource collection on the NVM Subsystem.

This instructs the service to provision (create) a new Namespace of the requested size. Any additional protection properties will be inherited from the NVM Subsystem.

Request:

POST `/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes`

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "Name" : "MyNamespace",
  "Capacity": {
    "Data": {
      "AllocatedBytes": 1099511627776,
      "ProvisionedBytes": 1099511627776
    }
  }
}
```

Response:

Response contains the details of the created volume.

- **HTTP Status:** 201 (Created)

- **Headers:**

Location : /redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/MyNamespace"

Content-type : application/json

- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2014-2022 SNIA. All rights
  ↪ reserved.",
  "@odata.id": "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-
  ↪ EG/Volumes/MyNamespace",
  "@odata.type": "#Volume.v1_5_0.Volume",
  "Id": "1",
  "Name": "MyNamespace",
  "LogicalUnitNumber": 1,
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "Identifiers": [
    {
      "DurableNameFormat": "NQN",
      "DurableName": "nqn.2014-08.org.nvmexpress:uuid:6c5fe566-
      ↪ 10e6-4fb6-aad4-8b4159029384"
    }
  ],
  "Capacity": {
    "Data": {
```

```
        "ConsumedBytes": 0,
        "AllocatedBytes": 1099511627776,
        "ProvisionedBytes": 1099511627776
    }
},
"CapacitySources": [
    {
        "@odata.id": "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-
↪ EG/Volumes/MyNamespace/CapacitySources/Source1"
    }
],
"NVMeNamespaceProperties": {
    "NamespaceId": "0x224",
    "NamespaceFeatures": {
        "SupportsThinProvisioning": false,
        "SupportsAtomicTransactionSize": false,
        "SupportsDeallocatedOrUnwrittenLBAError": false,
        "SupportsNGUIDReuse": false,
        "SupportsIOPerformanceHints": false
    },
    "NumberLBAFormats": 0,
    "FormattedLBASize": "LBAFormat0Support",
    "MetadataTransferredAtEndOfDataLBA": false,
    "NVMeVersion": "1.4"
}
}
```

Postconditions: The selected Namespace has been created and is added to the NVM Subsystem.

Failure Scenario: None defined.

See also: NVMe use case to Attach a Namespace, and to Provision a Namespace with NVMSets.

7.1.32 Remove Replication Relationship for a Consistency Group

Summary: Disable data synchronization between a source and target Consistency Group, remove the replication relationship, and optionally delete the target Consistency Group.

Purpose: The administrator wants to completely delete the relationship between the target and source ConsistencyGroups.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to remove a replication relationship due to changing system or environment requirements.

Detailed Context: The identified replication relationship is no longer needed, and is to be completely removed from the configuration.

Preconditions: User has already identified which replication relationship to delete, and whether or not to retain the target ConsistencyGroup.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: `/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2`
- Boolean value to determine whether target ConsistencyGroup should be retained or not: `false`

Basic Course of Events:

1. Post (as an Action) the request on the source ConsistencyGroup.

This instructs the service to delete the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/ConsistencyGroups/CG_DB1/  
ConsistencyGroup.RemoveReplicaRelationship
```

- **Headers:** Content-type : application/json
- **Body:**

```
{  
  "TargetConsistencyGroup": "/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2",
```

```
"DeleteTargetConsistencyGroup": "false"  
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/ConsistencyGroups/1
- **Body:** None.

Postconditions: The ConsistencyGroup will no longer have an entry in “ReplicaTargets” for the former replication relationship (the property is not returned in the above example if it were null). Elsewhere, the ConsistencyGroup “CG_DB2” in the system will still exist but will no longer have a StorageReplicaInfo which points back to this ConsistencyGroup.

Failure Scenario: None defined

See also: Remove Replication Relationship

7.1.33 Remove Replication Relationship

Summary: Disable data synchronization between a source and target volume, remove the replication relationship, and optionally delete the target volume.

Purpose: The administrator wants to completely delete the relationship between the target and source volumes.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to remove a replication relationship due to changing system or environment requirements.

Detailed Context: The identified replication relationship is no longer needed, and is to be completely removed from the configuration.

Preconditions: User has already identified which replication relationship to delete, and whether or not to retain the target volume.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica:

```
/redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973452245
```

- Boolean value to determine whether target volume should be retained or not:
false

Basic Course of Events:

1. Post (as an Action) the request on the source Volume.

This instructs the service to delete the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/Volume.RemoveReplicaRelationship
```

- **Headers:** Content-type : application/json
- **Body:**


```
{
  "TargetVolume" : "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973452245",
  "DeleteTargetVolume" : "false"
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
- **Body:** None.

Postconditions: The volume will no longer have an entry in “ReplicaTargets” for the former replication relationship (the property is not returned in the above example, as it is null). Elsewhere, the volume “650973452245” in the system will still exist but will no longer have a StorageReplicaInfo which points back to this volume.

Failure Scenario: None defined

See also: Remove Replication Relationship (CG)

7.1.34 Report Namespace Capacity

Summary: Report Namespace Capacity

Purpose: Report Namespace Capacity

Who: StorageAdmin CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: The namespace capacity information is provided as properties in the namespace object. The NVMe capacity information reported via the Redfish/Swordfish data structures maps the NVMe native capacity information into the RF/SF capacity structures, showing the capacity presented by the namespace to the consumer as `AllocatedBytes` (e.g., the addressable capacity), and the total available capacity of the namespace as `ProvisionedBytes` (e.g., the amount of addressable capacity that may actually be used). Note that for a thin provisioned system these values are expected to be different.

Preconditions: None defined.

Feature(s): NVMe

Inputs:

- URL for namespace: `/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/Namespace1`

Basic Course of Events:

1. Get the designated Namespace and find the `Capacity.Data.AllocatedBytes` property within the returned JSON data:

Request:

GET `/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/Namespace1`

- **Headers:** No additional headers required.
- **Body:** None.

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** `Content-type : application/json`
- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2014-2022 SNIA. All rights reserved.",
  "@odata.id":
  ↪ "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-EG/Volumes/Namespae1",
  "@odata.type": "#Volume.v1_5_0.Volume",
  "Id": "1",
  "Name": "Namespace 1",
  "LogicalUnitNumber": 1,
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "Identifiers": [
    {
      "DurableNameFormat": "NQN",
      "DurableName": "nqn.2014-08.org.nvmexpress:uuid:6c5fe566-10e6-4fb6-aad4-
      ↪ 8b4159029384"
    }
  ],
  "Capacity": {
    "Data": {
      "ConsumedBytes": 0,
      "AllocatedBytes": 10737418240,
      "ProvisionedBytes": 10737418240
    }
  },
  "CapacitySources": [
    {
      "@odata.id": "/redfish/v1/Systems/Sys-1/Storage/NVMeSSD-
      ↪ EG/Volumes/Namespae1/CapacitySources/Source1"
    }
  ],
  "NVMeNamespaceProperties": {
    "NamespaceId": "0x224",
    "NamespaceFeatures": {
      "SupportsThinProvisioning": false,
      "SupportsAtomicTransactionSize": false,
      "SupportsDeallocatedOrUnwrittenLBAError": false,
      "SupportsNGUIDReuse": false,
      "SupportsIOPerformanceHints": false
    }
  },
  "NumberLBAFormats": 0,
  "FormattedLBASize": "LBAFormat0Support",

```

```
"MetadataTransferredAtEndOfDataLBA": false,  
"NVMeVersion": "1.4"  
},  
"Links": {  
}  
}
```

Postconditions: The requested capacity information is returned in the GET request:

```
{  
  "Capacity": {  
    "Data": {  
      "ConsumedBytes": 0,  
      "AllocatedBytes": 10737418240,  
      "ProvisionedBytes": 10737418240  
    }  
  }  
}
```

Failure Scenario: None defined.

See also: None defined.

7.1.35 Report Remaining Life for a Namespace

Summary: Report Remaining Life for a Namespace

Purpose: Report Remaining Life for a Namespace

Who: StorageAdmin CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: The namespace itself doesn't have the notion of "remaining life". Instead, the user should go to the corresponding drive object, and retrieve the "PredictedMediaLifeLeftPercent" property. Note, for a system that has endurance groups and sets, the endurance group also has this property, and the namespace could take the related "PredictedMediaLifeLeftPercent" from its related endurance group as well.

Preconditions: The namespace object has a direct link (in the Links property) to its related Drive. This path may not exist in certain types of NVMe devices, such as an Opaque Array.

Feature(s): NVMe

Inputs:

- URL for Namespace

Basic Course of Events:

1. GET the Namespace of interest.

Request:

```
GET /redfish/v1/Systems/Sys-1/Storage/SimplestNVMeSSD/Volumes/  
SimpleNamespace
```

- **Headers:** No additional headers required.

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Content-type : application/json
- **Body:**

```
{  
  "@Redfish.Copyright": "Copyright 2014-2022 SNIA. All rights  
  => reserved.",
```

```
"@odata.id": "/redfish/v1/Systems/Sys-
↪ 1/Storage/SimplestNVMeSSD/Volumes/SimpleNamespace",
"@odata.type": "#Volume.v1_5_0.Volume",
"Id": "1",
"Name": "Namespace 1",
"LogicalUnitNumber": 1,
"Status": {
  "State": "Enabled",
  "Health": "OK"
},
"Identifiers": [
  {
    "DurableNameFormat": "NQN",
    "DurableName": "nqn.2014-08.org.nvmexpress:uuid:6c5fe566-
↪ 10e6-4fb6-aad4-8b4159029384"
  }
],
"Capacity": {
  "Data": {
    "ConsumedBytes": 0,
    "AllocatedBytes": 10737418240
  },
  "Metadata": {
    "AllocatedBytes": 536870912
  }
},
"NVMeNamespaceProperties": {
  "NamespaceId": "0x22F",
  "NamespaceFeatures": {
    "SupportsThinProvisioning": false,
    "SupportsAtomicTransactionSize": false,
    "SupportsDeallocatedOrUnwrittenLBError": false,
    "SupportsNGUIDReuse": false,
    "SupportsIOPerformanceHints": false
  },
  "NumberLBAFormats": 0,
  "FormattedLBASize": "LBAFormat0Support",
  "MetadataTransferredAtEndOfDataLBA": false,
  "NVMeVersion": "1.4"
},
"Links": {
  "Drives": {
```

```
        "@odata.id": "/redfish/v1/Chassis/SimplestNVMeSSD/Drives/SimplestNVMeSSD"
      }
    }
  }
```

2. GET the Drive related to the Namespace.

Request: GET /redfish/v1/Chassis/SimplestNVMeSSD/Drives/SimplestNVMeSSD

- **Headers:** No additional headers required.

Response:

- **HTTP Status:** 200 (OK)
- **Headers:** Content-type : application/json
- **Body:**

```
{
  "@odata.id":
  ↪ "/redfish/v1/Chassis/SimplestNVMeSSD/Drives/SimplestNVMeSSD",
  "@odata.type": "#Drive.v1_9_0.Drive",
  "IndicatorLED": "Lit",
  "Model": "ST9146802SS",
  "Revision": "S20A",
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "CapacityBytes": 899527000000,
  "FailurePredicted": false,
  "PredictedMediaLifeLeftPercent": 18,
  "Protocol": "NVMe",
  "MediaType": "SSD",
  "Manufacturer": "Contoso",
  "SerialNumber": "72D0A037FRD26",
  "PartNumber": "SG0GP8811253178M02GJA00",
  "Identifiers": [
    {
      "DurableNameFormat": "NAA",
      "DurableName": "500003942810D13A"
    }
  ],
  "Links": {
    "Volumes": [
```

```
{
  "@odata.id": "/redfish/v1/Systems/Sys-
↪ 1/Storage/SimplestNVMeSSD/Volumes/SimpleNamespace"
}
],
"Actions": {
  "#Drive.Reset": {
    "target": "/red-
↪ fish/v1/Chassis/SimplestNVMeSSD/Drives/SimplestNVMeSSD/Actions/Drive.Reset"
  }
}
}
```

Postconditions: The drive object returned a “PredictedMediaLifeLeftPercent” value of 18. The user can use this value as the apparent namespace life value.

Failure Scenario: None defined.

See also: None defined.

7.1.36 *Resume the Replication Synchronization Activity for a Consistency Group*

Summary: Resume the active data synchronization between a source and target Consistency Group, without otherwise altering the replication relationship.

Purpose: The administrator wants to restore the relationship between the target and source ConsistencyGroups, since the temporary condition that led to a suspension of replication has passed.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to re-activate a suspended replication relationship.

Detailed Context: The temporary condition that led to a suspension of replication has passed, and the admin needs to resume replication using the existing replication relationship.

Preconditions: User has already identified which target ConsistencyGroup to resume, and implementation preserves replication information what a relationship is suspended.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: `/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2`

Basic Course of Events:

1. Post (as an Action) the request on the source ConsistencyGroup.

This instructs the service to use the identified ConsistencyGroup as the source ConsistencyGroup for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/ConsistencyGroups/DB_CG1/  
ConsistencyGroup.ResumeReplication
```

- **Headers:** Content-type : application/json

- **Body:**

```
{  
  "TargetConsistencyGroup": "/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2"  
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/ConsistencyGroups/CG_DB1
- **Body:** None.

Postconditions: The selected ConsistencyGroup has an updated ReplicaTargets entry for the new relationship. Elsewhere, there is a ConsistencyGroup “CG_DB2” in the system that has a ReplicaInfo which points back to this ConsistencyGroup and which contains all of the Replica configuration information. The replica state in the target ConsistencyGroup has been updated according to the requested action (e.g., from “suspended” to “active”).

Failure Scenario: None defined

See also: Resume the Replication Synchronization Activity

7.1.37 Resume the Replication Synchronization Activity

Summary: Resume the active data synchronization between a source and target volume, without otherwise altering the replication relationship.

Purpose: The administrator wants to restore the relationship between the target and source volumes, since the temporary condition that led to a suspension of replication has passed.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to re-activate a suspended replication relationship.

Detailed Context: The temporary condition that led to a suspension of replication has passed, and the admin needs to resume replication using the existing replication relationship.

Preconditions: User has already identified which target volume to resume, and implementation preserves replication information what a relationship is suspended.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: /redfish/v1/Storage/1/Volumes/650973452245

Basic Course of Events:

1. Post (as an Action) the request on the source Volume.

This instructs the service to use the identified Volume as the source Volume for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
      Volume.ResumeReplication
```

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "TargetVolume" : "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973452245"
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
- **Body:** None.

Postconditions: The selected volume has an updated ReplicaTargets entry for the new relationship. Elsewhere, there is a volume “650973452245” in the system that has a ReplicaInfo which points back to this volume and which contains all of the Replica configuration information. The replica state in the target volume has been updated according to the requested action (e.g., from “suspended” to “active”).

Failure Scenario: None defined

See also: Resume the Replication Synchronization Activity (CG)

7.1.38 Reverse a Replication Relationship for Consistency Groups

Summary: Reverse the replication relationship between a source and target Consistency Group.

Purpose: The administrator wants to reconfigure the relationship between the target and source ConsistencyGroups, reversing their roles.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to reconfigure existing storage due to changing system or environment requirements.

Detailed Context: The admin needs to satisfy a user or application request swapping the target/source roles in a replication relationship.

Preconditions: User has already identified which target ConsistencyGroup and replication relationship to reverse.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: `/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2`

Basic Course of Events:

1. Post (as an Action) the request on the source ConsistencyGroup.

This instructs the service to use the identified ConsistencyGroup as the source ConsistencyGroup for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/ConsistencyGroups/DB_CG1/  
ConsistencyGroup.ReverseReplicationRelationship
```

- **Headers:** Content-type : application/json
- **Body:**

```
{  
  "TargetConsistencyGroup": "/redfish/v1/Storage/1/ConsistencyGroups/DB_CG2"  
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/ConsistencyGroups/1
- **Body:** None.

Postconditions: The selected ConsistencyGroup will now have an updated ReplicaInfo for the relationship, which contains the replication attributes and a pointer to the source replica. Elsewhere, there is a ConsistencyGroup “DB_CG2” in the system that now has an ReplicaTargets entry that points back to this ConsistencyGroup (“@odata.id”: “/redfish/v1/Storage/1/ConsistencyGroups/DB_CG1”).

Failure Scenario: None defined

See also: Reverse a Replication Relationship

7.1.39 Reverse a Replication Relationship

Summary: Reverse the replication relationship between a source and target volume.

Purpose: The administrator wants to reconfigure the relationship between the target and source volumes, reversing their roles.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to reconfigure existing storage due to changing system or environment requirements.

Detailed Context: The admin needs to satisfy a user or application request swapping the target/source roles in a replication relationship.

Preconditions: User has already identified which target volume and replication relationship to reverse.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973

Basic Course of Events:

1. Post (as an Action) the request on the source Volume.

This instructs the service to use the identified Volume as the source Volume for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
      Volume.ReverseReplicationRelationship
```

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "TargetVolume" : "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973452245"
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
- **Body:** None.

Postconditions: The selected volume will now have an updated ReplicaInfo for the relationship, which contains the replication attributes and a pointer to the source replica. Elsewhere, there is a volume “650973452245” in the system that now has an ReplicaTargets entry that points back to this volume (“@odata.id”: “/redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1”).

Failure Scenario: None defined

See also: Reverse a Replication Relationship (CG)

7.1.40 *Split a Replica*

Summary: Split the replication relationship and suspend data synchronization between a source and target volume.

Purpose: The administrator wants to reconfigure the relationship between the target and source volumes.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to reconfigure existing storage due to changing system or environment requirements.

Detailed Context: The admin needs to satisfy a user or application request to change the existing configuration between the target and source volumes in a replication relationship.

Preconditions: User has already identified which target volume and replication relationship to split.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: `/redfish/v1/Storage/1/Volumes/650973452245`

Basic Course of Events:

1. Post (as an Action) the request on the source Volume.

This instructs the service to use the identified Volume as the source Volume for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
     Volume.SplitReplication
```

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "TargetVolume": "/red-
↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973452245"
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
- **Body:** None.

Postconditions: The selected volume has a new ReplicaTargets property with the link to the volume. Elsewhere, there is a volume “650973452245” in the system that has a ReplicaInfo pointing back to this volume and which contains all of the Replica configuration information. The replica state in the target volume has been updated according to the requested action (e.g., from “active” to “suspended / split”).

Failure Scenario: None defined

See also: Split a Replica (CG)

7.1.41 *Split a set of Replicas in Consistency Groups*

Summary: Split the replication relationship and suspend data synchronization between a source and target ConsistencyGroup.

Purpose: The administrator wants to reconfigure the relationship between the target and source ConsistencyGroups.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to reconfigure existing storage due to changing system or environment requirements.

Detailed Context: The admin needs to satisfy a user or application request to change the existing configuration between the target and source ConsistencyGroups in a replication relationship.

Preconditions: User has already identified which target ConsistencyGroup and replication relationship to split.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: `/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2`

Basic Course of Events:

1. Post (as an Action) the request on the source ConsistencyGroup.

This instructs the service to use the identified ConsistencyGroup as the source ConsistencyGroup for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/ConsistencyGroups/CG_DB1/  
ConsistencyGroup.SplitReplication
```

- **Headers:** Content-type : application/json.

- **Body:**

```
{  
  "TargetConsistencyGroup" :  
  ↪ "/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2"  
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/ConsistencyGroups/1
- **Body:** None.

Postconditions: The selected ConsistencyGroup has a new ReplicaTargets property with the link to the ConsistencyGroup. Elsewhere, there is a ConsistencyGroup “650973452245” in the system that has a ReplicalInfo pointing back to this ConsistencyGroup and which contains all of the Replica configuration information. The replica state in the target ConsistencyGroup has been updated according to the requested action (e.g., from “active” to “suspended / split”).

Failure Scenario: None defined

See also: Split a Replica

7.1.42 *Subscribe to Threshold Events*

Summary: Subscribe to Trigger/Clear events for LowSpaceWarningThresholds for a named Volume.

Purpose: Provide an event stream to support utilization management. This is used in conjunction with LowSpaceWarningThresholds to provide a means for on-going monitoring of resource consumption.

Who: CloudAdmin, StorageAdmin, DevOps

Management domain: Block storage management, Application storage management

Triggers: None defined.

Detailed Context: This provides the basis for monitoring capacity consumption.

Preconditions: None defined.

Feature(s): Event notification

Inputs:

- The URL of the StorageService: `/redfish/v1/StorageServices/Simple1`
- The Volume to be monitored: `Vol1`
- The subscription destination: `"http://www.dnsname.com/Destination1"`
- An array of events to be subscribed:
`["LowSpaceWarningThresholdTriggered", "LowSpaceWarningThresholdCleared"]`

Basic course of events:

1. Retrieve the event destination

Request:

POST `/redfish/v1/EventService/Subscriptions/Members`

- **Headers:** Content-type : application/json
- **Body:**

```
{
  "@Redfish.Copyright": "Copyright 2016-2022 Storage Networking Industry
  → Association (SNIA), USA. All rights reserved. For the full SNIA
  → copyright policy, see
  → http://www.snia.org/about/corporate_info/copyright",
```

```
"@odata.context":
  ↪ "/redfish/v1/$metadata#EventDestination.EventDestination",
"@odata.type": "#EventDestination.v1_0_2.EventDestination",
"Name": "Volume1 Usage Threshold",
"Destination": "http://www.dnsname.com/Destination1",
"EventTypes": [
  "Alert"
],
"Context": "WebUser3",
"Protocol": "Redfish",
"OriginResources": [{"odata.id" :
  ↪ "/redfish/v1/StorageServices/Simple1/Volumes/Vol1"}],
"MessageIds": ["LowSpaceWarningThresholdTriggered",
  ↪ "LowSpaceWarningThresholdCleared"]
}
```

Response:

- **HTTP Status:** 201 (Created)

- **Headers:**

Location : /redfish/v1/EventService/Subscriptions/1/Members/1e7da

Postconditions: Newly-created event subscription is added to the EventService.

Failure Scenario: None defined.

See also: None defined.

7.1.43 *Suspend Replication Synchronization Activity between Consistency Groups*

Summary: Suspend active data synchronization between a source and target ConsistencyGroup, without otherwise altering the replication relationship.

Purpose: Due to temporarily changed environmental constraints, the administrator wants to change the level of data protection between the target and source ConsistencyGroups.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to reconfigure existing storage due to changing system or environment requirements.

Detailed Context: The admin needs to satisfy a user or application request to change the existing configuration between the existing target and source ConsistencyGroups in a replication relationship, without deleting the relationship.

Preconditions: User has already identified which target ConsistencyGroup to suspend.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: `/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2`

Basic Course of Events:

1. Post (as an Action) the request on the source ConsistencyGroup.

This instructs the service to use the identified ConsistencyGroup as the source ConsistencyGroup for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/ConsistencyGroups/CG_DB1/  
ConsistencyGroup.SuspendReplication
```

- **Headers:** Content-type : application/json

- **Body:**

```
{  
  "TargetConsistencyGroup":  
    ↪ "/redfish/v1/Storage/1/ConsistencyGroups/CG_DB2"  
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/ConsistencyGroups/CG_DB1

- **Body:** None.

Postconditions: The selected ConsistencyGroup has an updated ReplicaTargets entry for the new relationship. Elsewhere, there is a ConsistencyGroup “CG_DB2” in the system that has a ReplicaInfo which points back to this ConsistencyGroup and which contains all of the Replica configuration information. The replica state in the target ConsistencyGroup has been updated according to the requested action (e.g., from “Active” to “Suspended”).

Failure Scenario: None defined

See also: Suspend Replication Synchronization Activity

7.1.44 Suspend Replication Synchronization Activity

Summary: Suspend active data synchronization between a source and target volume, without otherwise altering the replication relationship.

Purpose: Due to temporarily changed environmental constraints, the administrator wants to change the level of data protection between the target and source volumes.

Who: StorageAdmin, DevOps

Management Domain: Block storage management

Triggers: Need to reconfigure existing storage due to changing system or environment requirements.

Detailed Context: The admin needs to satisfy a user or application request to change the existing configuration between the existing target and source volumes in a replication relationship, without deleting the relationship.

Preconditions: User has already identified which target volume to suspend.

Feature(s): Replication (both local and remote)

Inputs:

- URL for target replica: /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973

Basic Course of Events:

1. Post (as an Action) the request on the source Volume.

This instructs the service to use the identified Volume as the source Volume for the specified replication relationship. For any additional details required, the service will rely on default values.

Request:

```
POST /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1/
      Volume.SuspendReplication
```

- **Headers:** Content-type : application/json

- **Body:**

```
{
  "TargetVolume": "/red-
  ↪ fish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/650973452245"
}
```

Response:

- **HTTP Status:** 204 (No Content)
- **Headers:** Location : /redfish/v1/Storage/1/StoragePools/PrimaryPool/AllocatedVolumes/1
- **Body:** None.

Postconditions: The selected volume has an updated ReplicaTargets entry for the new relationship. Elsewhere, there is a volume “650973452245” in the system that has a ReplicaInfo which points back to this volume and which contains all of the Replica configuration information. The replica state in the target volume has been updated according to the requested action (e.g., from “Active” to “Suspended”).

Failure Scenario: None defined

See also: Suspend Replication Synchronization Activity (CG)

7.1.45 Update access rights on an existing volume

Summary: Update existing Connection information to make an existing Volume read-only.

Purpose: Remove write permission from an existing Volume, by updating Connection information.

Who: StorageAdmin CloudAdmin

Management Domain: Block storage management

Triggers: None defined.

Detailed Context: Modify the AccessCapabilities entry within the Connections for a given Volume, removing write permissions, and making the Volume read-only through that Connection.

Preconditions: User has already identified the Endpoints from which write permission will be removed.

Feature(s): NVMe

Inputs:

None.

Basic Course of Events:

1. Retrieve the current set of Connections

Request:

GET /redfish/v1/Systems/Sys-1/Fabrics/NVMeoF/Connections

- **Headers:** No additional headers required.

- **Body:**

None.

Response:

- **HTTP Status:** 200 (OK)

- **Headers:**

Content-type : application/json`

- **Body:**

```

    ``json
    {
"@odata.type": "#ConnectionCollection.ConnectionCollection",
"Name": "NVMeoF Connection Collection",
"Members@odata.count": 2,
"Members": [
  {
"@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections/1"
  },
  {
"@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections/3"
  }
],
"@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections",
"@Redfish.Copyright": "Copyright 2015-2021 SNIA. All rights reserved."
}“

```

2. Retrieve individual Connections, filtering on the selected Initiator to locate the one to update.

Request:

```
GET /redfish/v1/Systems/Sys-1/Fabrics/NVMeoF/Connections/1
```

- **Headers:** No additional headers required.
- **Body:**
None.

Response:

- **HTTP Status:** 200 (OK)
- **Headers:**
Content-type : application/json
- **Body:**

```

json { "@odata.type": "#Connection.v1_0_0.Connection",
      "Id": "1", "Name": "Connection info for host 1", "ConnectionType":

```

```

"Storage",      "VolumeInfo": [    {          "AccessCapabilities":
[                "Read",          "Write"          ],      "Volume":
{                "@odata.id": "/redfish/v1/Storage/IPAttachedDrive1/Volumes/SimpleNamespace"
}      },    {          "AccessCapabilities": [          "Read",
"Write"          ],      "Volume": {          "@odata.id":
"/redfish/v1/Storage/IPAttachedDrive2/Volumes/SimpleNamespace"
}      }    ],      "Links": {    "InitiatorEndpoints": [      {
"@odata.id": "/redfish/v1/Fabrics/NVMeoF/Endpoints/Initiator1"
}    ],      "TargetEndpointGroups": [      {          "@odata.id":
"/redfish/v1/Fabrics/NVMeoF/EndpointGroups/TargetEPs"          }      ]
},      "@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections/1",
"@Redfish.Copyright": "Copyright 2015-2021 SNIA. All rights reserved."
}

```

- Update the VolumeInfo entry to remove write permission on the Volume through this Connection.

Request:

PATCH /redfish/v1/Systems/Sys-1/Fabrics/NVMeoF/Connections/1/VolumeInfo

- **Headers:** Content-type : application/json.
- **Body:**

```

{
  "AccessCapabilities": [
    "Read"
  ],
  "Volume": {
    "@odata.id": "/red-
↵ fish/v1/Storage/IPAttachedDrive2/Volumes/SimpleNamespace"
  }
}

```

Response:

- **HTTP Status:** 200 (OK)
- **Headers:**
 - Content-type : application/json`

- ****Body:****

```
```json
{
 "@odata.type": "#Connection.v1_0_0.Connection",
 "Id": "1",
 "Name": "Connection info for host 1",
 "ConnectionType": "Storage",
 "VolumeInfo": [
 {
 "AccessCapabilities": [
 "Read",
 "Write"
],
 "Volume": {
 "@odata.id": "/redfish/v1/Storage/IPAttachedDrive1/Volumes/SimpleNamespace"
 }
 },
 {
 "AccessCapabilities": [
 "Read"
],
 "Volume": {
 "@odata.id": "/redfish/v1/Storage/IPAttachedDrive2/Volumes/SimpleNamespace"
 }
 }
],
 "Links": {
 "InitiatorEndpoints": [
 {
 "@odata.id": "/redfish/v1/Fabrics/NVMeoF/Endpoints/Initiator1"
 }
],
 "TargetEndpointGroups": [
 {
 "@odata.id": "/redfish/v1/Fabrics/NVMeoF/EndpointGroups/TargetEPs"
 }
]
 }
}
```

```
 },
 "@odata.id": "/redfish/v1/Fabrics/NVMeoF/Connections/1",
 "@Redfish.Copyright": "Copyright 2015-2021 SNIA. All rights reserved."
}
...

```

**Postconditions:** Write permission has been removed for accesses to the selected volume and the given Connection.

**Failure Scenario:** None defined.

**See also:** None defined.



### 7.1.46 Use Features Registry to confirm functionality

**Summary:** Search features registry to confirm that a particular feature is supported by the implementation.

**Purpose:** Need to confirm support for particular features before enabling related client functionality.

**Who:** DevOps

**Management Domain:** Application storage management

**Triggers:** None.

**Detailed Context:** The client interface needs to confirm support for replication before enabling the related UI elements.

**Preconditions:** None.

**Feature(s):** None

**Inputs:** None

**Basic Course of Events:**

1. Locate the features registry for the instance

**Request:** GET /redfish/v1/Registries

- **Headers:** No additional headers required.
- **Body:** None.

**Response:**

- **HTTP Status:** 200 (OK)
- **Headers:** None.
- **Body:**

```
json { "@Redfish.Copyright": "Copyright 2015-2022 SNIA.
All rights reserved.", "@odata.id": "/redfish/v1/Registries",
"@odata.type": "#MessageRegistryFileCollection.MessageRegistryFileCollection",
"Name": "Registry File Collection", "Description": "Registry
Repository", "Members@odata.count": 1, "Members": [
 {
"@odata.id": "/redfish/v1/Registries/AdvertisedFeatures.v1_0_0"
}
] }
```

2. Use the appropriate entry to retrieve the features registry locations for Swordfish

**Request:** GET /redfish/v1/Registries/AdvertisedFeatures.v1\_0\_0

- **Headers:** No additional headers required.
- **Body:** None.

**Response:**

- **HTTP Status:** 200 (OK)
- **Headers:** None.
- **Body:**

```

{
 "@Redfish.Copyright": "Copyright 2015-2022
 SNIA. All rights reserved.",
 "@odata.id": "/redfish/v1/Registries/AdvertisedFeatures.v1_1_3.MessageRegistryFile",
 "@odata.type": "#MessageRegistryFile.v1_1_3.MessageRegistryFile",
 "Id": "AdvertisedFeatures.v1_0_0",
 "Name": "Swordfish Feature
 Registry File",
 "Description": "Swordfish Feature Registry
 File locations",
 "Registry": "SwordfishFeaturesRegistry.1.2.1",
 "Location": [
 {
 "Language": "en",
 "PublicationUri":
 "https://contoso.com/productX/featureinfo/AdvertisedFeatures.v1_0_0.json",
 "Uri": "/redfish/v1/Registries/AdvertisedFeatures.v1_0_0.json"
 }
],
 "Oem": {}
}

```

3. Use the URI property in location to retrieve the list of supported Features, and confirm the presence of replication.

**Request:** GET /redfish/v1/Registries/AdvertisedFeatures.v1\_0\_0.json

- **Headers:** No additional headers required.
- **Body:** None.

**Response:**

- **HTTP Status:** 200 (OK)
- **Headers:** None.
- **Body:**

```

{
 "@odata.type": "#FeaturesRegistry.v1_1_1.FeaturesRegistry",
 "Id": "AdvertisedFeatures.v1_0_0",
 "Name": "Global Swordfish Features Registry",
 "Language": "en",
 "RegistryPrefix": "SwordfishFeatureRegistry",
 "RegistryVersion": "1.2.0",
 "OwningEntity": "SNIA",
 "Features": [

```

```
{
 "FeatureName": "SNIA.Swordfish.Discovery",
 "Description": "Supports discovery of resources in a Swordfish
 → system.",
 "Version": "1.1.0",
 "CorrespondingProfileDefinition": "SwordfishDiscovery.json"
},
{
 "FeatureName": "SNIA.Swordfish.Block.Provisioning",
 "Description": "Supports the Block Provisioning Feature.",
 "Version": "1.1.0",
 "CorrespondingProfileDefinition": "SwordfishBlockProvisioning.json"
},
{
 "FeatureName": "SNIA.Swordfish.Block.LocalReplication",
 "Description": "Supports the Local Block Replication Feature.",
 "Version": "1.1.0",
 "CorrespondingProfileDefinition": "SwordfishBlockProvisioning.json"
}
],
"@Redfish.Copyright": "Copyright 2015-2022 SNIA. All rights reserved."
}
```

**Postconditions:** None defined.

**Failure Scenario:** None defined

**See also:** None defined.