



ONTAP Automation documentation

ONTAP Automation

NetApp
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ONTAP Automation documentation

Release Notes

What's new with the ONTAP REST API and automation

NetApp periodically updates the ONTAP REST API to bring you new features, enhancements, and bug fixes.

ONTAP 9.11.1

ONTAP 9.11.1 continues to expand the capabilities of the ONTAP REST API with nearly a hundred new API calls. These endpoints support the new ONTAP features as well as enhancements to existing features. This release focuses on supporting customer migration to the ONTAP REST API from the Data ONTAP API (ONTAPI or ZAPI).

Granular RBAC

The ONTAP role-based access control (RBAC) capability has been enhanced to provide additional granularity. You can use the traditional roles or create new roles as needed. Every role can be associated with one or more access definitions, each of which identifies a command or REST API call along with the desired access level. New access permissions are also available, such as `read_create` and `read_modify`. This enhancement provides parity with the Data ONTAP API (ONTAPI or ZAPI) and supports customer migration to the REST API.

Performance counters

Previous ONTAP releases have maintained statistical information about the operational characteristics of the system. With the 9.11.1 release, this information has been enhanced and is now available through the REST API. An administrator or automated process can access the data to determine system performance. The statistical information, as maintained by the counter manager subsystem, is presented in a database format using tables and rows. This enhancement brings the ONTAP REST API closer to parity with the Data ONTAP API (ONTAPI or ZAPI).

Aggregate management

The management of ONTAP storage aggregates has been enhanced. You can use the updated REST endpoints to move aggregates online and offline as well as manage the spares.

IP subnet capability

The ONTAP networking capability has been expanded to include support for IP subnets. The REST API provides access to the configuration and management of the IP subnets within an ONTAP cluster.

Multiple administrator verification

The multiple administrator verification feature provides a flexible authorization framework for protecting access to ONTAP commands or operations. You can define rules that identify the restricted commands. When a user requests access to a specific command, approval can be granted by multiple ONTAP administrators as appropriate.

SnapMirror enhancements

The SnapMirror capability has been enhanced in several areas including scheduling. The SnapVault relationship parity has been added in a DP relationship with ONTAP 9.11.1. Also, the throttle feature available with the REST API has reached parity with the Data ONTAP API (ONTAPI or ZAPI).

Name services cache support

ONTAP name services has been enhanced to support caching which improves performance and resiliency. Configuration of the name services cache can now be accessed through the REST API. Settings can be applied at multiple levels including: hosts, unix-users, unix-groups, and netgroups.

ONTAP 9.10.1

ONTAP 9.10.1 continues to expand the capabilities of the ONTAP REST API. Over a hundred new endpoints have been added to support new ONTAP features as well as enhancements to existing features. A summary of the REST API enhancements is presented below.

Application consistency group

A consistency group is a set of volumes that are grouped together when performing certain operations such as a snapshot. This feature extends the same crash consistency and data integrity implicit with single-volume operations across a set of volumes. It is valuable for large multi-volume workload applications.

SVM migration

You can migrate an SVM from a source cluster to a destination cluster. The new endpoints provide complete control, including the ability to pause, resume, retrieve status, and abort a migration operation.

File cloning and management

Volume-level file cloning and management have been enhanced. New REST endpoints support file move, copy, and split operations.

Improved S3 auditing

Auditing of the S3 events is a security improvement allowing you to track and log certain S3 events. An S3 audit event selector can be set on a per SVM per bucket basis.

Ransomware defense

ONTAP detects files potentially containing a ransomware threat. You can retrieve a list of these suspect files as well as remove them from a volume.

Miscellaneous security enhancements

There are several general security enhancements that expand existing protocols and introduce new capabilities. Improvements have been made to IPSEC, key management, SSH configuration, and file permissions.

CIFS domains and local groups

Support for CIFS domains has been added at the cluster and SVM level. You can retrieve the domain configuration as well as create and remove preferred domain controllers.

Expanded volume analytics

Volume analytics and metrics have been expanded through additional endpoints to support top files, directories, and users.

Support enhancements

Support has been enhanced through several new features. Automatic update can keep your ONTAP systems current by downloading and applying the latest software updates. You can also retrieve and manage the memory core dumps generated by a node.

ONTAP 9.9.1

ONTAP 9.9.1 continues to expand the capabilities of the ONTAP REST API. There are new API endpoints for existing ONTAP features, including SAN port sets and vServer file directory security. In addition, endpoints have been added to support new ONTAP 9.9.1 features and enhancements. And the related documentation has also been improved. A summary of the enhancements is presented below.

Mapping ONTAPI to the ONTAP 9 REST API

To help you transition your ONTAP automation code to the REST API, NetApp provides API mapping documentation. This reference includes a list of ONTAPI calls and the REST API equivalent for each. The mapping document has been updated to include the new ONTAP 9.9.1 API endpoints. See [ONTAPI to REST API mapping](#) for more information.

API endpoints for new ONTAP 9.9.1 core features

Support for new ONTAP 9.9.1 features that are not available through the ONTAPI API has been added to the REST API. This includes support for nested igroups and Google Cloud Key Management Services.

Improved support for transitioning to REST from ONTAPI

More of the legacy ONTAPI calls now have corresponding REST API equivalents. This includes local Unix users and groups, management of NTFS file security without the need for a client, SAN port sets, and volume space attributes. These changes are also included in the updated ONTAPI to REST mapping documentation.

Enhanced online documentation

The ONTAP online documentation reference page now includes labels indicating the ONTAP release when each REST endpoint or parameter was introduced, including those new with ONTAP 9.9.1.

ONTAP 9.8

ONTAP 9.8 greatly expands the breadth and depth of the ONTAP REST API. It includes several new features which enhance your ability to automate the deployment and management of ONTAP storage systems. In addition, support has been improved for assisting with the transition to REST from the legacy ONTAPI API.

Mapping ONTAPI to the ONTAP 9 REST API

To help you update your ONTAPI automation, NetApp provides a list of ONTAPI calls that require one or more input parameters, along with a mapping of those calls to the equivalent ONTAP 9 REST API call. See [ONTAPI to REST API mapping](#) for more information.

API endpoints for new ONTAP 9.8 core features

Support for the new core ONTAP 9.8 features not available through ONTAPI has been added to the REST API. This includes REST API support for ONTAP S3 buckets and services, SnapMirror Business Continuity, and File System Analytics.

Expanded support for enhanced security

Security has been enhanced through the support of several services and protocols, including Azure Key Vault, Google Cloud Key Management Services, IPSec, and Certificate Signing Requests.

Enhancements to improve simplicity

ONTAP 9.8 delivers more efficient and modern workflows using the REST API. For example, oneclick firmware updates are now available for several different types of firmware.

Enhanced online documentation

The ONTAP online documentation page now includes labels indicating the ONTAP release that each REST endpoint or parameter was introduced, including those new in 9.8.

Improved support for transitioning to REST from ONTAPI

More legacy ONTAPI calls now have corresponding REST API equivalents. Documentation is also available to help identify which REST endpoint should be used in place of an existing ONTAPI call.

Expanded performance metrics

Performance metrics for the REST API have been expanded to include several new storage and network objects.

ONTAP 9.7

ONTAP 9.7 extends the functional scope of the ONTAP REST API by introducing three new resource categories, each with several REST endpoints:

- NDMP
- Object store
- SnapLock

ONTAP 9.7 also introduces one or more new REST endpoints in several of the existing resource categories:

- Cluster
- NAS
- Networking
- NVMe
- SAN
- Security
- Storage
- Support

ONTAP 9.6

ONTAP 9.6 greatly extends the REST API support originally introduced in ONTAP 9.4. The ONTAP 9.6 REST API supports most ONTAP configuration and administration tasks.

REST APIs in ONTAP 9.6 include the following key areas and many more:

- Cluster setup
- Protocol configuration
- Provisioning
- Performance monitoring
- Data protection
- Application aware data management

Getting started with the REST API

You can quickly get started using the ONTAP REST API and other automation technologies. After preparing and understanding a basic request-response flow, you can issue a simple API call using curl. This preparation provides the introduction and perspective needed before using more complex workflows on a live system.

Understand the ONTAP automation options

Beginning with ONTAP 9.6, ONTAP includes an expansive REST API that provides the foundation for automating the deployment and administration of your storage systems. You can access the REST API directly or through the NetApp Python client library. In addition, NetApp supports ONTAP automation using Ansible as well as other high-level software abstractions.



The ONTAPI API, also known as the Network Manageability SDK or ZAPI, is the legacy technology for programmatically accessing and administering ONTAP storage systems. The ONTAP REST API is now the strategic technology and should be selected where possible.

Accessing the ONTAP REST API natively

You can access the ONTAP REST API directly using any programming language that supports a REST client. Popular language choices include Python, PowerShell, and Java. You should begin by reviewing all the documentation at this site.

Adapt legacy ONTAPI code to use REST

If you have existing code using the ONTAPI API, NetApp provides support for converting your code to use the newer ONTAP REST API. See [ONTAPI to REST API mapping information](#) for information about mapping the ONTAPI calls to the equivalent REST API calls.

Using the NetApp Python client library

The Python client library is a package you can use when writing scripts to access the ONTAP REST API. It provides support for several underlying services, including connection management, asynchronous request processing, and exception handling. By using the Python client library, you can quickly develop robust code to support your ONTAP automation goals. You should begin by reviewing the documentation at this site, including [Python client library](#).

Using Ansible

Ansible is an open-source software tool that supports provisioning, configuration management, and application deployment. Since its release and subsequent acquisition by RedHat, it has continued to grow in popularity. NetApp provides Ansible-certified modules that customers can use to automate the administration of their ONTAP storage systems. You should begin by reviewing the documentation at this site, including [ONTAP and Ansible automation](#).

Prepare to use the ONTAP REST API

There are several steps you should take to prepare to use the ONTAP REST API.

Experience with ONTAP 9

You should have experience with ONTAP 9. This includes understanding the basic concepts and terminology as well as some experience with system administration. See [ONTAP 9 Concepts](#) to get started.

Review REST concepts and implementation

Make sure to review [ONTAP REST API](#) for information about REST concepts and details regarding how the ONTAP REST API is designed.

Software development background

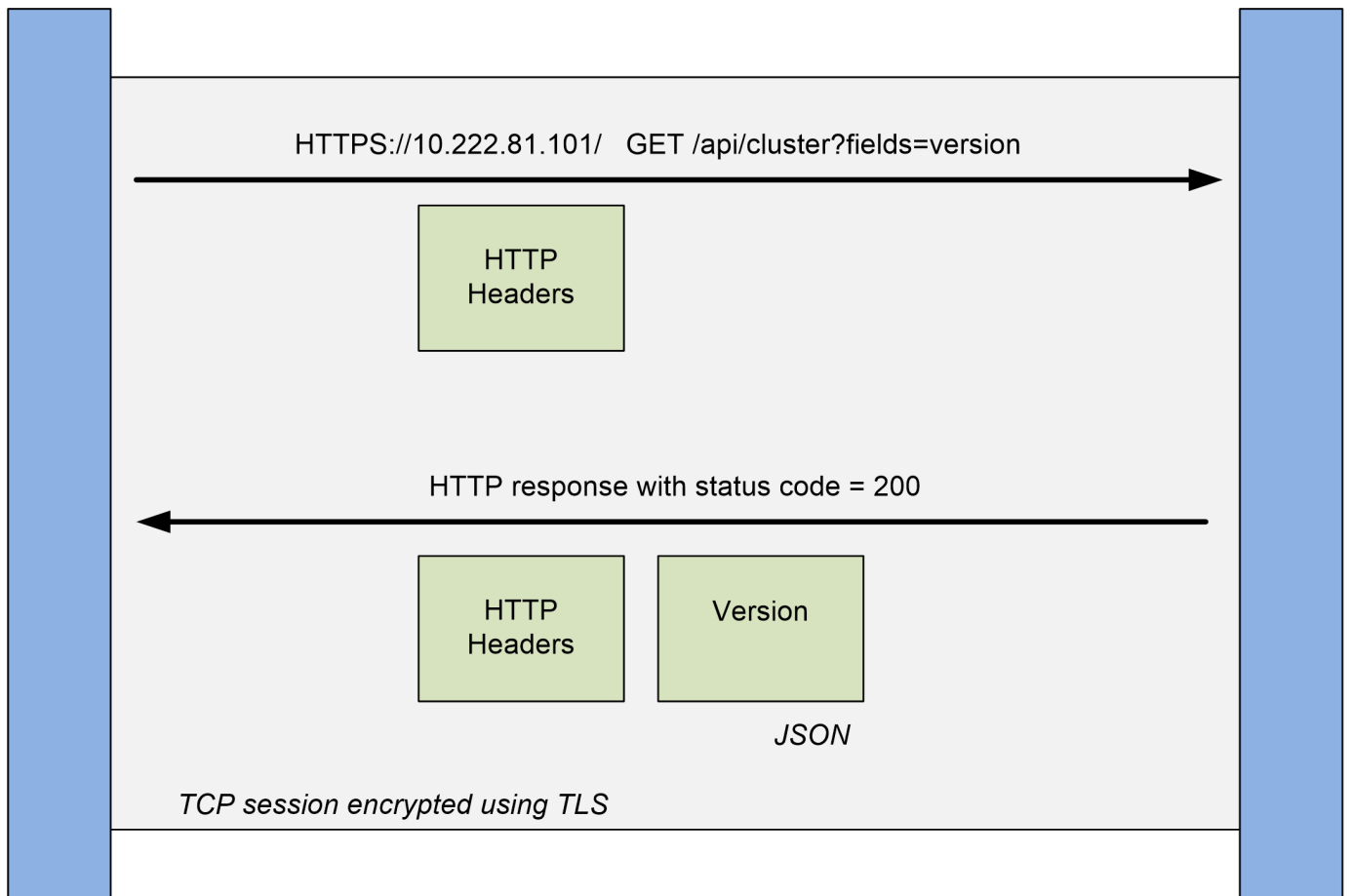
It is helpful to have some experience with software development technologies and processes, including one or more programming languages as well as common utilities such as curl.

Get more information

You should be aware of the additional information resources as suggested in [Get more information](#).

Retrieving the cluster software version

Each API transaction consists of an HTTP request and the associated response. This illustration shows how to retrieve the version of the ONTAP software used by the cluster.



Client

ONTAP

HTTP request

The request sent from the client to the server consists of the following:

- GET verb
- URL path for the cluster
- Query parameter (fields)
- Request headers, including authorization

HTTP response

The response sent from the server to the client consists of the following:

- Status code 200
- Response headers
- Response body containing the cluster software version

Hello world

You can issue a simple curl command at the CLI to get started using the ONTAP REST API and confirm its availability.

Before you begin

The curl utility must be available on your workstation. In addition, you must have the following:

- IP address or host name of the ONTAP cluster management LIF
- User name and password for an account with authority to access the ONTAP REST API (cluster resource).



If your credentials include special characters, you need to format them in a way that is acceptable to Curl based on the shell you are using. For example, you can insert a backslash before each special character or wrap the entire `username:password` string in single quotes.

Steps

1. At the command line interface of your local workstation, retrieve the version of the ONTAP software:

```
curl -X GET -u username:password -k  
"https://<ip_address>/api/cluster?fields=version"
```

Example

```
curl -X GET -u admin:password -k  
"'https://10.222.81.101/api/cluster?fields=version'"
```

After you finish

The ONTAP version information is displayed in a JSON format.

ONTAP REST API

REST implementation details

REST web services foundation

Representational State Transfer (REST) is a style for creating distributed web applications. When applied to the design of a web services API, it establishes a set of technologies for exposing server-based resources and managing their states. It uses mainstream protocols and standards to provide a flexible foundation for administering ONTAP clusters.



While REST establishes a common set of technologies and best practices, the details of each API can vary based on the choices made during development. You should be aware of the design characteristics of the ONTAP REST API before using it with a live deployment.

Resources and state representation

Resources are the basic components of a web-based system. When creating a REST web services application, early design tasks include:

- Identification of system or server-based resources

Every system uses and maintains resources. A resource can be a file, business transaction, process, or administrative entity. One of the first tasks in designing an application based on REST web services is to identify the resources.

- Definition of resource states and associated state operations

Resources are always in one of a finite number of states. The states, as well as the associated operations used to affect the state changes, must be clearly defined.

URI endpoints

Every REST resource must be defined and made available using a well-defined addressing scheme. The endpoints where the resources are located and identified use a Uniform Resource Identifier (URI). The URI provides a general framework for creating a unique name for each resource in the network. The Uniform Resource Locator (URL) is a type of URI used with web services to identify and access resources. Resources are typically exposed in a hierarchical structure similar to a file directory.

HTTP messages

Hypertext Transfer Protocol (HTTP) is the protocol used by the web services client and server to exchange request and response messages about the resources. As part of designing a web services application, HTTP methods are mapped to the resources and corresponding state management actions. HTTP is stateless. Therefore, to associate a set of related requests and responses as part of one transaction, additional information must be included in the HTTP headers carried with the request and response data flows.

JSON formatting

Although information can be structured and transferred between a web services client and server in several ways, the most popular option is JavaScript Object Notation (JSON). JSON is an industry standard for representing simple data structures in plain text and is used to transfer state information describing the resources. The ONTAP REST API uses JSON to format the data carried in the body of each HTTP request and response.

ONTAP REST API versioning

The REST API included with ONTAP 9 is assigned a version number which is independent of the ONTAP release number. You should be aware of the API version included with your release of ONTAP and how this might affect your use of the API.



All versions of ONTAP 9 use the same version of the REST API.

ONTAP 9.6 through ONTAP 9.10.1

Version 1

Related links

- [ONTAP Release Notes](#)

How to access the ONTAP API

You can access the ONTAP REST API in several different ways.

Network considerations

You can connect to the REST API through the following interfaces:

- Cluster management LIF
- Node management LIF
- SVM management LIF

The LIF you choose to use must be configured to support the HTTPS management protocol. Also, the firewall configuration in your network must allow the HTTPS traffic.



You should always use the cluster management LIF. This will load balance the API requests across all nodes and avoid nodes that are offline or experiencing connectivity issues.

ONTAP API online documentation page

The ONTAP API online documentation page provides an access point when using a web browser. In addition to providing a way to execute individual API calls directly, the page includes a detailed description of the API, including input parameters and other options for each call. The API calls are organized into functional categories. See [Summary of the REST resources](#) for more information.

The format of the URL used to access the documentation page for the most recent version of the API is:

`https://<cluster_mgmt_ip_address>/docs/api`

Custom software and tools

You can access the ONTAP API using any of several different programming languages and tools. Popular choices include Python, Java, Curl, and PowerShell. A program, script, or tool that uses the API acts as a REST web services client. Using a programming language enables a deeper understanding of the API and provides an opportunity to automate the ONTAP administration.

The format of the base URL used to directly access the most recent version of the API is:

```
https://<cluster_mgmt_ip_address>/api
```

To access a specific API version where multiple versions are supported, the format of the URL is:

```
https://<cluster_mgmt_ip_address>/api/v1
```

Basic operational characteristics

While REST establishes a common set of technologies and best practices, the details of each API can vary based on the design choices.

Request and response API transaction

Every REST API call is performed as an HTTP request to the ONTAP system which generates an associated response to the client. This request/response pair is considered an API transaction. Before using the API, you should be familiar with the input variables available to control a request and the contents of the response output.

Support for CRUD operations

Each of the resources available through the ONTAP REST API is accessed based on the CRUD model:

- Create
- Read
- Update
- Delete

For some of the resources, only a subset of the operations is supported. You should review the ONTAP API documentation page at your ONTAP cluster for more information about each resource.

Object identifiers

Each resource instance or object is assigned a unique identifier when it is created. In most cases, the identifier is a 128-bit UUID. These identifiers are globally unique within a specific ONTAP cluster. After issuing an API call that creates a new object instance, a URL with the associated id value is returned to the caller in the location header of the HTTP response. You can extract the identifier and use it on subsequent calls when referring to the resource instance.



The content and internal structure of the object identifiers can change at any time. You should only use the identifiers on the applicable API calls as needed when referring to the associated objects.

Object instances and collections

Depending on the resource path and HTTP method, an API call can apply to a specific object instance or a collection of objects.

Synchronous and asynchronous operations

There are two ways that ONTAP performs an HTTP request received from a client.

Synchronous processing

ONTAP performs the request immediately and responds with an HTTP status code of 200 or 201 if it is successful.

Every request using the methods GET, HEAD, and OPTIONS is always performed synchronously. In addition, requests that use POST, PATCH, and DELETE are designed to run synchronously if they are expected to complete in less than two seconds.

Asynchronous processing

If an asynchronous request is valid, ONTAP creates a background task to process the request and a job object to anchor the task. The 202 HTTP status is returned to the caller along with the job object. To determine final success or failure, you must retrieve the state of the job.

Requests that use the methods POST, PATCH, and DELETE are designed to run asynchronously if they are expected to take more than two seconds to complete.



The `return_timeout` query parameter is available with asynchronous API calls and can convert an asynchronous call to complete synchronously. Refer to [How asynchronous processing works using the Job object](#) for more information.

Security

The security provided with the REST API is based primarily on the existing security features available with ONTAP. The following security is used by the API:

- Transport Layer Security

All traffic sent over the network between the ONTAP LIF and client is typically encrypted using TLS, based on the ONTAP configuration settings.

- Client authentication

The same authentication options available with ONTAP System Manager and the Network Manageability SDK can also be used with the ONTAP REST API.

- HTTP authentication

At an HTTP level, basic authentication is used for the API transactions. An HTTP header with the user name and password in a base64 string is added to each request.

- ONTAP authorization

ONTAP implements a role-based authorization model. The account you use when accessing the ONTAP REST API or API documentation page should have the proper authority.

Related information

- [Security using RBAC](#)

Input variables controlling an API request

You can control how an API call is processed through parameters and variables set in the HTTP request.

HTTP methods

The HTTP methods supported by the ONTAP REST API are shown in the following table.



Not all the HTTP methods are available at each of the REST endpoints. Also, both PATCH and DELETE can be used on a collection. See *Object references and access* for more information.

HTTP method	Description
GET	Retrieves object properties on a resource instance or collection.
POST	Creates a new resource instance based on the supplied input.
PATCH	Updates an existing resource instance based on the supplied input.
DELETE	Deletes an existing resource instance.
HEAD	Effectively issues a GET request but only returns the HTTP headers.
OPTIONS	Determine what HTTP methods are supported at a specific endpoint.

Request headers

You must include several headers in the HTTP request.

Content-type

If the request body includes JSON, this header must be set to `application/json`.

Accept

This header should be set to `application/hal+json`. If it is instead set to `application/json` none of the HAL links will be returned except a link needed to retrieve the next batch of records. If the header is anything else aside from these two values, the default value of the `content-type` header in the response will be `application/hal+json`.

Authorization

Basic authentication must be set with the user name and password encoded as a base64 string.

Request body

The content of the request body varies depending on the specific call. The HTTP request body consists of one of the following:

- JSON object with input variables
- Empty JSON object

Filtering objects

When issuing an API call that uses GET, you can limit or filter the returned objects based on any attribute. For example, you can specify an exact value to match:

```
<field>=<query value>
```

In addition to an exact match, other operators are available to return a set of objects over a range of values. The ONTAP REST API supports the filtering operators shown in the table below.

Operator	Description
=	Equal to
<	Less than
>	Greater than
≤	Less than or equal to
≥	Greater than or equal to
UPDATE	Or
!	Not equal to
*	Greedy wildcard

You can also return a collection of objects based on whether a specific field is set or not set by using the `null` keyword or its negation `!null` as part of the query.



Any fields that are not set are generally excluded from matching queries.

Requesting specific object fields

By default, issuing an API call using GET returns only the attributes that uniquely identify the object or objects, along with a HAL self link. This minimum set of fields acts as a key for each object and varies based on the object type. You can select additional object properties using the `fields` query parameter in the following ways:

- Common or standard fields

Specify `fields=*`` to retrieve the most commonly used object fields. These fields are typically maintained in local server memory or require little processing to access. These are the same properties returned for an object after using GET with a URL path key (UUID).

- All fields

Specify `fields=**` to retrieve all the object fields, including those requiring additional server processing to access.

- Custom field selection

Use `fields=<field_name>` to specify the exact field you want. When requesting multiple fields, the values must be separated using commas without spaces.



As a best practice, you should always identify the specific fields you want. You should only retrieve the set of common fields or all fields when needed. Which fields are classified as common, and returned using `fields=*`, is determined by NetApp based on internal performance analysis. The classification of a field might change in future releases.

Sorting objects in the output set

The records in a resource collection are returned in the default order defined by the object. You can change the order using the `order_by` query parameter with the field name and sort direction as follows:

```
order_by=<field name> asc|desc
```

For example, you can sort the `type` field in descending order followed by `id` in ascending order:

```
order_by=type desc, id asc
```

Note the following:

- If you specify a sort field but don't provide a direction, the values are sorted in ascending order.
- When including multiple parameters, you must separate the fields with a comma.

Pagination when retrieving objects in a collection

When issuing an API call using GET to access a collection of objects of the same type, ONTAP attempts to return as many objects as possible based on two constraints. You can control each of these constraints using additional query parameters on the request. The first constraint reached for a specific GET request terminates the request and therefore limits the number of records returned.



If a request ends before iterating over all the objects, the response contains the link needed to retrieve the next batch of records.

Limiting the number of objects

By default, ONTAP returns a maximum of 10,000 objects for a GET request. You can change this limit using the `max_records` query parameter. For example:

```
max_records=20
```

The number of objects actually returned can be less than the maximum in effect, based on the related time constraint as well as the total number of objects in the system.

Limiting the time used to retrieve the objects

By default, ONTAP returns as many objects as possible within the time allowed for the GET request. The default timeout is 15 seconds. You can change this limit using the `return_timeout` query parameter. For example:

```
return_timeout=5
```

The number of objects actually returned can be less than the maximum in effect, based on the related constraint on the number of objects as well as the total number of objects in the system.

Narrowing the result set

If needed, you can combine these two parameters with additional query parameters to narrow the result set. For example, the following returns up to 10 ems events generated after the specified time:

```
time⇒ 2018-04-04T15:41:29.140265Z&max_records=10
```

You can issue multiple requests to page through the objects. Each subsequent API call should use a new time value based on the latest event in the last result set.

Size properties

The input values used with some API calls as well as certain query parameters are numeric. Rather than provide an integer in bytes, you can optionally use a suffix as shown in the following table.

Suffix	Description
KB	KB Kilobytes (1024 bytes) or kibibytes
MB	MB Megabytes (KB x 1024 bytes) or mebibytes
GB	GB Gigabytes (MB x 1024 bytes) or gibibytes
TB	TB Terabytes (GB x 1024 bytes) or tebibytes
PB	PB Petabytes (TB x 1024 bytes) or pebibytes

Related information

- [Object references and access](#)

Interpreting an API response

Each API request generates a response back to the client. You should examine the response to determine whether it was successful and retrieve additional data as needed.

HTTP status code

The HTTP status codes used by the ONTAP REST API are described below.

Code	Reason phrase	Description
200	OK	Indicates success for calls that do not create a new object.
201	Created	An object is successfully created. The location header in the response includes the unique identifier for the object.
202	Accepted	A background job has been started to perform the request, but has not completed yet.
400	Bad request	The request input is not recognized or is inappropriate.
401	Unauthorized	User authentication has failed.
403	Forbidden	Access is denied due to an authorization (RBAC) error.
404	Not found	The resource referred to in the request does not exist.

Code	Reason phrase	Description
405	Method not allowed	The HTTP method in the request is not supported for the resource.
409	Conflict	An attempt to create an object failed because a different object must be created first or the requested object already exists.
500	Internal error	A general internal error occurred at the server.

Response headers

Several headers are included in the HTTP response generated by the ONTAP.

Location

When an object is created, the location header includes the complete URL to the new object including the unique identifier assigned to the object.

Content-type

This will normally be `application/hal+json`.

Response body

The content of the response body resulting from an API request differs based on the object, processing type, and the success or failure of the request. The response is always rendered in JSON.

- Single object

A single object can be returned with a set of fields based on the request. For example, you can use GET to retrieve selected properties of a cluster using the unique identifier.

- Multiple objects

Multiple objects from a resource collection can be returned. In all cases, there is a consistent format used, with `num_records` indicating the number of records and `records` containing an array of the object instances. For example, you can retrieve the nodes defined in a specific cluster.

- Job object

If an API call is processed asynchronously, a Job object is returned which anchors the background task. For example, the PATCH request used to update the cluster configuration is processed asynchronously and returns a Job object.

- Error object

If an error occurs, an Error object is always returned. For example, you will receive an error when attempting to change a field not defined for a cluster.

- Empty JSON object

In certain cases, no data is returned and the response body includes an empty JSON object.

HAL linking

The ONTAP REST API uses HAL as the mechanism to support Hypermedia as the Engine of Application State (HATEOAS). When an object or attribute is returned that identifies a specific resource, a HAL-encoded link is also included allowing you to easily locate and determine additional details about the resource.

Errors

If an error occurs, an error object is returned in the response body.

Format

An error object has the following format:

```
"error": {  
  "message": "<string>",  
  "code": <integer>[,  
  "target": "<string>"]  
}
```

You can use the code value to determine the general error type or category, and the message to determine the specific error. When available, the target field includes the specific user input associated with the error.

Common error codes

The common error codes are described in the following table. Specific API calls can include additional error codes.

Code		Description
1	409	An object with the same identifier already exists.
2	400	The value for a field has an invalid value or is missing, or an extra field was provided.
3	400	The operation is not supported.
4	405	An object with the specified identifier cannot be found.
6	403	Permission to perform the request is denied.
8	409	The resource is in use.

Asynchronous processing using the Job object

After issuing an API request that is designed to run asynchronously, a job object is always created and returned to the caller. The job describes and anchors a background task that processes the request. Depending on the HTTP status code, you must retrieve the state of the job to determine if the request was successful.

Refer to [API reference](#) to determine which API calls are designed to be performed asynchronously.

Controlling how a request is processed

You can use the `return_timeout` query parameter to control how an asynchronous API call is processed. There are two possible outcomes when using this parameter.

Timer expires before the request completes

For valid requests, ONTAP returns a 202 HTTP status code along with the job object. You must retrieve the state of the job to determine if the request completed successfully.

Request is completed before the timer expires

If the request is valid and completes successfully before the time expires, ONTAP returns a 200 HTTP status code along with the job object. Because the request is completed synchronously, as indicated by the 200, you do not need to retrieve the job state.



The default value for the `return_timeout` parameter is zero seconds. Therefore, if you don't include the parameter, the 202 HTTP status code is always returned for a valid request.

Querying the Job object associated with an API request

The Job object returned in the HTTP response contains several properties. You can query the state property in a subsequent API call to determine if the request completed successfully. A Job object is always in one of the following states:

Non-terminal states

- Queued
- Running
- Paused

Terminal states

- Success
- Failure

General procedure for issuing an asynchronous request

You can use the following high-level procedure to complete an asynchronous API call. This example assumes the `return_timeout` parameter is not used, or that the time expires before the background job completes.

1. Issue an API call that is designed to be performed asynchronously.
2. Receive an HTTP response 202 indicating acceptance of a valid request.
3. Extract the identifier for the Job object from the response body.
4. Within a timed loop, perform the following in each cycle:
 - a. Get the current state of the Job.
 - b. If the Job is in a non-terminal state, perform loop again.
5. Stop when the Job reaches a terminal state (success, failure).

Related information

- [Workflow 1: Updating the cluster contact and checking job state](#)

Additional considerations

Object references and access

The resource instances or objects exposed through the ONTAP REST API can be referenced and accessed in several different ways.

Object access paths

At a high level, there are two path types when accessing an object:

- Primary

The object is the primary or direct target of the API call.

- Foreign

The object is not the primary reference of the API call, but rather is linked to from the primary object. It is therefore a foreign or downstream object and referenced through a field in the primary object.

Accessing an object using the UUID

Every object is assigned a unique identifier when it is created, which in most cases is a 128-bit UUID. The assigned UUID values are immutable and are used internally within ONTAP to access and manage the resources. Because of this, the UUID generally provides the fastest and most stable way to access objects.

For many of the resource types, a UUID value can be provided as part of the path key in the URL to access a specific object. For example, you can use the following to access a node instance:

```
`/cluster/nodes/{uuid}
```

Accessing an object using an object property

In addition to a UUID, you can also access an object using an object property. In most cases, it is convenient to use the name property. For example, you can use the following query parameter in the URL string to access a node instance by its name: `/cluster/nodes?name=node_one`. In addition to a query parameter, a foreign object can be accessed through a property in the primary object.

While you can use the name or other property to access an object instead of the UUID, there are several possible disadvantages:

- The name field is not immutable and can be changed. If the name of an object is changed before accessing an object, the wrong object will be returned or an object access error will fail.



This issue can occur with a POST or PATCH method on a foreign object or with a GET method on a primary object.

- ONTAP must translate the name field into the corresponding UUID. This is a type of indirect access which can become a performance issue.

In particular, a performance degradation is possible when one or more of the following is true:

- GET method is used

- A large collection of objects is accessed
- A complex or elaborate query is used

Cluster versus SVM context

There are several REST endpoints that support both a cluster and SVM. When using one of these endpoints, you can indicate the context of the API call through the `scope=[svm|cluster]` value. Examples of endpoints supporting a dual context include IP interfaces and security roles.



The scope value has a default value based on the properties provided for each API call.

Using PATCH and DELETE on a collection of objects

Every REST endpoint supporting PATCH or DELETE on a resource instance also supports the same method on a collection of objects. The only requirement is that at least one field must be provided through a query parameter in the URL string. When issuing a PATCH or DELETE over a collection, this is equivalent to doing the following internally:

- Query-based GET to retrieve the collection
- Serial sequence of PATCH or DELETE calls on each object in the collection

The time out for the operation can be set by `return_timeout` with a default of 15 seconds. If not completed before the timeout, the response includes a link to the next object. You must reissue the same HTTP method using the next link to continue the operation.

Users of the ONTAPI API and ONTAP CLI

ONTAPI is a set of API calls provided through the Network Manageability SDK that can be used to administer ONTAP storage systems. There are differences between the REST API and the ONTAPI API calls, as well as between the REST API and ONTAP CLI. You should understand these differences before using the REST API in a production environment.

General design differences

The ONTAP REST API and command line interface have a fundamentally different designs. The CLI commands and parameters do not map directly to the REST API calls. And even where there might be a similarity, the details of the input parameters can be different. For example, numeric units might be specified in bytes or using a suffix (such as KB). You should review [Input variables controlling an API request](#) as well as the [API reference](#) for more information.

Data SVMs exposed through the REST API

ONTAP supports several types of storage virtual machines (SVMs). However, only the data SVMs are directly exposed through the ONTAP REST API. The configuration information describing the cluster and nodes is available through the REST API, however the cluster and nodes are not treated as separate SVMs.

Migrating from ONTAPI to REST

The REST API is the primary and strategic choice for automating ONTAP system administration. If you are currently using the ONTAPI API, you should consider migrating to the REST API. NetApp provides mapping

documentation to assist with the migration from ONTAPI to REST.

Changes to SnapDiff availability in ONTAPI

Beginning with ONTAP 9.10.1, the SnapDiff v1 and v2 ONTAPI calls cannot be invoked. Any third-party application that invokes SnapDiff v1 or v2 ONTAPI calls will not function beginning with ONTAP 9.10.1. ONTAP users should verify that their backup application supports the SnapDiff v3 REST calls before upgrading to ONTAP 9.10.1.

SnapDiff API availability across ONTAP releases is defined as follows:

- ONTAP 9.7 and earlier releases: v1 and v2 (ONTAPI only)
- ONTAP 9.8 – 9.9.1: v1, v2 and v3 (both ONTAPI and REST API)
- ONTAP 9.10.1: v3 only (REST API only)

For more information, see the [ONTAP Release Notes](#).

Related information

- [Input variables controlling an API request](#)
- [ONTAPI to REST API mapping information](#)

Access the ONTAP CLI through the REST API

To assist CLI and ONTAPI API users in their transition to the ONTAP REST API, ONTAP provides a REST endpoint to access the CLI. You can use this passthrough feature to execute any CLI command. Usage of the REST endpoint is returned in AutoSupport data so NetApp can identify gaps in the REST API and make improvements in future releases.

To issue a CLI command, you must make a REST API call that is properly formed based on rules regarding:

- Resource paths
- Field names
- HTTP methods

The base resource path for CLI access is `/private/cli`. Refer to the ONTAP API online documentation page for details about accessing the CLI through the REST API.



NetApp maintains a GitHub repository containing code samples and other helpful information. You can access the repository for examples of how to use the CLI passthrough facility.

Related links

[ONTAP REST Python GitHub repository - CLI passthrough samples](#)

Security using RBAC

The REST API expands the role-based access control (RBAC) capabilities when using ONTAP. You can create user accounts with custom roles to restrict access to the REST endpoints.

Creating roles for the REST endpoints

A REST role is defined through a set of one or more privileges. Each privilege consists of a path to a REST endpoint and the associated access level. Access to each endpoint is provided in one of three levels and determines the HTTP methods that can be used against the resource. The access levels include:

- All
All HTTP methods can be used
- Read-only
Only GET can be used
- None
No access is allowed

Here is an example of two privileges that can be assigned to a REST role:

- `access="readonly", path="/api/storage/volumes"`
- `access="none", path="/api/snapmirror/policies"`

Creating a user account with a custom role

At a high level, you can create an account with a custom REST role as follows:

1. Create a user account with access to the HTTP management protocol.
2. Create a REST role with the desired privileges.
3. Associate the user account with the role.

Performance metrics for storage resources

ONTAP collects performance metrics about selected SVM storage objects and protocols, and reports this information through the REST API. You can use this data to monitor the performance of an ONTAP system.

For a given storage object or protocol, the performance data falls into three categories:

- IOPS
- Latency
- Throughput

Within each category, one or more of the following types of data is available:

- Read (R)
- Write (W)
- Other (O)
- Total (T)

The following table summarizes the performance data available through the ONTAP REST API, including the release when it was added. Refer to the REST API online documentation page at your ONTAP system for more information.

Storage object or protocol	IOPS	Latency	Throughput	ONTAP release
Ethernet port	Not applicable	Not applicable	RWT	9.8
FC port	RWOT	RWOT	RWT	9.8
IP interface	Not applicable	Not applicable	RWT	9.8
FC interface	RWOT	RWOT	RWT	9.8
NVMe namespace	RWOT	RWOT	RWOT	9.8
Qtree statistics	Raw RWOT	Not applicable	Raw RWOT	9.8
Volume Flexcache	RWOT	RWOT	RWT	9.8
Node – process utilization	Process utilization as a numerical value	Process utilization as a numerical value	Process utilization as a numerical value	9.8
Cloud volume	RWOT	RWOT	Not applicable	9.7
LUN	RWOT	RWOT	RWOT	9.7
Aggregate	RWOT	RWOT	RWOT	9.7
SVM NFS protocol	RWOT	RWOT	RWT	9.7
SVM CIFS protocol	RWOT	RWOT	RWT	9.7
SVM FCP protocol	RWOT	RWOT	RWT	9.7
SVM iSCSI protocol	RWOT	RWOT	RWT	9.7
SVM NVMe protocol	RWOT	RWOT	RWT	9.7
Cluster	RWOT	RWOT	RWOT	9.6
Volumes	RWOT	RWOT	RWOT	9.6

Summary of the REST resources

Overview of the resource categories

The resources available through the ONTAP REST API are organized in categories, as displayed on the ONTAP API documentation page. A brief description of each of the resources with the base resource paths is presented below, along with additional usage considerations where appropriate.

This section describes the REST resources for the latest version of the product. If you need to understand the changes that were made from the previous version, see the *Release Notes*.



For many of the REST endpoints, you can include a UUID key as part of the path string to access a specific object instance. However, you can also access objects using a property value on a query parameter.

Related information

- [Additional REST considerations](#)
- [API reference](#)
- [ONTAP Release Notes](#)

Application

You can use these API calls to manage the ONTAP application resources.

Application snapshots

Applications support snapshot copies, which can be created or restored at any time. This resource type was introduced with ONTAP 9.6.

Applications

The ONTAP applications are arranged based on type, including: templates, applications, components, and Snapshot copies. This resource type was introduced with ONTAP 9.6.

Consistency groups

A consistency group is a set of volumes that are grouped together when performing certain operations such as a snapshot. This feature extends the same crash consistency and data integrity implicit with single-volume operations across a set of volumes. This resource type was introduced with ONTAP 9.10.

Consistency groups snapshots

You can use these endpoints to copy, create, inventory, and restore SnapShots for a consistency group. This resource type was introduced with ONTAP 9.10.

Cloud

You can use these API calls to manage connections to object storage resources in the cloud.

Targets

A target represents an object storage resource in the cloud. Each target includes the configuration information needed to connect to the storage resource. This resource type was introduced with ONTAP 9.6.

Cluster

You can use these API calls to manage ONTAP clusters and the related resources.

Capacity pools

The capacity pools licensing model allows you to license storage capacity for each cluster node from a shared pool. This resource type is new with ONTAP 9.8.

Chassis

The chassis is the hardware framework supporting a cluster. This resource type was introduced with ONTAP 9.6.

Clusters

An ONTAP cluster contains one or more nodes and the related configuration settings which define the storage system. This resource type was introduced with ONTAP 9.6.

Firmware

You can retrieve a history of the firmware update requests. This resource type is new with ONTAP 9.8.

Jobs

Asynchronous REST API requests are performed using a background task anchored by a job. This resource type was introduced with ONTAP 9.6.

License instance

Each license can be managed as a separate package. This resource type was introduced with ONTAP 9.6.

License managers

You can manage configuration and other information related to each license manager instance associated with an ONTAP cluster. This resource type is new with ONTAP 9.8.

Licenses

The licenses allow you to implement specific ONTAP features and functionality. This resource type was introduced with ONTAP 9.6.

Mediators

You can manage the mediator associated with MetroCluster, including adding or removing the mediator instance. This resource type is new with ONTAP 9.8.

MetroCluster

You can create and manage a MetroCluster deployment, including executing switchover or switchback operations. This resource type is new with ONTAP 9.8.

MetroCluster diagnostics

You can perform a diagnostic operation on a MetroCluster deployment and retrieve the results. This resource type is new with ONTAP 9.8.

MetroCluster DR groups

You can perform operations related to the MetroCluster DR groups. This resource type is new with ONTAP 9.8.

MetroCluster interconnects

You can retrieve the MetroCluster interconnect status. This resource type is new with ONTAP 9.8.

MetroCluster nodes

You can retrieve the status of the individual nodes in a MetroCluster deployment. This resource type is new with ONTAP 9.8.

MetroCluster operations

You can retrieve a list of the recently executed operations for a MetroCluster configuration. This resource type is new with ONTAP 9.8.

MetroCluster SVMs

You can retrieve information about all the SVM pairs in a MetroCluster configuration. This resource type was introduced with ONTAP 9.11.1.

Nodes

ONTAP clusters are composed of one or more nodes. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

NTP keys

The Network Time Protocol (NTP) can be configured to use shared private keys between ONTAP and trusted external NTP time servers. This resource type was introduced with ONTAP 9.7.

NTP server

You can use these API calls to configure the ONTAP Network Time Protocol settings, including the external NTP servers and keys. This resource type was introduced with ONTAP 9.7.

Peers

The peer objects represent endpoints and support the cluster peering relationships. This resource type was introduced with ONTAP 9.6.

Performance counters

Previous ONTAP releases have maintained statistical information about the operational characteristics of the system. With the 9.11.1 release, the information has been enhanced and is now available through the REST API. This feature brings the ONTAP REST API closer to parity with the Data ONTAP API (ONTAPI or ZAPI). This resource type was introduced with ONTAP 9.11.1.

Schedules

Schedules can be used to automate the perform of tasks. This resource type was introduced with ONTAP 9.6.

Sensors

You can use these endpoints to retrieve details about all the platform environment sensors. This resource type was introduced with ONTAP 9.11.1.

Software

An ONTAP cluster includes the cluster software profile, software packages collection, and software history collection. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

Web

You can use these endpoints to update the web services configurations and to retrieve the current configuration. This resource type was introduced with ONTAP 9.10.

Name services

You can use these API calls to manage the name services supported by ONTAP.

Cache

ONTAP name services supports caching which improves performance and resiliency. Configuration of the name services cache can now be access through the REST API. Settings can be applied at multiple levels including: hosts, unix-users, unix-groups, and netgroups. This resource type was introduced with ONTAP 9.11.1.

DDNS

You can display the Dynamic DNS (DDNS) information and manage the DDNS subsystem. This resource type is new with ONTAP 9.8.

DNS

DNS supports the integration of the ONTAP cluster in your network. This resource type was introduced with ONTAP 9.6.

Host record

These endpoints allow you to displays the IP address of a specified hostname as well as the hostname for an IP address. This resource type was introduced with ONTAP 9.10.

LDAP

LDAP servers can be used to maintain user information. This resource type was introduced with ONTAP 9.6.

LDAP schemas

You can create, modify, and list the LDAP schemas used by ONTAP. There are four default schemas included. This resource type was introduced with ONTAP 9.11.1.

Local hosts

You can use these endpoints to display and manage the local mappings for hostnames. This resource type was introduced with ONTAP 9.10.

Name mappings

Name mappings allow you to map identities from one name domain to another. For example, you can map identities from CIFS to UNIX, Kerberos to UNIX, and UNIX to CIFS. This resource type was introduced with ONTAP 9.6.

Netgroup files

You can retrieve netgroup file details and delete a file for an SVM. This resource type was introduced with ONTAP 9.11.1.

NIS

NIS servers can be used to authenticate users and client workstations. This resource type was introduced with ONTAP 9.6.

UNIX users and groups

Local UNIX users and groups have been a part of previous ONTAP releases. However, support has now been added to the REST API allowing you to display and manage the users and groups. These REST resource types were introduced with ONTAP 9.9 and significantly enhanced with ONTAP 9.10.

NAS

You can use these API calls to manage the CIFS and NFS settings for the cluster and SVMs.

Audit

Certain CIFS and NFS events can be logged for the SVMs, which can help to improve security. This resource type was introduced with ONTAP 9.6.

Audit log redirect

You can redirect NAS auditing events to a specific SVM. This resource type is new with ONTAP 9.8.

CIFS connections

You can retrieve a list of the established CIFS connections. This resource type was introduced with ONTAP 9.11.1.

CIFS domains

Support for CIFS domains has been added at the cluster and SVM level with several categories of endpoints. You can retrieve the domain configuration as well as create and remove preferred domain controllers. This resource type is new with ONTAP 9.10.

CIFS home directory search paths

Home directories for SMB users on a CIFS server can be created without creating an individual SMB share for each user. The home directory search path is a set of absolute paths from the root of an SVM. This resource type was introduced with ONTAP 9.6.

CIFS local groups

The CIFS server can use local groups for authorization when determining share, file, and directory access rights. This resource type was introduced with ONTAP 9.9 and significantly expanded with ONTAP 9.10.

CIFS NetBIOS

You can display information about the NetBIOS connections for the cluster. Details include the IP addresses and registered NetBIOS names. This information can help you to troubleshoot name resolution issues. This resource type was introduced with ONTAP 9.11.1.

CIFS services

The core configuration of the CIFS server. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

CIFS session files

You can retrieve a list of open files for the CIFS sessions based on several filtering options. This resource type was introduced with ONTAP 9.11.1.

CIFS sessions

You can use this API to retrieve detailed information about a CIFS session. This resource type was introduced with the ONTAP 9.8 REST API and enhanced with ONTAP 9.9.

CIFS shadow copies

Microsoft Remote Volume Shadow Copy Services is an extension of the existing Microsoft VSS functionality. It extends the VSS capability to support shadow copying of SMB shares. This feature is now available through the ONTAP REST API. This resource type was introduced with ONTAP 9.11.1.

CIFS shares

The SMB shares defined at a CIFS server. This resource type was introduced with ONTAP 9.6.

CIFS shares ACLs

The access control lists (ACLs) controlling access to folders and files on the CIFS shares. This resource type was introduced with ONTAP 9.6.

CIFS UNIX symlink mapping

Both CIFS and UNIX clients can access the same datastore. When UNIX clients create symbolic links, these mappings provide a reference to another file or folder to support the CIFS clients. This resource type was introduced with ONTAP 9.6.

CIFS user and group bulk import

You can use the new REST API endpoints to perform a bulk import of the CIFS local users, groups, and group membership information as well as monitor the status of the request. This resource type was introduced with ONTAP 9.11.1.

File access tracing

You can use these API calls to trace access to specific files. This resource type is new with ONTAP 9.8.

File security permissions

You can use these API calls displays the effective permission granted to Windows or Unix user for a specific file or folder. You can also manage NTFS file security and audit policies. This resource type was introduced with the ONTAP 9.8 REST API and significantly enhanced with ONTAP 9.9.

FPolicy

FPolicy is a file access notification framework used to monitor and manage file access events on the SVMs. This resource type was introduced with ONTAP 9.6.

FPolicy connections

These endpoints allow you to display and update connection status information for external FPolicy servers. This resource type was introduced with ONTAP 9.10.

FPolicy engines

The FPolicy engines allow you to identify the external servers that receive the file access notifications. This resource type was introduced with ONTAP 9.6.

FPolicy events

The configuration identifying how file access is monitored and what events are generated. This resource type was introduced with ONTAP 9.6.

FPolicy policies

A container for elements of the FPolicy framework, including FPolicy engines and events. This resource type was introduced with ONTAP 9.6.

Locks

A lock is a synchronization mechanism for enforcing limits on concurrent access to files where many clients are accessing the same file simultaneously. You can use these endpoints to retrieve and delete locks. This resource type was introduced with ONTAP 9.10.

NFS connected client maps

The NFS map information for the connected clients is available through the new endpoint. You can retrieve details about the node, SVM, and IP addresses. This resource type was introduced with ONTAP 9.11.1.

NFS connected clients

You can display a list of connected clients with the details of their connection. This resource type was introduced with ONTAP 9.7.

NFS export policies

The policies including rules that describe the NFS exports. This resource type was introduced with ONTAP 9.6.

NFS Kerberos interfaces

The configuration settings for an interface to Kerberos. This resource type was introduced with ONTAP 9.6.

NFS Kerberos realms

The configuration settings for Kerberos realms. This resource type was introduced with ONTAP 9.6.

NFS services

The core configuration of the NFS server. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

Object store

Auditing of the S3 events is a security improvement allowing you to track and log certain S3 events. An S3

audit event selector can be set on a per SVM per bucket basis. This resource type was introduced with ONTAP 9.10.

Vscan

A security feature to protect your data from viruses and other malicious code. This resource type was introduced with ONTAP 9.6.

Vscan on-access policies

The Vscan policies allowing files objects to be actively scanned when accessed by a client. This resource type was introduced with ONTAP 9.6.

Vscan on-demand policies

The Vscan policies allowing files objects to be immediately scanned on demand or according to a set schedule. This resource type was introduced with ONTAP 9.6.

Vscan scanner pools

A set of attributes used to manage the connection between ONTAP and an external virus-scanning server. This resource type was introduced with ONTAP 9.6.

Vscan server status

The status of the external virus-scanning server. This resource type was introduced with ONTAP 9.6.

NDMP

The Network Data Management Protocol provides a standard for backing up NAS devices. You can use these API calls to manage the NDMP services.

NDMP mode

The NDMP operational mode can be SVM scope or node scope. This resource type was introduced with ONTAP 9.7.

NDMP nodes

You can manage the NDMP configuration of the nodes. This resource type was introduced with ONTAP 9.7.

NDMP sessions

You can retrieve and delete NDMP session details for a specific SVM or node. This resource type was introduced with ONTAP 9.7.

NDMP SVMs

You can manage the NDMP configuration of the SVMs. This resource type was introduced with ONTAP 9.7.

NDMP SVM user passwords

You can generate and retrieve passwords for a specific NDMP user within the SVM content. This resource type was introduced with the ONTAP 9.8 REST API and enhanced with ONTAP 9.9.

Networking

You can use these API calls to manage the physical and logical networking resources used with the cluster.

BGP peer groups

You can create and administer Border Gateway Protocol peer groups. This resource type was introduced with ONTAP 9.7.

Ethernet broadcast domains

An Ethernet broadcast domain is a set of physical ports that appear to be part of the same physical network. All the ports receive a packet when broadcast from one of the ports in the domain. Each broadcast domain is part of an IPspace. This resource type was introduced with ONTAP 9.6.

Ethernet ports

An Ethernet port is a physical or virtual networking endpoint. The ports can be combined into a Link Aggregate Group (LAG) or separated using a Virtual LAN (VLAN). This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

Ethernet switch ports

You can retrieve the port information for an Ethernet switch. This resource type is new with ONTAP 9.8.

Ethernet switches

You can retrieve or modify the configuration for Ethernet switches used for the ONTAP cluster or storage network. This resource type is new with ONTAP 9.8.

Fibre Channel fabrics

You can use the Fibre Channel (FC) fabric REST API endpoints to retrieve information about the FC network. This includes the connections between the ONTAP cluster and the FC fabric, the switches comprising the fabric, and the zones of the active zoneset. This resource type was introduced with ONTAP 9.11.1.

Fibre Channel interfaces

A Fibre Channel interface is a logical endpoint associated with an SVM. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

Fibre Channel ports

A Fibre Channel port is a physical adapter on an ONTAP node used to connect to the Fibre Channel network. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

HTTP proxy

You can configure an HTTP proxy for either an SVM or a cluster IPspace. This resource type was introduced with ONTAP 9.7.

IP interfaces

A logical interface (LIF) is an IP address with additional configuration attributes. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

IP routes

A routing table is a collection of IP routes used to forward traffic to its destination. This resource type was introduced with ONTAP 9.6.

IP service policies

The IP service policies define the services available at a specific LIF. Service policies can be configured within the context of an SVM or IPspace. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

IP subnets

The ONTAP networking capability has been expanded to support IP subnets. The REST API provides access

to the configuration and management of the IP subnets within an ONTAP cluster. This resource type was introduced with ONTAP 9.11.1.

IPspaces

An IPspace creates a networking space to support one or more SVMs. The IPspaces can be isolated from each other, providing security and privacy. This resource type was introduced with ONTAP 9.6.

NVMe

You can use these API calls to manage resources supporting non-volatile memory express (NVMe).

Fibre Channel logins

Fibre Channel logins represent connections formed by Fibre Channel initiators logged in to ONTAP. This resource type was introduced with ONTAP 9.6.

Namespaces

An NVMe namespace is a collection of addressable logical blocks presented to hosts connected to the SVM using the NVMe over Fabrics protocol. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

NVMe interfaces

NVMe interfaces are the network interfaces configured to support the NVMe over Fabrics (NVMe-oF) protocol. This resource type was introduced with ONTAP 9.6.

NVMe services

An NVMe service defines the properties of the NVMe controller target for an SVM. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

NVMe subsystem controllers

The NVMe subsystem controllers represent dynamic connections between hosts and a storage solution. This resource type was introduced with ONTAP 9.6.

NVMe subsystem maps

An NVMe subsystem map is an association of an NVMe namespace with an NVMe subsystem. This resource type was introduced with ONTAP 9.6.

NVMe subsystems

An NVMe subsystem maintains configuration state and namespace access control for a set of NVMe-connected hosts. This resource type was introduced with ONTAP 9.6.

Object store

You can use these API calls to access S3-based object storage.

Buckets

A bucket is a container of objects and is structured using an object name space. Each S3 object server can have multiple buckets. This resource type was introduced with ONTAP 9.7 and updated with ONTAP 9.8.

Services

You can create and manage the ONTAP S3 configuration, including servers and bucket configurations. This

resource type was introduced with ONTAP 9.7.

Service buckets

A bucket is a container of objects and is structured using an object name space. You can manage the buckets for a specific S3 server. This resource type was introduced with ONTAP 9.7.

S3 groups

You can create groups of S3 users and manage access control at the group level. This resource type is new with ONTAP 9.8.

S3 policies

You can create an S3 policy and associate it with a resource to define various permissions. This resource type is new with ONTAP 9.8.

Users

The S3 user accounts are maintained at the S3 server. User accounts are based on a pair of keys and associated with the buckets they control. This resource type was introduced with ONTAP 9.7.

SAN

You can use these API calls to manage storage area networking (SAN) resources.

Fibre Channel logins

Fibre Channel logins represent connections formed by Fibre Channel initiators that have logged in to ONTAP. This resource type was introduced with ONTAP 9.6.

Fibre Channel Protocol services

A Fibre Channel Protocol (FCP) service defines the properties of a Fibre Channel target for an SVM. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

Fibre Channel WWPN aliases

A world wide port name (WWPN) is a 64-bit value uniquely identifying a Fibre Channel port. This resource type was introduced with ONTAP 9.6.

igroups

An initiator group (igroup) is a collection of Fibre Channel WWPNs (world wide port names), and iSCSI IQNs (qualified names), and iSCSI EUIs (extended unique identifiers) that identify host initiators. This resource type was originally introduced with ONTAP 9.6.

Nested igroups is a new feature with ONTAP 9.9 and support has also been added to the REST API. This REST resource type was introduced with ONTAP 9.9.

iSCSI credentials

The iSCSI credentials object contains authentication credentials which are used by an initiator and ONTAP. This resource type was introduced with ONTAP 9.6.

iSCSI services

An iSCSI service defines the properties of the iSCSI target for an SVM. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

iSCSI sessions

An iSCSI session is one or more TCP connections that link an iSCSI initiator with an iSCSI target. This

resource type was introduced with ONTAP 9.6.

LUN attributes

LUN attributes are caller-defined name/value pairs that can be optionally stored with a LUN. Attributes are available to save small amounts of application-specific metadata and are not interpreted by ONTAP. The endpoints allow you to create, update, delete, and discover attributes for a LUN. This resource type was introduced with ONTAP 9.10.

LUN maps

A LUN map is an association between a LUN and an initiator group. This resource type was introduced with ONTAP 9.6.

LUN maps reporting nodes

The reporting nodes are the cluster nodes from which network paths to a mapped LUN are advertised using the SAN protocols as part of the selective LUN map (SLM) feature of ONTAP. The new endpoints allow you to add, remove, and discover the reporting nodes of a LUN map. This resource type was introduced with ONTAP 9.10.

LUNs

A LUN is the logical representation of storage in a storage area network (SAN). This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

Port sets

A port set is a collection of Fibre Channel or iSCSI network interfaces associated with the *portset* Storage VM. While this feature has existed with previous releases of ONTAP, support has now been added to the REST API. This REST resource type was introduced with ONTAP 9.9.

vVol bindings

A VMware virtual volume (vVol) binding is an association between a LUN of class `protocol_endpoint` and a LUN of class `vvol`. The vVol binding REST API allows you to create, delete, and discover vVol bindings. This resource type was introduced with ONTAP 9.10.

Security

These API calls can be used to manage the cluster and SVM security settings.

Accounts

There is a collection of user accounts for the cluster and SVMs. This resource type was introduced with ONTAP 9.6.

Accounts name

The configuration for a scoped user account. This resource type was introduced with ONTAP 9.6.

Active Directory proxy

You can administer the SVM account information at the Active Directory server. This resource type was introduced with ONTAP 9.7.

Anti-ransomware

ONTAP detects files potentially containing a ransomware threat. There are several categories of endpoints. You can retrieve a list of these suspect files as well as remove them from a volume. This resource type was introduced with ONTAP 9.10.1.

Audit

The settings which determine what is logged to the audit log files. This resource type was introduced with ONTAP 9.6.

Audit destinations

These settings control how audit log information is forwarded to remote systems or splunk servers. This resource type was introduced with ONTAP 9.6.

Audit messages

You can retrieve the audit log messages. This resource type was introduced with ONTAP 9.6.

AWS KMS

This set of API calls allows you to use the Amazon Web Services Key Management Service to store the ONTAP encryption keys. This resource type is new with ONTAP 9.8.

Azure Key Vault

This set of API calls allows you to use the Azure Key Vault to store the ONTAP encryption keys. This resource type is new with ONTAP 9.8.

Certificates

The APIs calls can be used to install, display, and delete certificates used by ONTAP. This resource type was introduced with ONTAP 9.7.

Cluster security

You can retrieve details of the cluster-wide security and update certain parameters. This resource type was introduced with ONTAP 9.7 and updated with ONTAP 9.8.

GCP KMS

This set of API calls allows you to use the Google Cloud Platform Key Management Service to store and manage the ONTAP encryption keys. This resource type was initially introduced with the ONTAP 9.8 REST API. However, this feature has been redesigned and so is considered to be new, with new resources types, in ONTAP 9.9.

IPSec

Internet Protocol Security (IPSec) is a suite of protocols providing security between two endpoints over an underlying IP network. This resource type is new with ONTAP 9.8.

IPSec CA certificates

You can add, remove, and retrieve IPSec CA certificates. This resource type is new with ONTAP 9.10.

IPSec policies

You can use this set of API calls to manage the policies in effect for an IPSec deployment. This resource type is new with ONTAP 9.8.

IPSec security associations

You can use this set of API calls to manage the security associations in effect for an IPSec deployment. This resource type is new with ONTAP 9.8.

Key manager configurations

These endpoints allow you to retrieve and update the configurations for key managers. This resource type is new with ONTAP 9.10.

Key managers

A key manager allows client modules within ONTAP to securely stored keys. This resource type was introduced with ONTAP 9.6 and updated for ONTAP 9.7.

Key stores

A key store describes the type of a key manager. This resource type is new with ONTAP 9.10.

LDAP authentication

These API calls are used to retrieve and manage the cluster LDAP server configuration. This resource type was introduced with ONTAP 9.6.

Login messages

Used to display and manage the login messages used by ONTAP. This resource type was introduced with ONTAP 9.6.

Multiple administrator verification

The multiple administrator verification feature provides a flexible authorization framework for protecting access to ONTAP commands or operations. There are seventeen new endpoints that support defining, requesting, and approving access in the following areas:

- Rules
- Requests
- Approval groups

Providing the option for multiple administrators to approve access improves the security of your ONTAP and IT environments. These resource types were introduced with ONTAP 9.11.1.

NIS authentication

These settings are used to retrieve and manage the cluster NIS server configuration. This resource type was introduced with ONTAP 9.6.

Password authentication

This includes the API call used to change the password for a user account. This resource type was introduced with ONTAP 9.6.

Privileges for a role instance

Manage the privileges for a specific role. This resource type was introduced with ONTAP 9.6.

Public key authentication

You can use these API calls to configure the public keys for user accounts. This resource type was introduced with ONTAP 9.7.

Roles

The roles provide a way to assign privileges to user accounts. This resource type was introduced with ONTAP 9.6.

Roles instance

Specific instance of a role. This resource type was introduced with ONTAP 9.6.

SAML service provider

You can display and manage the configuration for the SAML service provider. This resource type was

introduced with ONTAP 9.6.

SSH

These calls allow you to set the SSH configuration. This resource type was introduced with ONTAP 9.7.

SSH SVMs

These endpoints allow you to retrieve the SSH security configuration for all SVMs. This resource type was introduced with ONTAP 9.10.

SnapLock

SnapLock is a storage-based implementation of the traditional WORM (write once, read many) optical solution and provides for the long-term retention of data. You can use these API calls to administer the SnapLock feature.

Log

The SnapLock log structure is based on directories and files on a specific volume which contain the log records. Log files are filled and archived based on the maximum log size. This resource type was introduced with ONTAP 9.7.

Compliance clock

The compliance clock determines the expiration time of the SnapLock objects. The clock must be initialized outside of the REST API and cannot be changed. This resource type was introduced with ONTAP 9.7.

Event retention

You can use the SnapLock Event Based Retention (EBR) feature to define how long a file is retained after the occurrence of an event. This resource type was introduced with ONTAP 9.7.

File retention and privileged delete

You can manage the retention time of a file created by SnapLock. If needed, you can also delete unexpired WORM files on a SnapLock enterprise volume. This resource type was introduced with ONTAP 9.7.



The only built-in role with authority to execute the delete operation is vsadmin-snaplock.

File fingerprint

You can view and manage the core information describing files and volumes, such as type and expiration date. This resource type was introduced with ONTAP 9.7.

Legal hold

You can use these API calls to manage files that are part of a litigation process. This resource type was introduced with ONTAP 9.7.

SnapMirror

You can use these API calls to manage the SnapMirror data protection technology.

Policies

The SnapMirror policies are applied to relationships, and control the configuration attributes and behavior of each relationship. This resource type was introduced with ONTAP 9.6.

Relationships

Both asynchronous and synchronous relationships establish the connectivity needed transfer data. This resource type was introduced with ONTAP 9.6.

Relationships transfers

You can manage the SnapMirror transfers over existing SnapMirror relationships. This resource type was introduced with ONTAP 9.6.

Storage

You can use these API calls to manage the physical and logical storage.

Aggregate metrics

You can retrieve historical metrics data for a specific aggregate. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

Aggregate plexes

A physical copy of the WAFL storage within an aggregate. This resource type was introduced with ONTAP 9.6.

Aggregates

An aggregate consists of one or more RAID groups. This resource type was introduced with ONTAP 9.6.

Bridges

You can retrieve the bridges in a cluster. This resource type was introduced with ONTAP 9.9.

Disks

The physical disks in the cluster. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7 and 9.8.

File clone

You can use these endpoints to create file clones, retrieve split status, and manage split loads. The file cloning endpoint resources were first introduced with ONTAP 9.6 and expanded with ONTAP 9.8. They were significantly expanded again with ONTAP 9.10.

File moves

You can use these REST API endpoints to move a file between two FlexVol volumes or within a FlexGroup volume. After the request is accepted you can monitor the progress and status. This resource type was introduced with ONTAP 9.11.1.

FlexCache

This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.8.

FlexCache origins

FlexCache is a persistent cache of an origin volume. This resource type was originally introduced with ONTAP 9.6. Support has been enhanced with the ONTAP 9.9 REST API to support modification through the HTTP PATCH method.

Monitored files

You can designate specific files for additional monitoring. This resource type is new with ONTAP 9.8.

Pools

You can create a shared storage pool as well as retrieve the storage pools in a cluster. This resource type was introduced with ONTAP 9.11.1.

Ports

Storage ports of the cluster. This resource type was introduced with ONTAP 9.6 and enhanced with ONTAP 9.11.1.

QOS policies

Quality of service policy configuration. This resource type was introduced with ONTAP 9.6.

QOS workloads

A QOS workload represents a storage object tracked by QOS. You can retrieve the QOS workflows. This resource type was introduced with ONTAP 9.10.

Qtrees

You can use these API calls to management Qtrees, a type of logically divided file system. This resource type was introduced with ONTAP 9.6.

Quota reports

Report on quotas, which is a technique for restricting or tracking files or space usage. This resource type was introduced with ONTAP 9.6.

Quota rules

The rules used to enforce the quotas. This resource type was introduced with ONTAP 9.6 and updated with ONTAP 9.7.

Shelves

Shelves in the cluster. This resource type was introduced with ONTAP 9.6.

Snapshot policies

Snapshots are created based on policies. This resource type was introduced with ONTAP 9.6.

Snapshot schedules

You can control the snapshot schedules. This resource type is newly redesigned with ONTAP 9.8.

Switches

You can retrieve the switches in a cluster. This resource type was introduced with ONTAP 9.9.

Tape devices

You can retrieve the tape devices in a cluster. This resource type was introduced with ONTAP 9.9.

Top metrics

The top metrics endpoints allow you to determine activity for a volume filtered by a specific metric. Filtering can be done based on clients, directories, files, and users. This resource type was introduced with ONTAP 9.10.

Volume efficiency policies

You can use these API calls to configure the efficiencies applied to an entire volume. This resource type is new with ONTAP 9.8.

Volumes

Logical containers are used to serve data to clients. This resource type was originally introduced with ONTAP 9.6 REST API. Many of the parameter values used with the API were significantly expanded with ONTAP 9.9 including those used with space management.

Volume files

You can retrieve a list of files and directories for a specific directory on a volume. This resource type was introduced with ONTAP 9.7 and updated with ONTAP 9.8.

Volumes Snapshots

Snapshots for a volume. This resource type was introduced with ONTAP 9.6.

Support

You can use these API calls to manage the ONTAP features used to support a cluster.

Application log

A standalone application can record EMS events and optionally generated AutoSupport packages at an ONTAP system by issuing a POST request. This resource type was introduced with ONTAP 9.11.1.

Automatic update

The automatic update feature keeps your ONTAP systems current by downloading and applying the latest software updates. There are several endpoint categories to support the feature, including status, configurations, and updates. These resource types were introduced with ONTAP 9.10.

AutoSupport

AutoSupport collects configuration and status details as well as errors, and reports the information to NetApp. This resource type was introduced with ONTAP 9.6.

AutoSupport messages

Each node maintains AutoSupport messages that can be generated and retrieved. This resource type was introduced with ONTAP 9.6.

Configuration backup

You can use these APIs to retrieve and update the current backup settings. This resource type was introduced with ONTAP 9.6.

Configuration backup operations

You can create, retrieve, and delete configuration backup files. This resource type was introduced with ONTAP 9.7.

Core dump

You can use these endpoints to retrieve and manage the memory core dumps generated by a cluster or node. This resource type was introduced with ONTAP 9.10.

EMS

The event management system (EMS) collects events and sends notifications to one or more destinations. This resource type was introduced with ONTAP 9.6.

EMS destinations

The EMS destinations determine how and where notifications are sent. This resource type was introduced with ONTAP 9.6.

EMS destinations instance

An EMS destination instance is defined by type and location. This resource type was introduced with ONTAP 9.6.

EMS events

This is a live collection of system events for the cluster. This resource type was introduced with ONTAP 9.6.

EMS filters

The EMS filters collectively identify the events that require additional processing. This resource type was introduced with ONTAP 9.6.

EMS filters instance

An EMS filter instance is a collection of rules that are applied to the events. This resource type was introduced with ONTAP 9.6.

EMS messages

Provides access to the EMS event catalog. This resource type was introduced with ONTAP 9.6.

EMS rules for filter instance

A list of rules can be managed for a specific instance of an EMS filter. This resource type was introduced with ONTAP 9.6.

EMS rules instance for filter instance

An individual rule for a specific instance of an EMS filter. This resource type was introduced with ONTAP 9.6.

SNMP

You can enable and disable SNMP and trap operations for the cluster. This resource type was introduced with ONTAP 9.7.

SNMP trap host

An SNMP trap host is a system that is configured to receive SNMP traps from ONTAP. You can retrieve and define the hosts. This resource type was introduced with ONTAP 9.7.

SNMP trap host instance

You can manage specific SNMP trap hosts. This resource type was introduced with ONTAP 9.7.

SNMP users

You can define and administer SNMP users. This resource type was introduced with ONTAP 9.7.

SNMP users instance

You can administer a specific SNMP user where the engine ID is associated with the administrative SVM or a data SVM. This resource type was introduced with ONTAP 9.7.

SVM

You can use these API calls to manage storage virtual machines (SVMs).

Migrations

You can migrate an SVM from a source cluster to a destination cluster. The new endpoints provide complete control, including the ability to pause, resume, retrieve status, and abort a migration operation. This resource type was introduced with ONTAP 9.10.

Peer permissions

Peer permissions can be assigned which enable the SVM peering relationships. This resource type was introduced with ONTAP 9.6.

Peers

The peering relationships establish connectivity among the SVMs. This resource type was introduced with ONTAP 9.6.

SVMs

You can manage the SVMs that are bound to a cluster. This resource type was introduced with ONTAP 9.6.

Top metrics

You can access additional performance metrics data for a specific SVM instance. There are four lists available and each provides the top I/O activity for ONTAP FlexVol and FlexGroup volumes. The lists include:

- Clients
- Directories
- Files
- Users

These resource types were introduced with ONTAP 9.11.1.

Web

You can use these endpoints to update and retrieve the web services security configuration for each data SVM. This resource type was introduced with ONTAP 9.10.

Workflows

Prepare to use the workflows

You should prepare before using the workflow processes.

Understanding the API calls used in the workflows

The ONTAP API online documentation page includes the details of every REST API call. Rather than repeat those details here, each API call used in the workflow samples includes only the information you need to locate the call on the documentation page. After locating a specific API call, you can review the complete details of the call, including the input parameters, output formats, HTTP status codes, and request processing type.

The following information is included for each API call within a workflow to help locate the call on the documentation page:

- Category

The API calls are organized on the documentation page into functionally related areas or categories. To locate a specific API call, scroll to the bottom of the page and click the applicable API category.

- HTTP method

The HTTP method identifies the action performed on a resource. Each API call is executed through a single HTTP method.

- Path

The path determines the specific resource which the action applies to as part of performing a call. The path string is appended to the core URL to form the complete URL identifying the resource.

Constructing a URL to directly access the REST API

In addition to the ONTAP documentation page, you can also access the ONTAP REST API directly through a programming language such as Python. In this case, the core URL is slightly different than the URL used when accessing the online documentation page. When accessing the API directly, you must append `/api` to the domain and port string. For example: <https://ontap.mycompany.com/api>

Related links

- [How to access the ONTAP API](#)
- [Summary of the REST resources](#)

Workflow 1: Update the cluster contact and check job state

This workflow updates the cluster contact information. Because the request is processed asynchronously, it also illustrates how to determine if the background job completes successfully.

1. Update the contact information for the cluster

You can issue an API call to update the contact information. Because the request runs asynchronously, you must confirm success of the associated job.

Category	HTTP method	Path
Cluster	PATCH	/cluster

Processing type

Asynchronous

Curl

```
1 curl -X PATCH -H 'Content-Type: application/json' -u admin:password -k
  -d @step01 'https://10.222.81.101/api/cluster'
2 {
3   "contact": "support@company-demo.com"
4 }
```

JSON output

A job object with the associated identifier is returned.

```
1 { "job": {
2   "uuid": "d877f5bb-3aa7-11e9-b6c6-005056a78c89",
3   "_links": {
4     "self": {
5       "href": "/api/cluster/jobs/d877f5bb-3aa7-11e9-b6c6-005056a78c89"
6     }
7   }
8 }
9 }
```

2. Retrieve the status of the job

You must retrieve the state of the job to determine if the asynchronous request has completed successfully.

Category	HTTP method	Path
Cluster	GET	/cluster/jobs/{uuid}

Processing type

Synchronous

Curl

```
1 curl -X GET -H 'Content-Type: application/json' -u admin:password -k
  'https:// 10.222.81.101/api/cluster/jobs/*uuid*'
```


Output

A job object with the state and other fields is returned.

```
1 {
2   "uuid": "d877f5bb-3aa7-11e9-b6c6-005056a78c89",
3   "description": "PATCH /api/cluster",
4   "state": "success",
5   "message": "success",
6   "code": 0,
7   "_links": {
8     "self": {
9       "href": "/api/cluster/jobs/d877f5bb-3aa7-11e9-b6c6-005056a78c89"
10    }
11  }
12 }
```

Manage ONTAP with REST API

Manage EMS event notifications with the ONTAP REST API

You can use the ONTAP REST API to configure how important Event Management System (EMS) event notifications are sent to you, as well as retrieve all EMS messages or specific messages with certain attributes. You can use the REST API to help automate EMS-related tasks, saving time over other methods of working with EMS messages.

The following examples show you how you can use the ONTAP REST API to work with EMS messages. In each example, be sure to provide your values for information in brackets <> where indicated. You can also reference a sample [Python script](#) that demonstrates how to automate a number of EMS-related activities.

View specific event logs

Using the `GET /support/ems/events` API call, you can retrieve specific event messages, such as the latest message, messages that contain specific text, or messages with a specific severity.

Example request: Retrieve the latest message

```
curl -X GET -u admin:<PASSWORD> -k  
'https://<IP_ADDRESS>/api/support/ems/events?fields=message.name&max_recor  
ds=1'
```

Example response

```
"records": [
  {
    "node": {
      "name": "malha-vs1",
      "uuid": "da4f9e62-9de3-11ec-976a-005056b369de",
      "_links": {
        "self": {
          "href": "/api/cluster/nodes/da4f9e62-9de3-11ec-976a-005056b369de"
        }
      }
    },
    "index": 6260,
    "message": {
      "name": "netinet6.rtr.high.mtu"
    },
    "_links": {
      "self": {
        "href": "/api/support/ems/events/malha-vs1/6260"
      }
    }
  }
],
"num_records": 1,
"_links": {
  "self": {
    "href": "/api/support/ems/events?fields=message.name&max_records=1"
  },
  "next": {
    "href": "/api/support/ems/events?start.keytime=2022-03-22T10%3A28%3A29-04%3A00&start.node.name=malha-vs1&start.index=6260&fields=message.name&max_records=1"
  }
}
```

Example request: Retrieve a message containing specific text and severity

```
curl -X GET -u admin:<PASSWORD> -k
'https://<IP_ADDRESS>/api/support/ems/events?log_message=*disk*&message.severity=alert'
```

Example response

```
"records": [
  {
    "node": {
      "name": "malha-vs1m1",
      "uuid": "da4f9e62-9de3-11ec-976a-005056b369de",
      "_links": {
        "self": {
          "href": "/api/cluster/nodes/da4f9e62-9de3-11ec-976a-005056b369de"
        }
      }
    },
    "index": 4602,
    "time": "2022-03-18T06:37:46-04:00",
    "message": {
      "severity": "alert",
      "name": "raid.autoPart.disabled"
    },
    "log_message": "raid.autoPart.disabled: Disk auto-partitioning is disabled on this system: the system needs a minimum of 4 usable internal hard disks.",
    "_links": {
      "self": {
        "href": "/api/support/ems/events/malha-vs1m1/4602"
      }
    }
  }
],
"num_records": 1,
"_links": {
  "self": {
    "href": "/api/support/ems/events?log_message=*disk*&message.severity=alert&max_records=1"
  },
  "next": {
    "href": "/api/support/ems/events?start.keytime=2022-03-18T06%3A37%3A46-04%3A00&start.node.name=malha-vs1m1&start.index=4602&log_message=*disk*&message.severity=alert"
  }
}
}
```

View the existing EMS configuration

Using the GET `/support/ems/` API call, you can retrieve information about the existing EMS notification configuration.

Example request

```
curl -X GET -u admin:<PASSWORD> -k 'https://<IP_ADDRESS>/api/support/ems/'
```

Example response

```
{
  "proxy_url": "https://proxyserver.mycompany.com",
  "proxy_user": "proxy_user",
  "mail_server": "mail@mycompany.com",
  "_links": {
    "self": {
      "href": "/api/resourcelink"
    }
  },
  "pubsub_enabled": "1",
  "mail_from": "administrator@mycompany.com"
}
```

Create a new EMS notification configuration

You can use several API calls together to create a new EMS configuration to customize how and when you receive messages.

Steps

1. Configure the system-wide email settings. For example:

```
curl -X PATCH -u admin:<PASSWORD> -k
'https://<IP_ADDRESS>/api/support/ems?mail_from=administrator@mycompany.
com&mail_server=mail@mycompany.com'
```

2. Define a filter that uses specific rules to match certain messages. For example:

```
curl -u admin:<PASSWORD> -X POST -d '{"name": "test-filter",
"rules.type": ["include"], "rules.message_criteria.severities":
["emergency"]}' -k 'https://<IP_ADDRESS>/api/support/ems/filters/'
```

3. Create a destination for the messages. For example:

```
curl -u admin:<PASSWORD> -X POST -d '{"name": "test-destination",
"type": "email", "destination": "administrator@mycompany.com",
"filters.name": ["important-events"]}' -k
'https://<IP_ADDRESS>/api/support/ems/destinations/'
```

ONTAP REST API versus ONTAP CLI commands

The ONTAP REST API enables you to automate workflows with fewer commands than the ONTAP CLI for many tasks. For example, you can use a single POST API method to create a filter, instead of using multiple CLI commands. The following table shows the CLI commands that you would need to complete common EMS tasks versus the corresponding REST API calls:

ONTAP REST API	ONTAP CLI
GET /support/ems	event config show
POST /support/ems/destinations	<ol style="list-style-type: none"> 1. event notification destination create 2. event notification create
GET /support/ems/events	event log show
POST /support/ems/filters	<ol style="list-style-type: none"> 1. event filter create -filter-name <filtername> 2. event filter rule add -filter-name <filtername>

Related information

- [ONTAP REST API EMS example Python script](#)
- [ONTAP REST APIs: Automate Notification of High-Severity Events](#)

Manage DACL and SACL file permissions with the ONTAP REST API

ONTAP uses System Access Control Lists (SACLs) and Discretionary Access Control Lists (DACLs) to assign permissions to file objects. Beginning with ONTAP 9.9.1, the ONTAP REST API includes endpoints to assign SACL and DACL permissions for files and automate file-security permissions. (You can learn more about options for automating SACL and DACL permissions prior to ONTAP 9.9.1 [here](#)).

Beginning with ONTAP 9.9.1, you can use a single REST API call in the place of multiple CLI commands or ONTAPI calls. The following examples show how you can use the ONTAP REST API to work with file permissions. In each example, be sure to provide your values for information in brackets <> where indicated.

You can also reference a sample [Python script](#) that demonstrates how to automate a number of SACL- and DACL-related activities.

View effective permissions

Using the GET `/protocols/file-security/effective-permissions/` API call, you can retrieve the current permissions for a specific file or directory.

Example request:

```
curl -X GET -u admin:<PASSWORD> -k  
'https://<IP_ADDRESS>/api/protocols/file-security/effective-  
permissions/cf5f271a-1beb-11ea-8fad-  
005056bb645e/administrator/windows/%2F?share.name=sh1&return_records=true'
```

Example response

```
{
  "svm": {
    "uuid": "cf5f271a-1beb-11ea-8fad-005056bb645e",
    "name": "vs1"
  },
  "user": "administrator",
  "type": "windows",
  "path": "/",
  "share": {
    "path": "/"
  },
  "file_permission": [
    "read",
    "write",
    "append",
    "read_ea",
    "write_ea",
    "execute",
    "delete_child",
    "read_attributes",
    "write_attributes",
    "delete",
    "read_control",
    "write_dac",
    "write_owner",
    "synchronize",
    "system_security"
  ],
  "share_permission": [
    "read",
    "read_ea",
    "execute",
    "read_attributes",
    "read_control",
    "synchronize"
  ]
}
```

View all auditing information

Using the GET `/protocols/file-security/permissions/` API call, you can retrieve all auditing information for a specific file or directory.

Example request:

```
curl -X GET -u admin:<PASSWORD> -k  
'https://<IP_ADDRESS>/api/protocols/file-security/permissions/9479099d-  
5b9f-11eb-9c4e-0050568e8682/%2Fparent'
```

Example response

```
{  
  "svm": {  
    "uuid": "9479099d-5b9f-11eb-9c4e-0050568e8682",  
    "name": "vs1"  
  },  
  "path": "/parent",  
  "owner": "BUILTIN\\Administrators",  
  "group": "BUILTIN\\Administrators",  
  "control_flags": "0x8014",  
  "acls": [  
    {  
      "user": "BUILTIN\\Administrators",  
      "access": "access_allow",  
      "apply_to": {  
        "files": true,  
        "sub_folders": true,  
        "this_folder": true  
      },  
      "advanced_rights": {  
        "append_data": true,  
        "delete": true,  
        "delete_child": true,  
        "execute_file": true,  
        "full_control": true,  
        "read_attr": true,  
        "read_data": true,  
        "read_ea": true,  
        "read_perm": true,  
        "write_attr": true,  
        "write_data": true,  
        "write_ea": true,  
        "write_owner": true,  
        "synchronize": true,  
        "write_perm": true  
      },  
      "access_control": "file_directory"  
    },  
    {
```

```

"user": "BUILTIN\\Users",
"access": "access_allow",
"apply_to": {
  "files": true,
  "sub_folders": true,
  "this_folder": true
},
"advanced_rights": {
  "append_data": true,
  "delete": true,
  "delete_child": true,
  "execute_file": true,
  "full_control": true,
  "read_attr": true,
  "read_data": true,
  "read_ea": true,
  "read_perm": true,
  "write_attr": true,
  "write_data": true,
  "write_ea": true,
  "write_owner": true,
  "synchronize": true,
  "write_perm": true
},
"access_control": "file_directory"
}
],
"inode": 64,
"security_style": "mixed",
"effective_style": "ntfs",
"dos_attributes": "10",
"text_dos_attr": "----D---",
"user_id": "0",
"group_id": "0",
"mode_bits": 777,
"text_mode_bits": "rwxrwxrwx"
}

```

Apply new permissions

Using the POST `/protocols/file-security/permissions/` API call, you can apply a new security descriptor to a file or directory.

Example request

```
curl -u admin:<PASSWORD> -X POST -d '{ \"acls\": [ { \"access\": \"access_allow\", \"advanced_rights\": { \"append_data\": true, \"delete\": true, \"delete_child\": true, \"execute_file\": true, \"full_control\": true, \"read_attr\": true, \"read_data\": true, \"read_ea\": true, \"read_perm\": true, \"write_attr\": true, \"write_data\": true, \"write_ea\": true, \"write_owner\": true, \"write_perm\": true }, \"apply_to\": { \"files\": true, \"sub_folders\": true, \"this_folder\": true }, \"user\": \"administrator\" } ], \"control_flags\": \"32788\", \"group\": \"S-1-5-21-2233347455-2266964949-1780268902-69700\", \"ignore_paths\": [ \"/parent/child2\" ], \"owner\": \"S-1-5-21-2233347455-2266964949-1780268902-69304\", \"propagation_mode\": \"propagate\"}' -k 'https://<IP_ADDRESS>/api/protocols/file-security/permissions/9479099d-5b9f-11eb-9c4e-0050568e8682/%2Fparent?return_timeout=0'
```

Example response

```
{
  \"job\": {
    \"uid\": \"3015c294-5bbc-11eb-9c4e-0050568e8682\",
    \"_links\": {
      \"self\": {
        \"href\": \"/api/cluster/jobs/3015c294-5bbc-11eb-9c4e-0050568e8682\"
      }
    }
  }
}
```

Update security descriptor information

Using the PATCH `/protocols/file-security/permissions/` API call, you can update specific security descriptor information for a file or directory, such as the primary owner, group, or control flags.

Example request

```
curl -u admin:<PASSWORD> -X PATCH -d '{ \"control_flags\": \"32788\", \"group\": \"everyone\", \"owner\": \"user1\"}' -k 'https://<IP_ADDRESS>/api/protocols/file-security/permissions/9479099d-5b9f-11eb-9c4e-0050568e8682/%2Fparent?return_timeout=0'
```

Example response

```
{
  "job": {
    "uuid": "6f89e612-5bbd-11eb-9c4e-0050568e8682",
    "_links": {
      "self": {
        "href": "/api/cluster/jobs/6f89e612-5bbd-11eb-9c4e-0050568e8682"
      }
    }
  }
}
```

Delete an existing SACL/DACL Access Control Entry (ACE)

Using the DELETE `/protocols/file-security/permissions/` API call, you can delete an existing ACE from a file for directory. This example propagates the change to any child objects.

Example request

```
curl -u admin:<PASSWORD> -X DELETE -d '{ \"access\": \"access_allow\",
\"apply_to\": { \"files\": true, \"sub_folders\": true, \"this_folder\":
true }, \"ignore_paths\": [ \"/parent/child2\" ], \"propagation_mode\":
\"propagate\"}' -k 'https://<IP_ADDRESS>/api/protocols/file-
security/permissions/9479099d-5b9f-11eb-9c4e-
0050568e8682/%2Fparent/acl/himanshu?return_timeout=0'
```

Example response

```
{
  "job": {
    "uuid": "e5683b61-5bbf-11eb-9c4e-0050568e8682",
    "_links": {
      "self": {
        "href": "/api/cluster/jobs/e5683b61-5bbf-11eb-9c4e-0050568e8682"
      }
    }
  }
}
```

ONTAP REST API versus ONTAP CLI commands

The ONTAP REST API enables you to automate workflows with fewer commands than the ONTAP CLI for many tasks. For example, you can use a single POST API method to modify a security descriptor for a file, instead of using multiple CLI commands. The following table shows the CLI commands that you would need to complete common filesystem permission tasks versus the corresponding REST API calls:

ONTAP REST API	ONTAP CLI
GET /protocols/file-security/effective-permissions/	vserver security file-directory show-effective-permissions
POST /protocols/file-security/permissions/	<ol style="list-style-type: none"> 1. vserver security file-directory ntfs create 2. vserver security file-directory ntfs dacl add 3. vserver security file-directory ntfs sacl add 4. vserver security file-directory policy create 5. vserver security file-directory policy task add 6. vserver security file-directory apply
PATCH /protocols/file-security/permissions/	vserver security file-directory ntfs modify
DELETE /protocols/file-security/permissions/	<ol style="list-style-type: none"> 1. vserver security file-directory ntfs dacl remove 2. vserver security file-directory ntfs sacl remove

Related information

- [ONTAP REST API DACL/SACL permissions example Python script](#)
- [Simplified management of file-security permissions with ONTAP REST APIs](#)
- [Using the private CLI passthrough with the ONTAP REST API \(for versions of ONTAP prior to version 9.9.1\)](#)

Python client library

Overview of the Python client library

The NetApp ONTAP Python client library is a package you can install and use to write scripts that access the ONTAP REST API. It provides support for several underlying services, including connection management, asynchronous processing, exception handling, and error messages. By using the Python client library, you can quickly develop robust code to support the automation of ONTAP deployments.

Beginning with ONTAP 9.6, you have the option of using the Python client library to access the ONTAP REST API. The library provides a client-side development environment with several underlying services, such as connection management, asynchronous processing, exception handling, and error messages. After downloading and installing the ONTAP Python client library package, you can quickly create robust Python scripts to support the automation of your ONTAP deployments.



NetApp maintains a GitHub repository containing code samples and other helpful information. You can navigate to the *examples* folder to access samples using the Python client library.

Related links

[ONTAP REST Python GitHub repository](#)

Prepare to use the Python client library

You should prepare the environment before using the Python client library.

Basic requirements

You must use Python 3.5 or later. In addition, the following packages are also required:

- requests 2.22.1 or later
- requests-toolbelt 0.9.1 or later
- marshmallow 3.2.1 or later

Package name and version

The name of the Python client library package is **netapp-ontap**. The version associated with the package is a combination of the ONTAP major and minor version numbers the library was generated from, along with a minor version for the client within the ONTAP release. For example, valid version numbers include: 9.6.1, 9.6.2, and 9.7.1.

Installation

You must use pip to install the netapp_ontap package from the Python Package Index (PyPI) web site.

Documentation and additional resources

See the *NetApp Developer Network* for links to documentation and other resources.

Related information

- [PyPI: NetApp ONTAP 9.10.1](#)

- [NetApp PCL documentation for 9.10.1](#)
- [NetApp Developer Network: ONTAP RESTful API](#)

Script to retrieve the cluster configuration

The following script provides a simple example of how to use the Python client library. You can run the script using Python 3 at the CLI to retrieve the ONTAP cluster configuration.

```

1 ##-----
2 #
3 # Description: Python script to retrieve the cluster configuration.
4 #
5 # Usage example:
6 #
7 # python3 get_cluster.py
8 #
9 #
10 # (C) Copyright 2020 NetApp, Inc.
11 #
12 # This sample code is provided AS IS, with no support or warranties of
13 # any kind, including but not limited for warranties of merchantability
14 # or fitness of any kind, expressed or implied. Permission to use,
15 # reproduce, modify and create derivatives of the sample code is
    granted
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18 # provided that the above copyright notice appears in all copies and
19 # that the software application product is distributed pursuant to
    terms
20 # no less restrictive than those set forth herein.
21 #
22 ##-----
23 # Global configuration for the library
24 from netapp_ontap import config
25 # Support for the connection to ONTAP
26 from netapp_ontap import HostConnection
27 # Specific API needed for this script
28 from netapp_ontap.resources import Cluster
29 # Create connection to the ONTAP management LIF
30 conn = HostConnection("10.236.252.97", username="admin",
31 password="mypassword", verify=False)
32 # Set connection as the default for all API calls
33 config.CONNECTION = conn
34 # Create new cluster object
35 clus = Cluster()
36 # Issue REST API call
37 clus.get()
38 # Display the cluster configuration
39 print(clus)
40 ....

```


API reference

You can access the details of all the ONTAP REST API calls, including the HTTP methods, input parameters, and responses. This complete reference is helpful when developing automation applications using the REST API.



You can access the API reference content at your local ONTAP system or at the NetApp Developer Network web site.

Access the ONTAP API documentation page

You can access the ONTAP API online documentation page at your local ONTAP system.

Before you begin

You must have the following:

- IP address or host name of the ONTAP cluster management LIF
- User name and password for an account with authority to access the ONTAP REST API

Steps

1. Type the URL in your browser and press **Enter**:

```
https://<ip_address>/docs/api
```

2. Sign in using the ONTAP account.

The ONTAP API documentation page is displayed with the API calls organized in major resource categories at the bottom.

3. As an example of an individual API call, scroll down to the **cluster** category and click **GET /cluster**.

Access the reference content at NetApp DevNet

You can access the ONTAP REST API reference documentation at the NetApp Developer Network web site.

Steps

1. Navigate to the **ONTAP REST API** page at the NetApp Developer Network web site:

[NetApp DevNet: ONTAP REST APIs](#)

2. Scroll down and under **Online REST APIs Reference** click the link for the appropriate ONTAP version.

The ONTAP API documentation page is displayed with the API calls organized in major resource categories at the bottom.

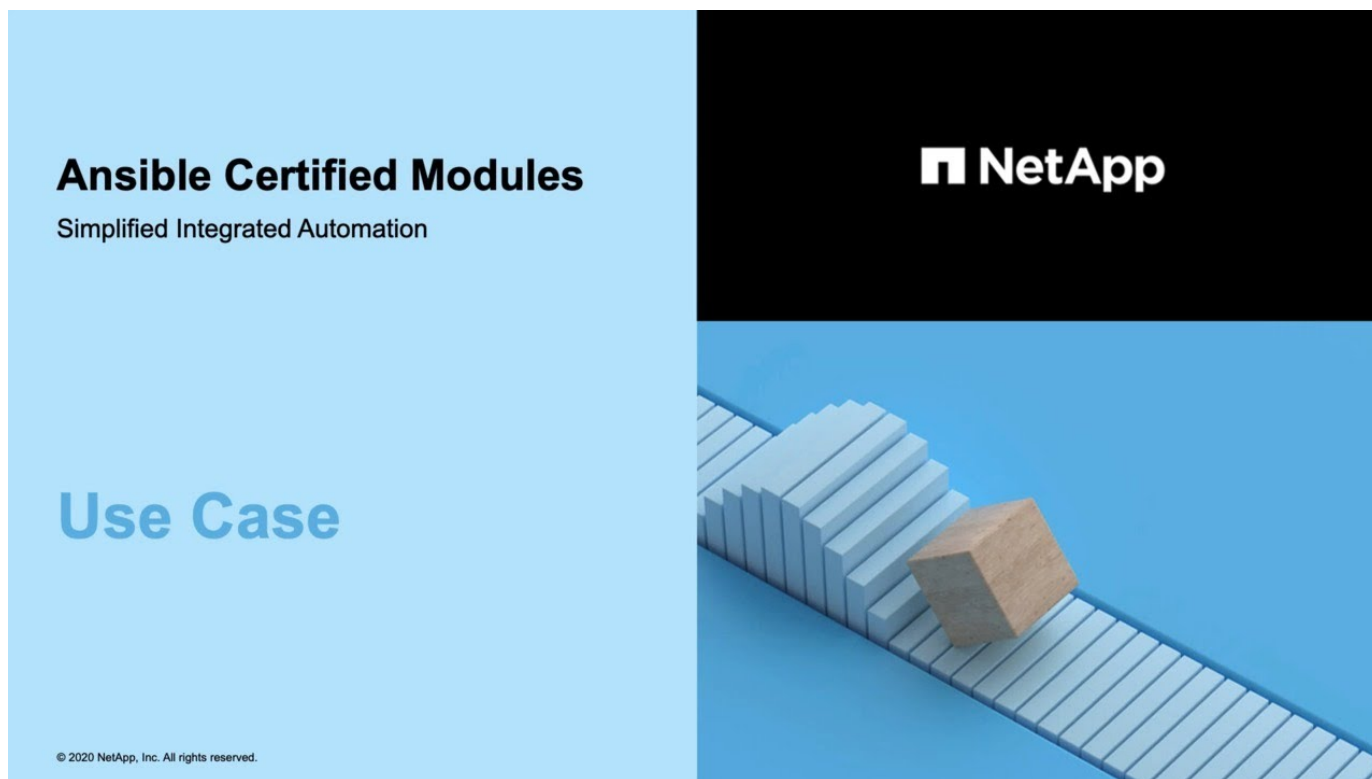
3. As an example of an individual API call, scroll down to the **cluster** category and click **GET /cluster**.

Automation technologies

ONTAP and Ansible automation

There are several resources available to help you understand how Ansible can be used to automate the deployment and administration of ONTAP storage resources.

Videos



The above video is also available through NetApp TV at [Ansible Certified Modules](#).

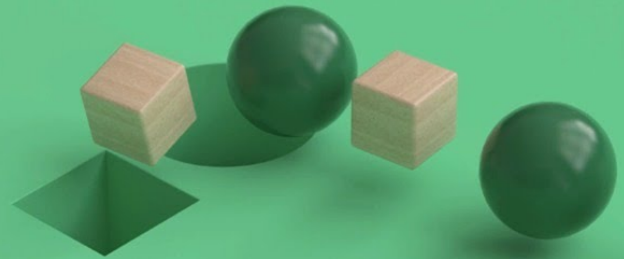
Ansible Certified Modules

Simplified Integrated Automation



Tech Clip

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Developer resources

See [NetApp Ansible DevOps Solutions](#) for help getting started with Ansible in a DevOps environment.

Blogs about ONTAP automation

There are several blog articles available to help you better understand the different technologies and approaches to ONTAP automation.

Using the private CLI passthrough with the ONTAP REST API

The CLI passthrough provides a technique for executing ONTAP CLI commands using the REST API.

netapp.io/2020/11/09/private-cli-passthrough-ontap-rest-api

Getting Started with NetApp and Ansible: Install Ansible

If you're new to using Ansible for ONTAP automation, this is a good place to start.

netapp.io/2018/10/08/getting-started-with-netapp-and-ansible-install-ansible

Migrate to the REST API

Overview

NetApp first introduced the REST API with ONTAP 9.6. Since then the API has continued to expand and mature. It now provides the preferred and strategic alternative to the earlier ONTAPI API when automating the administration of your ONTAP deployments.

If you are using ONTAPI, you are encouraged to begin migrating to the ONTAP REST API. This section describes the available resources and highlights helpful features and tools that support your migration.

ONTAPI to REST API mapping

The ONTAP REST API includes functionality that is equivalent to ONTAPI in most areas. NetApp provides documentation that describes the mapping from the ONTAPI calls to the equivalent REST API calls.

The API mapping documentation is dependent on the ONTAP release:

- [ONTAP 9.8](#)
- [ONTAP 9.9.1](#)
- [ONTAP 9.10.1](#)
- [ONTAP 9.11.1](#)

Blogs about migrating to the ONTAP REST API

There are several blog articles available to help you better understand how to migrate from ONTAPI to the ONTAP REST API.

ONTAPI to REST Mapping

NetApp provides support for moving from the proprietary ONTAPI API to the ONTAP REST API through mapping documentation.

netapp.io/2020/12/17/ontapi-to-rest-mapping

Transform your Automation to ONTAP REST API from ONTAPI

There are several technologies available to help you transform your ONTAP automation environment based on the REST API.

www.netapp.com/blog/transform-automation-ontap-rest-api

Transitioning from ONTAPI using ONTAPI Usage Reporting Tool

NetApp provides a tool to help customers and partners transition to the ONTAP REST API.

netapp.io/2022/03/21/transitioning-from-ontapizapi-using-ontapi-usage-reporting-tool

Get more information

There are several additional resources you can access to get help and find more information about how to automate the deployment and administration of your ONTAP storage systems.

ONTAP 9 resources

- [ONTAP 9 Documentation](#)

Provides the documentation for ONTAP 9 (except the CLI commands).

- [ONTAP 9 Documentation Center](#)

Provides the documentation for the ONTAP 9 CLI commands.

- [ONTAP and ONTAP System Manager Resources](#)

Includes documentation and other helpful links you need to plan, administer, and support ONTAP 9.

- [ONTAP 9 Product Library](#)

Access the release notes and other documentation for previous ONTAP releases.

ONTAP 9 developer resources

- [ONTAPI to REST API mapping information](#)

Provides the key ONTAPI calls and the mapping to the equivalent REST API calls.

- [PyPI: NetApp ONTAP 9.10.1](#)

The NetApp Python Client Library package at PyPI.

- [NetApp PCL documentation for 9.10.1](#)

Documentation for the NetApp Python Client Library.

- [NetApp Developer Network: ONTAP RESTful API](#)

Provides resources and documentation needed to use the ONTAP REST API, including the ONTAP Python client library.

Videos

- [Getting started with the NetApp ONTAP Python client library](#)

Good introduction to the NetApp Python client library and how to get started writing code using the library.

NetApp resources

- [NetApp Support](#)

Access troubleshooting tools, documentation, and technical support assistance.

- [NetApp Interoperability Matrix Tool](#)

Access requirements and compatibility information related to using ONTAP 9 and the ONTAP REST API.

- [NetApp library of technical reports and white papers](#)

Access technical reports, white papers, and other documents.

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