NetApp® SANtricity® Web Services Proxy 1.1

User Guide

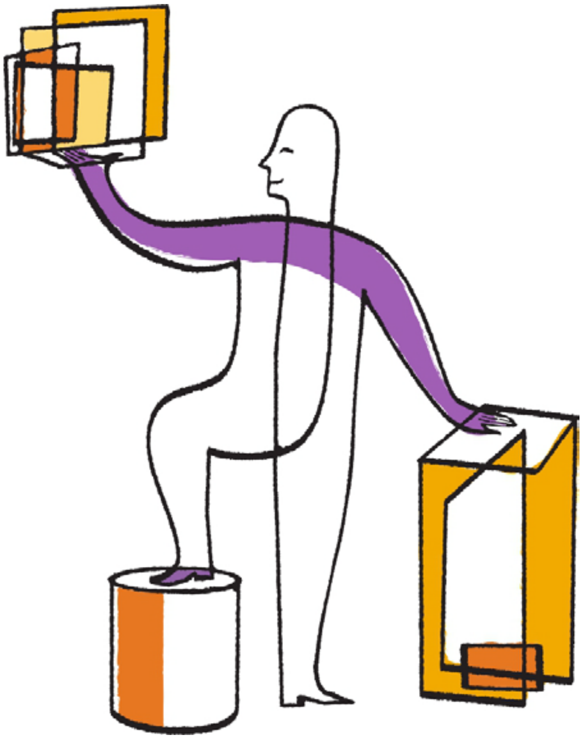

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Table of Contents

Overview of the NetApp Web Services Proxy

The NetApp Web Services Proxy provides access through standard HTTPS mechanisms for configuring management services for NetApp storage arrays. You can install the Web Services Proxy on both Linux machines and Windows machines. As the NetApp Web Services Proxy satisfies client requests by collecting data or executing configuration change requests to a target storage array, the NetApp Web Services Proxy module issues SYMbol requests to the target storage arrays.

The NetApp Web Services Proxy provides a Representative State Transfer (REST)-style application programming interface (API) for managing NetApp storage array controllers. The API enables you to integrate array management into other applications or ecosystems. The Web Services Proxy Array Manager complements the API as a management and debugging tool. If you are having problems scripting array commands, you can check the status of a storage array in the Array Manager.

New in This Release

This release of the Web Services Proxy adds the following features, functions, and capabilities:

- REST resource enhancements
  - Asynchronous Remote Volume Mirroring (ARVM)—the ability to create and configure ARVM mirror pairs and to activate and tear down mirror relationship
  - Initial configuration—the ability to perform initial configuration as a mass operation for IP address assignments
  - Interactive API documentation
  - Provisioning and managing consistency groups
  - Performing health checks and controller firmware upgrades
  - Logging events for configuration changes
- Hardware and firmware
  - E5600, EF550, and EF560 storage arrays
  - Dual Port FDR 56Gb InfiniBand
  - Support for controller firmware 8.20

Abbreviations, Acronyms, Terms, and Definitions

Table 1 shows the abbreviations, acronyms, and terms used in this guide and their definitions.

Table 1 Abbreviations, Acronyms, Terms, and Definitions

Abbreviations, Acronyms, Terms	Definitions
API	Application Programming Interface
CORS	Cross-Origin Resource Sharing
FDR	Fourteen Data Rate
JSON	JavaScript Object Notation
REST	Representational State Transfer

NetApp Web Services Proxy Interfaces

The Web Services Proxy provides REST-style interface for accessing common configuration operations and to retrieving basic configuration data, status, and statistics. For more information about the interface, go to the NetApp Web Services Proxy Developer Guide at `https://<nnn.nnn.nnn.nnn>:8443/docs`, where `nnn.nnn.nnn.nnn` represents the host server.

NetApp Web Services Proxy APIs

The Storage Management Web Services Proxy executes commands on the target controller. The REST-style API enables you to manage the following storage system objects:

- MEL events
- Disk drives
- Storage pools
- Volume copy jobs
- Snapshot groups
- Host groups
- Volume I/O statistics
- Snapshot images
- Host groups
- Thin-provisioned volumes
- Volume mappings
- Hardware inventory
- Snapshot volumes
- Host types
- Volumes
- Hosts
- Storage arrays
- Disk statistics

For a complete list of all endpoints, se the API documentation

Cross-Domain Resource Sharing

Cross-domain resource sharing (CORS) is handled by a `cors.cfg` file in the `working` directory of the web server as specified in the `wsconfig.xml` file. The CORS configuration is open by default, so cross-domain access is not restricted.

NOTE If no configuration file is present, CORS is open.

Symbol Web

Symbol Web is a URL in the REST API, but it gives access to almost all symbol calls. The symbol function is the part of the following URL:

```
http://host:port/devmgr/storage-system/storage array ID/symbol/symbol function
```

Compatible Storage Arrays and Controller Firmware

Web Services Proxy is compatible with the following NetApp storage arrays and controller firmware versions.

Table 2 Compatible Storage Arrays and Controller Firmware

Storage Array	Interfaces	Controller Firmware
NetApp E2600	6Gbps iSCSI 8Gbps FC 6Gpbs SAS	7.84 7.86 8.10
NetApp E2700	10Gbps iSCSI 16Gbps FC 12Gpbs SAS	7.84 7.86 8.10
NetApp E5400 NetApp EF540	10Gbps iSCSI 8Gbps FC 6Gbps SAS	7.84 7.86 8.10

Storage Array	Interfaces	Controller Firmware
NetApp E5500 NetApp EF550	10Gbps iSCSI 16Gbps FC 12Gbps SAS FDR 56Gbps IB	7.84 7.86 8.10
NetApp E5600 NetApp EF560	10Gbps iSCSI 16Gbps FC 56Gbps IB 12Gbps SAS	

IP Support

Web Services Proxy supports both the IPv4 protocol and the IPv6 protocol.

NOTE The Ipv6 protocol might not work in some situations when the Web Services Proxy is attempting to automatically discover management address from the controller configuration, such as in IP address forwarding or when Ipv6 is enabled on the storage arrays but not on the server.

NVSRAM File Name Constraints

The Web Services Proxy uses NVSRAM file names to accurately identify version information. Therefore you cannot change NVSRAM filenames when they are to be used with the Web Services Proxy. The Web Services Proxy might not recognize a renamed NVSRAM file as a valid firmware file.

MEL Events Cache Size

The default cache size is 8192 events. The approximate data usage for the MEL events cache is 1MB for each 8192 events. Therefore, by retaining the defaults, cache usage should be approximately 1MB for a storage array.

Web Services Proxy Configuration Files

After you have installed the NetApp Web Service, you can either accept the default NetApp Web Services Proxy settings or modify them to meet the unique operating and performance requirements for your environment.

Default Configuration Files

The Web Services Proxy installs the following two default configuration files:

- `wsconfig.xml`
- `users.properties`

By default, the files are installed in the following locations:

- Windows – `C:\Program Files\NetApp\SANtricity Web Services Proxy`
- Linux – `/opt/netap/ santricity_web_services_proxy`

Table 3 Default Locations and Configuration Files

Default Directory Locations	Description
`<install root>/wsconfig.xml`	The primary configuration file for the Web Services Proxy
`<install root>/working/users.properties`	Web Services Proxy password files. For more information, go to Configuring the users.properties File on page 5.

To restrict Cross-Origin Resource Sharing (CORS) access, you can install and configure the optional `cors.cfg` file. For more information about the `cors.cfg` file, go to Configuring the Optional cors.cfg File.

Configuring the Optional cors.cfg File

Cross-Domain Resource Sharing (CORS) is handled by the `cors.cfg` file in the working directory in the web service, as specified by the `wsconfig.xml` file. The CORS configuration is open by default, so cross-domain access is not restricted. If no configuration file is present, CORS is open. If the `cors.cfg` file is present, it is used. If the `cors.cfg` file is empty, you cannot make a CORS request.

To configure CORS settings, add lines to the `cors.cfg` file. Each line in the CORS configuration file is a regular expression pattern to match. The origin header must match a line in the `cors.cfg` file. If any line pattern matches the origin header, the request is allowed. The complete origin is compared, not just the host element. This allows requests to be matched not only on the host, but also according to protocol, such as the following:

- Match localhost with any protocol—*localhost*
- Match localhost for HTTP only—https://localhost*

Configuring the wsconfig.xml File

The `wsconfig.xml` file controls most of the service. Use the `wsconfig.xml` to configure the HTTP and HTTPS ports and various directory paths.

Configuring Polling Intervals

To enable polling and the analyzed URLs, add the following lines to the `wsconfig.xml` file, where nn is the number of seconds for the interval between polling requests:

```
<env-entries>
<env key="stats.poll.interval">nn</env>
</env-entries>
```

Example

```
<env-entries>
<env key="stats.poll.interval">60</env>
</env-entries>
```

- Polling starts at 60-second intervals; that is, the system requests that polling starts 60 seconds after the prior polling period was completed, regardless of the duration of the prior polling period. It does *not* mean that polling starts every 60 seconds.

- All the statistics are time-stamped with the exact time they were retrieved. The system uses the time stamp or time difference on which to base the 60-second calculation.

NOTE The statistics are cached in memory, so you might see an increase of about 1.5 megabytes of memory-use for each array.

Resolving Port Conflicts

When the Web Services Proxy is running, but another application is available at a defined address or port, a port conflict can occur. To resolve a port conflict do the following:

1. Change the port or ports configured in the `wsconfig.xml` file.
2. Restart the service.

Table 4 shows the attributes of the NetApp Web Server configuration file that control HTTP ports and HTTPS ports. Figure 1 on page 5 shows an example of the screen output.

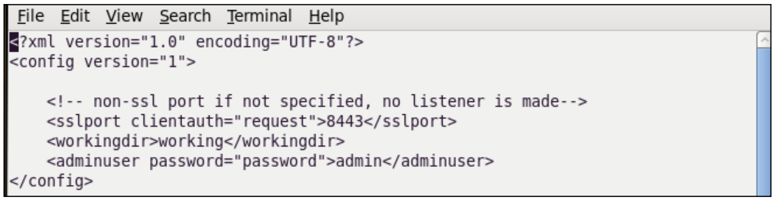
Table 4 Attributes of the `wsconfig.xml` File

Name	Description	Parent Node	Attributes	Required
`config`	The root node for the config	Null	Version - The version of the config schema is currently 1.0.	Yes
`sslport`	The TCP port to listen for SSL requests. Defaults to 8443	config	Clientauth	No

To configure the `wsconfig.xml` file, perform these actions:

1. Open a terminal window, and log in to the NetApp Web Services Proxy as root.
2. Navigate to the /opt/netapp/webservice directory.
3. With a text editor, open the `wsconfig.xml` file.
4. Make the necessary changes.
5. Save the file.
6. Close the file.

Figure 1 Sample Screen Output of the `wsconfig.xml` File



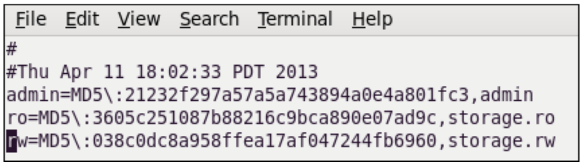
```
<?xml version="1.0" encoding="UTF-8"?>
<config version="1">

    <!-- non-ssl port if not specified, no listener is made-->
    <sslport clientauth="request">8443</sslport>
    <workingdir>working</workingdir>
    <adminuser password="password">admin</adminuser>
</config>
```

Configuring the users.properties File

The `users.properties` file contains user authentication information, including user names, passwords, and roles. The file is in the /opt/netapp/webservice/working directory. For detailed information about user names, passwords, and roles, go to User Roles and Access on page 8.

When you edit the user.properties file, type the password as plain text. Then use the securepasswordcs command line untility to encrypt the passwords. The utility is installed in the base install directory for the Web Services Proxy.

Figure 2 Default users.properties File



```
#
#Thu Apr 11 18:02:33 PDT 2013
admin=MD5\:21232f297a57a5a743894a0e4a801fc3,admin
ro=MD5\:3605c251087b88216c9bca890e07ad9c,storage.ro
rw=MD5\:038c0dc8a958ffea17af047244fb6960,storage.rw
```

Flags and Settings

You can edit the following other settings in the Environment Entries section.

```
<env-entries>

   <!-- Enables basic authentication. The user no longer is required to use the
   /devmgt/utils/login URL --->

<env key="enable-basic-auth">true</env>

   <!-- Turns on analyzed stats. The polling interval is really a rest interval
   between polling runs. If the user has many arrays with many drives and
   volumes, polling runs may take a while.

<env key="stats.poll.interval">30</env>

      </env-entries>
```

Logging in to Web Services Proxy

Login URL Authentication

This is the default way to log in. The sample code shows, using the cookie that it is set on, when the `/util/login` URL is used.

For reference, the cookie value to pass back to the server is `JSESSIONID`.

Basic Authentication

You can use basic authentication when it it enabled. If you are not logged in, the server returns a basic authentication challenge. To enable basic authentication, add the following lines to the `wsconfig.xml` file.

```
<env-entries>
<env key="enable-basic-auth">true</env>
</env-entries>
```

NetApp Web Services Proxy Security

The NetApp Web Services Proxy uses Secure Sockets Layer (SSL) for security.

Generating Certificates

Generating a Self-Signed Certificate

To enable SSL, add an SSL port designation to the `wsconfig.xml` configuration file. When the server is started with SSL configured, the server looks for the keystore and truststore files.

- If the server does not find a keystore, the server uses the IP address of the first non-loop back IPv4 address it finds to generate a keystore and add a self-signed certificate to the keystore.
- If the server does not find a truststore, or the truststore is not specified, the server uses the keystore as the truststore.

Generating an SSL Certificate

The NetApp Web Services Proxy provides a Java keytool with which to generate an SSL certificate. To generate a signed SSL certificate and export and store it on each client, perform these actions:

Generating an SSL Certificate on the Application Server

After you have generated the certificate and saved it in the application server keystore, you can use the certificate again on the same application server.

1. Remove any auto-generated keystores in the working directory.
2. Stop the server.
3. Run the following command to generate the certificate:

   ```
   keytool -genkeypair -keyalg RSA -keysize 2048 -alias jetty -dname CN=<THE SERVER
   DNS NAME> -keypass changeit -storepass changeit -keystore keystore -ext
   san=ip:<THEIR IP ADDRESS> <or> keytool -genkeypair -keyalg RSA -keysize 2048 -alias
   jetty -dname CN=servername -keypass changeit -storepass changeit -keystore keystore
   -ext san=ip:192.168.1.1
   ```

   The following message appears in the terminal window:

   ```
   When prompted for a password, use "changeit", unless you specify a specific one in
   the wsconfig.xml file
   When prompted for your first and last name, use the IP address or DNS name of the
   host, whichever one you plan on using in URLs
   ```

4. Follow the instructions in the terminal window.
5. Run the following command to export the certificate for signing:

   ```
   keytool -certreq -alias jetty -file mycertreq.cet -keystore keystore -<dname>
   CN=<servername> -ext san=ip:192.168.1.1
   ```

6. Send the certificate request to a certifying authority to be signed.
7. Run the following commands to import the CA certificate and the signed certificate back into your keystore.

   ```
   keytool -import -trustcacerts -alias root -file <CA CERT FILE> -keystore keystore
   keytool -import -trustcacerts -alias jetty -file <signed cert from ca> -keystore
   keystore
   ```

8. Restart the server.
9. Save the certificate in your keystore.

Generating an SSL Certificate on an Application Client

If you do not already have the certificate, import it from the certifying authority. Follow the prescribed import process for your specific operating system and web browser.

File Handles Limit

As a security measure, most operating systems limit the number of open file handles that a process or a user can have open at one time. Especially in Linux environments, where open TCP connections are considered to be file handles, it is very easy for the Web Services Proxy to exceed this limit. The fix is system dependent, so you should refer to your operating system's documentation for how to raise this value.

User Roles and Access

User access to the NetApp Web Services Proxy is based on user roles and their corresponding levels. Only the Read-Write user role can access the Array Manager and the array tree. The Read-Write role enables you to perform any action to a storage array in the array tree in the Array Manager.

- The initial user role is `rw.`
- The password is `rw.`

The following file contains the user IDs, user roles, and passwords:

```
/opt/netapp/webservice/working/users.properties
```

User names, passwords, and roles are in the following sequence:

```
user=encryptedpassword,storage.role
```

For more information about configuring passwords, go to Configuring the wsconfig.xml File on page 4

Adding Storage Arrays

Automatically Discovering Storage Arrays

By default, you need to provide only one management IP address to add an array. The server automatically discovers all management paths when the paths are not configured or they are configured and rotatable.

NOTE If you attempt to use an Ipv6 protocol to automatically discover storage arrays from the controller configuration after an initial connection has been made, the process might fail. Possible causes for the failure include during IP address forwarding or IPv6 is enabled on the Storage Systems but it is not on enabled on the server.

Turning Off Automatic Discovery of Storage Arrays

When the paths are configured, but not configured so that the server can route to the addresses, intermittent connection errors happen. If you cannot set the IP addresses to be routable from the host, you can turn off auto discovery. To turn off auto discovery, modify the following lines in the wsconfig.xml file.

```
<env key="autodiscover.ipv6.enable">false</env>
<env key="autodiscover.ipv4.enable">false</env>
```

Automatic Polling of Volume and Disk Statistics

The REST service provides the ability to set up an automatic polling of volume and disk statistics. To enable automatic polling, modify the `wsconfig.xml` file normally is located in the `webserver` directory. The new service will poll for all disk and volume statistics on the storage array registered with the service.

This feature does not change the behavior of the URLs for current disk and volume statistics. These URLs continue to retrieve the statistics when they are called. However, the user has the option to add the `usecache=true` query string to the end of the URL to retrieve cached statistics from the last poll. Using cached results greatly increases the performance of statistics retrieval. However, multiple calls at a rate equal to or less than the configured polling interval cache will retrieve the same data.

Two new URLs have been added to a storage array:

- analysed-drive-statistics/{optional list of disk ids}
- analysed-volume-statistics/{optional list of volume ids}

These URLs retrieve analyzed statistics from the last poll and are only available when polling is enabled. These URLs provide the following input-output data:

- Operations per second
- Throughput in megabytes per second
- Response times in milliseconds

These calculations are based on the differences between statistical polling iterations, which are the most common measures of storage performance. These statistics are preferable to unanalyzed statistics.

NOTE When the system starts, there is no previous poll to use to calculate the data, so it is based off cumulative data. In addition, if the cumulative counters are reset, the next polling cycle will have unpredictable numbers for the data.

Logging in to the API

Web Services Proxy has two default user logins and permission levels:

- Read-write access
  - User ID is: rw
  - Password is rw
- Read-only access
  - User id is: ro
  - Password is ro

To log in, type the following URL in a web browser:

`http://<host:port>/utils/login`

In addition, user can use “Basic Authentication” to login to the service. If a login session has not been established. A Basic Authentication challenge will be sent to the client.

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