

# Junos® OS

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## Junos Snapshot Administrator in Python Guide

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Juniper Networks, Inc.  
1133 Innovation Way  
Sunnyvale, California 94089  
USA  
408-745-2000  
[www.juniper.net](http://www.juniper.net)

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# About This Guide

Junos Snapshot Administrator in Python (jsnapy) is a Python version of the Junos Snapshot Administrator. It runs on a network server and requires Junos PyEZ. Through NETCONF connections, it enables you to capture and audit runtime environment snapshots of your Junos devices. You can capture and validate the operational status of a device and review operational changes to a device. You create YAML formatted configuration files that define the scope of snapshots and customize the evaluation criteria for the snapshot data. Configuration files reference YAML formatted test files that set the details for taking or comparing snapshots. Optionally, configuration files can instruct jsnapy to store or compare the snapshots in a SQLite database, or send e-mail regarding the results of snapshot operations. JSNAPy can also be included as a module in other Python scripts.

## RELATED DOCUMENTATION

| [Junos Snapshot Administrator Software](#)

# 1

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## Overview

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# Junos Snapshot Administrator in Python Overview

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- Junos Snapshot Administrator in Python Overview | 2
- Understanding Junos Snapshot Administrator in Python when Running as a Python Module | 4

## Junos Snapshot Administrator in Python Overview

Junos® Snapshot Administrator in Python (jsnapy) enables you to capture and audit runtime environment snapshots of your networked devices running the Junos OS. You can capture and validate the operational and configuration status of a device and review operational changes to a device. You create configuration files that define the scope of snapshots and customize the test criteria for the snapshot data.

You can use Junos Snapshot Administrator in Python to perform the following functions on either a single device or list of devices running Junos OS:

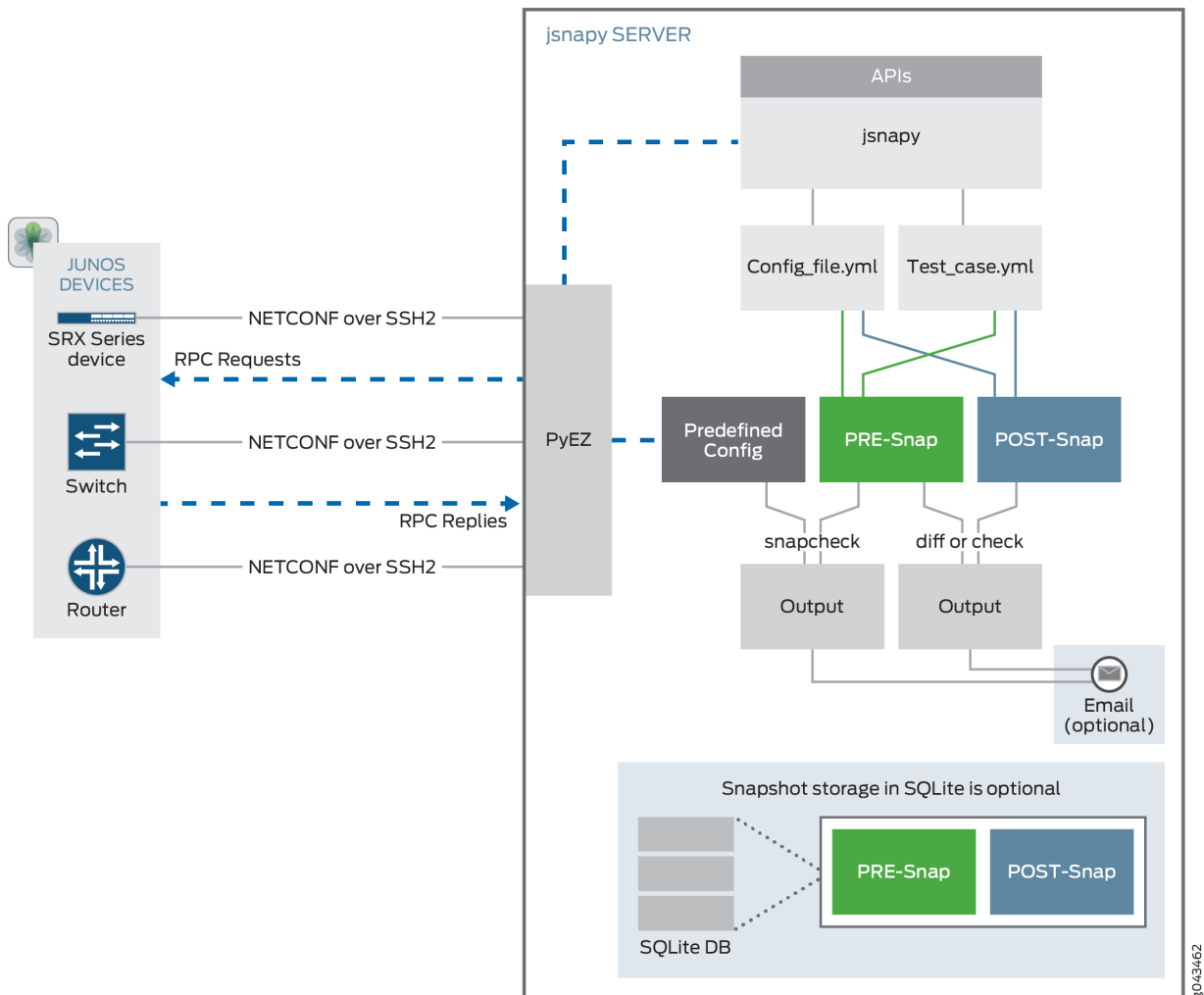
- Take a snapshot of the runtime environment on a device.
- Compare two snapshots.
- Audit a device's runtime environment against pre-defined criteria.
- Use it as a module in other Python programs.
- Send e-mail alerts that include test results.
- Store and compare snapshots in an SQLite database.

For example, prior to a software or hardware upgrade on a device, you can take a pre-install and post-install snapshot of the device and then compare the two snapshots. You can then review the operational changes on the device and validate these changes from a list of expected changes.

[Figure 1 on page 3](#) shows an operational overview of Junos Snapshot Administrator in Python.



**Figure 1: Junos Snapshot Administrator in Python Operational Overview**



Junos Snapshot Administrator in Python is installed on a remote server running an OS that can support Python, including Mac OS X, and many Linux distributions. The jsnappy server uses Junos PyEZ to make NETCONF connections over SSHv2 to your networked Junos OS devices. Using YAML-formatted configuration and test files for connection and test criteria, jsnappy sends RPC requests to the devices over the NETCONF connections. RPC replies are received back at the server in the form of snapshots. You can run jsnappy from the server command line or can be included as a module in other Python applications. See ["Understanding Junos Snapshot Administrator in Python when Running as a Python Module" on page 4](#)

The snapshots are formatted as text or XML files and are stored on the server in a location designated by the `jsnappy.cfg` file located in the directory `/etc/jsnappy/`. The full list of directories and files installed with jsnappy in the `/etc/jsnappy` directory can be seen in the ["Installing Junos Snapshot Administrator in Python" on page 22](#). Optionally, the snapshots can be stored in an SQLite database on the server. Jsnapy can

then compare the snapshots either to other snapshots or to pre-defined criteria in order to audit the effects of configuration changes or to confirm proper device configuration.

The only requirement for Junos devices to work with jsnapy is that NETCONF and SSH must be enabled.

Junos Snapshot Administrator in Python logs information regarding its operations to the console and to the `/var/log/jsnapy/jsnapy.log` file by default. The level of logging performed can be set to `DEBUG`, `INFO`, `ERROR`, or `CRITICAL` by changing parameters in the `/etc/jsnapy/logging.yml` file. Using this file, you can change the logging level, disable logging to the console, or change the locations and names of the log files that jsnapy uses. The logging level can be temporarily set to debug by using the `-v` option when calling jsnapy from the CLI, for example:

```
jsnapy -snap PRE -f config_file.yml -v.
```

## RELATED DOCUMENTATION

[Install Junos Snapshot Administrator in Python | 22](#)

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

## Understanding Junos Snapshot Administrator in Python when Running as a Python Module

Junos® Snapshot Administrator in Python (jsnapy) enables you to capture and audit runtime environment snapshots of your networked devices running the Junos OS. Jsnapy can be run from the command line of a network server (jsnapy server) or called as a module from within other python scripts on the jsnapy server. See "[Junos Snapshot Administrator in Python Overview](#)" on page 2 for details about CLI operation.

Once installed on the network server, jsnapy is ready to be used as a module within other python scripts and programs. No further configuration is needed. Jsnapy retains all of its functionality when used as a module in a python script or program.

In order to use jsnapy as a module inside of another python script, you must first use the python `import` statement so that the python script has access to jsnapy features. Because the script relies not only on jsnapy but also an understanding of Junos OS devices when working with snapshots, you must create

two distinct import statements, each importing a different module from the available Juniper python libraries, jnpr.

```
from jnpr.jsnapy import SnapAdmin
from jnpr.junos import Device
```

Importing the SnapAdmin module gives the script or program access to all of the same jsnapy options available on the command line. When used within the script, the SnapAdmin() function is usually assigned to a variable for use later in the script. Arguments are passed to SnapAdmin() to control the available jsnapy options. The following example assigns SnapAdmin to the variable *js* and then calls jsnapy with each of the 3 major options, snap, check, and snapcheck.

Assign the SnapAdmin Function to a Variable

```
js = SnapAdmin()
```

Call jsnapy 3 Times

```
snapshot = js.snap(config_file, "snapshot_filename")
chk = js.check(config_file, snapshot_1, snapshot_2)
snapchk = js.snapcheck(config_file, "snapshot_filename")
```

The Device module allows python scripts to be able to connect-to, login, and run commands on Junos OS devices. You supply connection IP address, username, and password arguments when calling the Device module from within python scripts. For example, the following line from a python script creates a variable called *device\_object* for use later in the script.

```
device_object = Device(host='192.0.2.1', user='username', password='password')
```

The variables named as argument values above can come from a variety of sources.

- You can build the configuration file information into the python script by creating a variable in which to store the data and then specifying all of the host and test information needed to connect to and test that device. For example,

```
config_data = """
hosts:
  - device: 192.0.2.1
    username : username
    passwd: password
```

```
tests:
  - test_exists.yml
  - test_does_not_contain.yml
"""
```

- You can specify an existing YAML formatted configuration file that contains connection and test information for the target device. For example:

```
config_file = /etc/jsnapy/samples/config_single_snapcheck.yml
```

- You can use a combination of a script defined device object for connection purposes and a list of existing YAML formatted test files to test the device. For example, the following line uses the previously defined `device_object` along with a list of tests to run and a name for the snapshot file.

```
js.snapcheck({'tests': ['test_exists.yml', 'test_contains.yml', 'test_is_equal.yml']},
            "snapshot_name", dev=device_object)
```

A wide variety of options are available when running jsnapy from within other Python scripts or programs. Strong familiarity with Python scripting and Junos OS device interaction is helpful in learning what is possible.

## RELATED DOCUMENTATION

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[Example: Use Jsnapy as a Python module | 87](#)

# Junos Snapshot Administrator in Python Configuration Files Overview

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## Understanding Junos Snapshot Administrator in Python Configuration Files

### IN THIS SECTION

- [Where to Store a Configuration File | 8](#)
- [Understanding the Sections of a Configuration File | 8](#)
- [Elements of a Configuration File | 9](#)
- [Inserting Comments into a Configuration File | 11](#)

The Junos Snapshot Administrator in Python (jsnapy) configuration files define the scope of a snapshot and specify the names of the files containing the test criteria for either a single snapshot or a comparison of two snapshots. You provide the location of the jsnapy configuration file as an argument to the `jsnapy` command or as an argument when calling `jsnapy` from another Python script.

## Where to Store a Configuration File

The jsnapy configuration files can be stored anywhere on the jsnapy server's file system. If the configuration file does not exist in the current working directory from which jsnapy is called, jsnapy looks in the path specified in `/etc/jsnapy/jsnapy.cfg` under the `config_file_path` heading. If the file does not exist there, jsnapy looks in the default location (`/etc/jsnapy/`) for configuration files. If the file does not exist there either, an error is displayed. To use a specific configuration file, you can specify the full path to the configuration file on the command line when calling jsnapy. For example:

```
jsnapy --snap PRE -f /full/path/to/config/file/config.yml
```

## Understanding the Sections of a Configuration File

Jsnapy configuration files consist of two mandatory sections: hosts and tests, and two optional sections: sqlite and mail.

- The hosts section defines which Junos OS hosts or devices jsnapy connects to when using the configuration file. Jsnapy can connect to a single host or to multiple hosts. Configuration files that direct jsnapy to connect to a single host define the host IP address and login credentials within the configuration file.

Configuration files that direct jsnapy to connect to multiple hosts use the include feature of YAML files to read a list of hosts and credentials from a separate YAML devices file. Devices files can be large files with many hosts listed. To use fewer hosts, the devices file can be broken up into groups that are referenced using the `group:` keyword in the hosts section of the configuration file. For more information, see ["Understanding Junos Snapshot Administrator in Python Device Files" on page 15](#). To specify which file contains the list of devices, enter the name of the file or the full path to the file. When only the filename is supplied, the location of the file follows the rules described in ["Where to Store a Configuration File" on page 8](#).

- The tests section tells jsnapy which test files to use when using the configuration file. The tests to be performed against the hosts are always defined in separate test files whose names are specified within the tests section of the configuration files. Multiple test filenames can be entered, each on its own line. Test filenames can be supplied as a filename or as the full path to the file. When only the filename is supplied, the location of the file follows the rules described in ["Where to Store a Configuration File" on page 8](#). For more information, see ["Understanding Junos Snapshot Administrator in Python Test Files" on page 11](#) and ["Example: Creating the Junos Snapshot Administrator in Python Test Files" on page 38](#).
- The sqlite section defines the parameters for storing and comparing snapshots in an SQLite database. You can specify whether snapshots created with this configuration file should be stored in a specific SQLite database in addition to being stored in the jsnapy server's file system. You can also specify

whether `--check` and `--snapcheck` options perform the compare operations on snapshots stored in the SQLite database. The SQLite database can store up to 51 snapshots, and these are indexed by ID numbers 0 through 50. [Table 2 on page 10](#) describes the configuration elements needed to configure snapshot storage in an SQLite database.

- The mail section includes the name of the file containing e-mail configuration information. The mail file can be supplied as a filename or as a full path to the file. When only the filename is supplied, the location of the file follows the rules described in ["Where to Store a Configuration File" on page 8](#). The details of what is contained in the mail file are described in ["Understanding Junos Snapshot Administrator in Python Mail Files" on page 17](#).

## Elements of a Configuration File

The jsnapy configuration files are YAML files that you build using combinations of keywords and values that are pertinent to your network. Like any YAML file, structure is derived through indentation (one or more spaces), sequence items are denoted by a dash (-), and key-value pairs are separated by a colon (:). [Table 1 on page 9](#) shows the supported keywords and their meaning.

**Table 1: Configuration File Keywords and Descriptions**

Keyword	Description
hosts	This keyword denotes the beginning of the hosts section. It must be on a line by itself and must be followed by a colon. (hosts:)
group	This keyword is an optional part of the hosts section. It refers to device group names within an external devices file (when contacting multiple hosts). It must be on a line by itself and must be followed by a colon. (group:) The group name used here must be a case-sensitive match to the group name in the external devices file. To include all hosts in the devices file, use the value <code>all</code> in place of any group name.
device	This keyword is part of the hosts section. It is preceded by a dash and followed immediately by a colon (- devices:). Single hosts can be contacted by specifying their IP address. Multiple hosts can be contacted by specifying a separate devices file (also in YAML format) that contains a listing of multiple device IP addresses.
include	This optional keyword is part of the hosts section. It is preceded by a dash and followed immediately by a colon. It specifies the name of a file that contains multiple device IP addresses and login credentials. It is needed only when you are connecting jsnapy to multiple hosts.

**Table 1: Configuration File Keywords and Descriptions (Continued)**

Keyword	Description
username	This keyword is part of the hosts section. It is followed immediately by a colon. It specifies a username that is used when contacting the device listed directly above it in the configuration or devices file.
passwd	This keyword is part of the hosts section. It is followed immediately by a colon. It specifies the login password used when contacting the device listed immediately above it in the configuration or devices file.
tests	This keyword denotes the beginning of the tests section. It is followed immediately by a colon. It is used to list one or more test files that are used to create or compare snapshots.
sqlite	This keyword denotes the beginning of the sqlite section. It is followed immediately by a colon. The sqlite section is used to define the parameters for storing snapshots in or comparing snapshots from an sqlite database. To complete this section, you must fill in the parameters shown in <a href="#">Table 2 on page 10</a> .
mail	This keyword activates the e-mail capability. It is followed by a colon. The argument is the name of a file that contains e-mail configuration information; for example, mail: mail.yml. When activated, e-mail is sent regarding the results of --check and --snapcheck operations, but is not sent when using the --snap option.

[Table 2 on page 10](#) shows the available parameters for filling in the sqlite section of the configuration file.

**Table 2: SQLite Configuration Parameters**

Parameter	Description
- store_in_sqlite:	Required when using the --snap option. Optional with the --check or --snapcheck options. Set to <b>true</b> to activate.
database_name	Required regardless of option. Specifies the name of the sqlite database in which to store or read the snapshot.



Table 2: SQLite Configuration Parameters *(Continued)*

Parameter	Description
check_from_sqlite	Required for --check or --snapcheck options. Optional for --snap option. Set to <b>true</b> to activate.
compare:	Required if you are comparing two snapshots by snapshot ID number (0-50) with the --check or --snapcheck options. Ignored if you compare by snapshot name using the command line; for example, jsnapy --check PRE POST -f config.yml.

Inserting Comments into a Configuration File

Comments can be inserted into the file at any location by starting the comment with the pound sign (#). This is useful for users who need to manage multiple configuration files so that they can quickly understand what is contained in the file.

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<a href="#">Understanding Junos Snapshot Administrator in Python Test Operators</a>	<a href="#">  19</a>
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Understanding Junos Snapshot Administrator in Python Test Files

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- [Elements of a Test File](#) | 12

The Junos Snapshot Administrator in Python (jsnapy) test files define the details of what a snapshot contains. Test files, also known as test cases, are YAML-formatted files that are referenced from inside

jsnappy configuration files. Configuration files are read as an argument to the jsnappy CLI command. Generally speaking, test files define what tests are included within the test case and the specific definitions for those tests.

## Understanding the Structure of a Test File

There are only two sections to a test file: the tests\_include list, and the details section. There is a details section for each test named in the include list. Test files begin with an include statement: tests\_include:. The include statement denotes the beginning of a list of tests that are contained within the test case. Each test name in the list is preceded by a dash (-); for example, - test\_name. You can name the tests whatever you want, except test names cannot include spaces or special characters. Valid test names include: check\_interfaces\_up, show\_software\_version, or test\_bgp\_neighbors.



**NOTE:** If the tests\_include list does not exist in the test file, but there are tests defined in the details section, all tests detailed within the test file are run. You can skip the running of specific tests within a test file by leaving the test name off of the tests\_include list.

The details section begins with the name of the test from the include list, followed by a colon; for example, check\_interfaces\_up:. The purpose of the details section is to provide all of the test criteria for the test case, including:

- Junos OS CLI or RPC commands (one per test) that are executed on the device. The output of these commands forms the basis of the snapshot.
- The Extensible Markup Path Language (XPath) that identifies the starting node in the Junos OS hierarchy from which the tests are run.
- Test operators that help to analyze the output from the commands.
- Info messages that are returned as the result of successful execution of the test operators.
- Error messages that are returned as the result of failure of the test operators.

When using the get-config RPC command, you can filter for specific configuration information using the filter\_xml: statement. As an example, the filter\_xml: configuration/system/login statement causes the device to filter out all of the configuration elements except those in the Junos OS /system/login hierarchy. This statement only works on the specific RPC command get-config. For more information, see ["Example: Creating the Junos Snapshot Administrator in Python Test Files" on page 38](#).

## Elements of a Test File

Like the other YAML files used with jsnappy, test files are structured using key-value pairs. The keywords and values are separated by a colon (:).

For example `rpc: get-config`.

[Table 3 on page 13](#) shows the keys available for use in a jsnapy test file and describes each key.

**Table 3: Test File Keywords and Descriptions**

Keyword	Description
tests_include	<p>This keyword denotes the beginning of a jsnapy test file and the beginning of the include statement. It is followed by a colon (:) and a carriage-return. Each element of the list that follows is the name of a test case, preceded by a space, a dash, and another space and must be on a line by itself. For example:</p> <pre>tests_include: - show_version - check_interface_state - return_bgp_neighbors</pre>
command	<p>This keyword is used to specify what Junos OS command is run on the device by jsnapy. It is preceded by a space, a dash (-), and another space and followed immediately by a colon (:). For example:</p> <pre>- command: show version</pre>
rpc	<p>This keyword is used to specify what Junos OS RPC command should be run on the device by jsnapy. It is preceded by a space, a dash (-), and another space and followed immediately by a colon (:). For example:</p> <pre>- rpc: get-software-version</pre>
format	<p>This keyword is used to format the device output. Available options are: text and xml. When comparing output that is formatted as text, only the --diff operation is supported. The --check and --snapcheck operations do not work on text formatted snapshots.</p>
kwargs	<p>This keyword only works with RPC commands. It is ignored if the command keyword is used in the test case definition. The keyword is used to provide arguments to the rpc command being sent to the device. For example:</p> <p>when using the get-interface-information rpc command, arguments like interface-name and media-type could be used to provide specific information about the interface.</p>

Table 3: Test File Keywords and Descriptions (*Continued*)

Keyword	Description
item	<p>This keyword denotes the beginning of a test definition. It is preceded by a space, a dash (-), and another space and followed immediately by a colon (:). For example:</p> <pre>- item:</pre> <p>This keyword also instructs jsnappy to match only the first node in the xpath.</p>
iterate	<p>This keyword denotes the beginning of a test definition. It is preceded by a space, a dash (-), and another space and followed immediately by a colon (:). For example:</p> <pre>- iterate:</pre> <p>This keyword also instructs jsnappy to continue to match all nodes in the xpath.</p> <p><b>NOTE:</b> A test definition can use either iterate or item. They cannot be used together.</p>
xpath	<p>This keyword denotes the path in the Junos OS hierarchy from which you want to start tests. It is preceded by two spaces and followed by a colon (:). For example:</p> <pre>  xpath:</pre> <p>The values used with this keyword are path syntax values. For example,</p> <p>the /configuration/system/services XPath selects the [system services] portion of the Junos OS hierarchy.</p>
id	<p>This keyword denotes an XPATH expression relative to the node-set being iterated that specifies a unique data element that maps the first snapshot data item with the second snapshot data item. The keyword is followed immediately by a colon (:). It is possible to use single or multiple id keywords under the same iterate or item XPATH blocks.</p>
tests	<p>This keyword denotes the beginning of the test definition. It is followed by a colon. Tests are activated only when the --check and --snapcheck options are used. Tests are not performed when taking snapshots using the --snap option. See <a href="#">"Junos Snapshot Administrator in Python Test Operators Summary" on page 44</a> for details about the available tests.</p>

**Table 3: Test File Keywords and Descriptions** *(Continued)*

Keyword	Description
info	<p>This keyword specifies what information is logged upon successful completion of the tests if the jsnapy logging level is set to debug. The information can use a jinja2 formatted template that pulls node values from the snapshot files. For example:</p> <pre>info: "Test successful! The admin status of the interface is &lt;{{pre['admin-status']}}&gt;."</pre>
err	<p>This keyword specifies what information will be logged upon failure of the test if the jsnapy logging level is set to debug. The information can use a jinja2 formatted template that pulls node values from the snapshot files. For example:</p> <pre>err: "Test Failed! The admin-status of the interface is &lt;{{post['admin-status']}}&gt;."</pre>
pre	<p>When used with jinja2 formatted variables in the info or err message sections, this keyword causes jsnapy to search for the named variable inside of the pre-change snapshot.</p>
post	<p>When used with jinja2 formatted templates in the info or err message sections, this keyword causes jsnapy to search for the named variable inside of the post-change snapshot.</p>

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**Understanding Junos Snapshot Administrator in Python Device Files****IN THIS SECTION**

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The Junos Snapshot Administrator in Python (jsnapy) devices file is a YAML file that contains IP addresses, group names, and login credentials for multiple Junos OS devices. IP addresses and login credentials within the file can be grouped by user-defined criteria such as model, device type, or location. There are no naming restrictions for the device file, so multiple device files can be created and any of them can be referenced by the jsnapy configuration files.

## Junos Snapshot Administrator in Python Device File Elements

Jsnapy device files are built using combinations of keywords and values that are pertinent to your network. Like any YAML file, structure is derived through indentation (one or more spaces), sequence items are denoted by a dash (-), and key value pairs are separated by a colon (:). The IP addresses used to identify the Junos OS hosts to contact appear on lines by themselves, preceded by a dash (-) and followed by a colon (:); for example:

```
- 192.0.2.1:
```

If you want to create groups of devices in the devices file, you can enter a group name on a line by itself, followed by a colon (:); for example:

```
MX_Devices:
```

The host IP addresses listed after the group name are considered a part of this group until the next group name is encountered in the devices file. This allows smaller groups to be contacted by referencing the group name (or names) from within the hosts section of the configuration file. If there are no group names configured in the devices file, the entire list of devices is contacted whenever that particular devices file is referenced in the configuration file.

Login credentials follow each IP address unless an SSH trust relationship has been established between the jsnapy server and the Junos OS host. The login credentials specify the username and password needed for that particular host IP using the keywords `username:` and `passwd:`, respectively.

Comments can be inserted into the devices file at any location by simply starting the comment with a hash (#); for example, `#This is a comment.`

Jsnapy device files should be stored in the same directory as the configuration file that is being used with the jsnapy command.

The following commented example shows the structure of a jsnapy devices file.

## Example Devices File

```
user@host:~> cat devices_example.yml
#Junos Snapshot Administrator in Python - Example Devices File
MX_Devices: #This is a group name.
- 192.0.2.33: #IP address of a Junos OS host
```

```

username: username
passwd: password
- 192.0.2.65:
  username: yourname
  passwd: yourpassword
QFX: #<-- Group name
- 192.0.2.12:
  username: switchuser
  password: password1
- 198.51.100.10:
  username: switchuser
  passwd: password1
Finance:
- 192.0.2.36:
  username: financeuser
  passwd: 1password
- 192.0.2.11:
  username: financeuser
  passwd: 1password
RandD:
- 198.51.100.1 #No login credentials needed for these hosts because of existing SSH trust
relationships.
- 198.51.100.254

```

## RELATED DOCUMENTATION

[Junos Snapshot Administrator in Python Overview | 2](#)

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

[Understanding Junos Snapshot Administrator in Python Test Files | 11](#)

## Understanding Junos Snapshot Administrator in Python Mail Files

### IN THIS SECTION

- [General Information | 18](#)
- [Understanding the Structure of a Mail File | 18](#)

The Junos Snapshot Administrator in Python (jsnapy) mail files are YAML-formatted files that define the details needed for jsnapy to send e-mail regarding the results of completed snapshots and comparison tests.

## General Information

You can name mail files whatever you want except that the name cannot contain spaces or special characters. The mail file should be stored in the same directory as the jsnapy configuration file to which it is linked. When a mail file is referenced from a configuration file, e-mail will be sent every time jsnapy is run with that configuration using either the `--check` or `--snapcheck` options, regardless of success or failure of the tests that are run on the Junos OS host. If jsnapy is run with the `--check` option, then no mail is sent.

After installation and initialization, there is a sample mail file named `send_mail.yml` in the `/etc/jsnapy/samples` directory. This file shows the available fields and some sample values.

```
user@jsnapy-server:~> cat /etc/jsnapy/samples/send_mail.yml
to: abc@juniper.net
from: foo@gmail.com
sub: "Sample Jsnapy Results, please verify"
recipient_name: ABC
passwd: pass123
#server: smtp.gmail.com optional
sender_name: "Juniper Networks"
```

This sample mail file will not work for sending mail without modification.

Jsnapy uses sendmail on the jsnapy server to send SMTP e-mail to the Gmail server `smtp.gmail.com` by default.

## Understanding the Structure of a Mail File

The jsnapy mail file has several required parameter-value pairs and two optional ones. All parameter-value pairs are separated by a colon (:). [Table 4 on page 18](#) describes both the required and optional parameters for jsnapy mail file configuration.

**Table 4: Key-Value Pairs in jsnapy Mail Files**

Parameter	Description
to	This value is the e-mail address to which you want the e-mail messages sent.



Table 4: Key-Value Pairs in jsnappy Mail Files *(Continued)*

Parameter	Description
from	<p>This value is an e-mail address that is used as the from field of the outgoing e-mail. It is also used as the username for login to the SMTP server specified by the server parameter.</p> <p><b>NOTE:</b> If no value is given for the server parameter, then this value should be a valid e-mail address @gmail.com.</p>
sub	This value is used as the subject line in the outgoing e-mail.
recipient_name	This value is used as the salutation in the body of the e-mail.
passwd	This value is the password associated with the e-mail account value in the from parameter.
server	This optional value is the IP address or DNS name of an SMTP server that jsnappy will use for sending e-mail. If no value is given, jsnappy will use smtp.gmail.com for sending e-mail.
port	This optional value tells jsnappy to send e-mail on a TCP port other than port 587 (SMTP).
sender_name	This value is the name used as the signature line in the body of the e-mail.

## RELATED DOCUMENTATION

[Junos Snapshot Administrator in Python Overview | 2](#)

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

## Understanding Junos Snapshot Administrator in Python Test Operators

Junos Snapshot Administrator in Python (jsnappy) enables you to capture and audit runtime environment snapshots of your networked devices running Junos OS. The jsnappy configuration file defines the scope of a snapshot and specifies the test files to use for either a single snapshot or a comparison of two snapshots. The --snapcheck option takes a single snapshot and evaluates the results, and the --check option compares the results of two separate snapshots. Within the test file, you specify the commands to be

run on the Junos device, the XPath from which to start, an optional id value, and the tests to run against the command output. The test cases use test operators to either evaluate data elements in a single snapshot or compare data elements in two separate snapshots.

Jsnapy provides numerous relational operators that test for existence, equality, inequality, size, and inclusion in or exclusion from a specific range or list. Specific operators work with different operand types including strings, numbers, and XML elements. You should construct test cases using test operators that pertain to the type of check being performed. For a list of available operators, see ["Junos Snapshot Administrator in Python Test Operators Summary" on page 44](#).

Junos Snapshot Administrator in Python uses a few test operators, `delta`, `list-no-less`, `list-no-more`, and `no-diff`, to compare elements or element values in two separate snapshots. Test cases using these test operators are executed when you use the `--check` option. When you use the `--snapcheck` option, which is specific to a single collection, test cases using these test operators are effectively ignored. Junos Snapshot Administrator in Python outputs a message when a test case is ignored, as shown in the following sample output:

```
-----  
CHECKING SECTION: ospf-checks  
-----  
INFO: snapcheck mode: skipping test: list-not-less  
INFO: snapcheck mode: skipping test: no-diff  
+ TEST PASSED: All OSPF neighbors are up  
+ TEST PASSED: OSPF neighbors must have the same priority value  
INFO: snapcheck mode: skipping test: no-diff
```

## RELATED DOCUMENTATION

[Junos Snapshot Administrator in Python Test Operators Summary | 44](#)

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

# 2

PART

## Installation

---

- [Installing Junos Snapshot Administrator in Python | 22](#)
-

## CHAPTER 3

# Installing Junos Snapshot Administrator in Python

**IN THIS CHAPTER**

- [Install Junos Snapshot Administrator in Python | 22](#)

## Install Junos Snapshot Administrator in Python

**SUMMARY**

Install Junos Snapshot Administrator in Python (JSNAPy) on a remote network management system.

**IN THIS SECTION**

- [Install Prerequisite Software | 23](#)
- [Install the JSNAPy Library | 25](#)
- [Upgrade JSNAPy | 29](#)

You install Junos Snapshot Administrator in Python (JSNAPy) on a remote network management system. Prior to installing JSNAPy, ensure that the server is running an OS that supports Python 3.8 or later. This includes, but is not limited to:

- Linux (CentOS, Debian, Fedora, FreeBSD, and Ubuntu)
- macOS



**NOTE:** Windows does not support installing JSNAPy.

To install JSNAPy, first install the prerequisite software and then install JSNAPy as described in the following sections:

- ["Install Prerequisite Software" on page 23](#)
- ["Install the JSNAPy Library" on page 25](#)

To upgrade an existing JSNAPy installation, see the following section:

- ["Upgrade JSNAPy" on page 29](#)

**Install Prerequisite Software**

Before you install JSNAPy, ensure that the server has the following software installed:

- Python 3.8 or later
- All prerequisite software for the given operating system, which is outlined in [Table 5 on page 23](#)

**Table 5: jsnapy Dependencies**

OS	Dependencies
CentOS	<ul style="list-style-type: none"><li>• gcc</li><li>• libffi-devel</li><li>• libxml2-devel</li><li>• libxslt-devel</li><li>• openssl</li><li>• python3-devel</li><li>• python3-pip</li></ul>
Debian	<ul style="list-style-type: none"><li>• libffi-dev</li><li>• libssl-dev</li><li>• libxml2-dev</li><li>• libxslt1-dev</li><li>• python3-dev</li><li>• python3-pip</li></ul>

Table 5: jsnappy Dependencies (*Continued*)

OS	Dependencies
Fedora	<ul style="list-style-type: none"> <li>• gcc</li> <li>• libffi-devel</li> <li>• libxml2-devel</li> <li>• libxslt-devel</li> <li>• openssl</li> <li>• python3-devel</li> <li>• python3-pip</li> </ul>
FreeBSD	<ul style="list-style-type: none"> <li>• py3xx-pip (e.g. py-311-pip)</li> <li>• libxml2</li> <li>• libxslt</li> </ul>
OSX	<ul style="list-style-type: none"> <li>• pip</li> <li>• xcode</li> <li>• xquartz</li> </ul>
Ubuntu	<ul style="list-style-type: none"> <li>• libffi-dev</li> <li>• libssl-dev</li> <li>• libxml2-dev</li> <li>• libxslt1-dev</li> <li>• python3-dev</li> <li>• python3-pip</li> </ul>

## Install the JSNAPy Library

### IN THIS SECTION

- [Install JSNAPy Under the System-Installed Python | 25](#)
- [Install JSNAPy in a Python Virtual Environment | 26](#)
- [JSNAPy Directories and Files | 27](#)

You can install JSNAPy under the system-installed Python or in a Python virtual environment. You can use the Python package manager, `pip`, to install JSNAPy from the following locations:

- Python Package Index (PyPI) at <https://pypi.org/>
- [Juniper/jsnapy](#) GitHub repository



**NOTE:** We recommend that you upgrade to the latest version of `pip` before installing JSNAPy.

The following sections outline the JSNAPy installation tasks and results:

### Install JSNAPy Under the System-Installed Python

To install JSNAPy under the system-installed Python on the remote server:

#### 1. Install JSNAPy using `pip`.

- To install the latest JSNAPy release from PyPI:
- On Ubuntu, include the following options:

```
user@server:~$ sudo pip3 install jsnapy --no-binary :all: --no-cache-dir
```

- Otherwise, use the following command:

```
user@server:~$ sudo pip3 install jsnapy
```

- To install the latest JSNAPy development code from GitHub:

- On Ubuntu, include the following options:

```
user@server:~$ sudo pip3 install git+https://github.com/Juniper/jsnapy.git --no-binary :all: --no-cache-dir
```

- Otherwise, use the following command.

```
user@server:~$ sudo pip3 install git+https://github.com/Juniper/jsnapy.git
```



**NOTE:** The latest code in the GitHub source repository is under active development and might not be stable.

2. Create the JSNAPy **snapshots** and **testfiles** directories. Specify the paths to the default directory locations in the user's home directory.

```
user@server:~$ mkdir -p ~/jsnapy/snapshots
user@server:~$ mkdir -p ~/jsnapy/testfiles
```



**NOTE:** Alternatively, you can update the JSNAPy configuration file (**jsnapy.cfg**) to specify alternate locations for the **snapshots** and **testfiles** directories.

## Install JSNAPy in a Python Virtual Environment

To install JSNAPy in an existing Python virtual environment:

1. Navigate to your virtual environment and activate it. For example:

```
user@server:~$ cd jsnapy-venv
user@server:~/jsnapy-venv$ source .venv/bin/activate
(.venv) user@server:~/jsnapy-venv$
```

2. Install JSNAPy using pip.

- To install the latest JSNAPy release from PyPI:



- On Ubuntu and macOS, include the following options:

```
(.venv) user@server:~/jsnapy-venv$ pip install jsnapy --no-binary :all: --no-cache-dir
```

- Otherwise, use the following command:

```
(.venv) user@server:~/jsnapy-venv$ pip install jsnapy
```

- To install the latest JSNAPy development code from GitHub:

- On Ubuntu and macOS, include the following options:

```
(.venv) user@server:~/jsnapy-venv$ pip install git+https://github.com/Juniper/jsnapy.git --no-binary :all: --no-cache-dir
```

- Otherwise, use the following command:

```
(.venv) user@server:~/jsnapy-venv$ pip install git+https://github.com/Juniper/jsnapy.git
```



**NOTE:** The latest code in the GitHub source repository is under active development and might not be stable.

## JSNAPy Directories and Files

JSNAPy uses the directories and files listed in [Table 6 on page 27](#).

**Table 6: JSNAPy Directories and Files**

Directory or File Name	Purpose
<b>jsnapy.cfg</b>	File that specifies the default paths for configuration files, snapshot files, and test files.
<b>logging.yml</b>	File that specifies the settings for logging JSNAPy events and messages.

**Table 6: JSNAPy Directories and Files (Continued)**

Directory or File Name	Purpose
<b>snapshots/</b>	Default directory for the storage of JSNAPy snapshot files. The snapshot filenames include the device name and the test.
<b>testfiles/</b>	Default directory for JSNAPy test files.

Table 7 on page 28 outlines the default locations for the JSNAPy files and directories for the given environment. The table also indicates whether the JSNAPy installer automatically generates the file or directory during the installation.

**Table 7: Default Locations for JSNAPy Files and Directories**

Files	Environment	Default Location	JSNAPy Creates the File or Directory During Installation
<b>jsnapy.cfg</b>	Non-virtual	<b>/etc/jsnapy/</b>	Yes
	Virtual	<b>/etc/jsnapy/</b> directory inside the virtual environment	Yes
<b>logging.yml</b>	Non-virtual	<b>/var/log/jsnapy/</b>	Yes
	Virtual	<b>/var/log/jsnapy/</b> directory inside the virtual environment	Yes
Configuration and test files	Non-virtual	<b>~/jsnapy/testfiles</b>	No
	Virtual	<b>/etc/jsnapy/testfiles</b> directory inside the virtual environment	Yes
Snapshots	Non-virtual	<b>~/jsnapy/snapshots</b>	No

Table 7: Default Locations for JSNAPy Files and Directories (*Continued*)

Files	Environment	Default Location	JSNAPy Creates the File or Directory During Installation
	Virtual	<code>/etc/jsnapy/snapshots</code> directory inside the virtual environment	Yes

## Upgrade JSNAPy

Juniper Networks periodically updates the JSNAPy code in GitHub for improvements and bug fixes. You can upgrade your JSNAPy installation at any time to the latest release posted on <https://pypi.org/> or to the latest development code in the Juniper/jsnapy GitHub repository. You can use the pip command with the upgrade flag (-U or --upgrade) to update the existing installation as described in the following sections:

### Upgrade JSNAPy Under the System-Installed Python

To update JSNAPy after you have installed it under the system-installed Python:

- To update JSNAPy to the latest released code in PyPI, use the following command:

```
user@server:~$ sudo pip3 install -U jsnapy
```

- To update jsnapy to the latest development code in GitHub, use the following command:

```
user@server:~$ sudo pip3 install -U git+https://github.com/Juniper/jsnapy.git
```



**NOTE:** The latest code in the GitHub source repository is under active development and might not be stable.

### Upgrade JSNAPy in a Python Virtual Environment

To update JSNAPy after you have installed it in a Python virtual environment:

- To update JSNAPy to the latest released code in PyPI, use the following command:

```
(.venv) user@server:~/jsnapy-venv$ pip install -U jsnapy
```

- To update JSNAPy to the latest development code in GitHub, use the following command:

```
(.venv) user@server:~/jsnapy-venv$ pip install -U git+https://github.com/Juniper/jsnapy.git
```



**NOTE:** The latest code in the GitHub source repository is under active development and might not be stable.

## RELATED DOCUMENTATION

[Junos Snapshot Administrator in Python Overview | 2](#)

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

# 3

PART

## Configuration

---

- [Creating Junos Snapshot Administrator in Python Configuration Files | 32](#)
  - [Junos Snapshot Administrator in Python Test Operators and Flags | 44](#)
-

# Creating Junos Snapshot Administrator in Python Configuration Files

## IN THIS CHAPTER

- [Example: Creating the Junos Snapshot Administrator in Python Configuration Files | 32](#)
- [Example: Creating the Junos Snapshot Administrator in Python Test Files | 38](#)

## Example: Creating the Junos Snapshot Administrator in Python Configuration Files

### IN THIS SECTION

- [Requirements | 32](#)
- [Overview | 33](#)
- [One Host, One Test | 33](#)
- [One Host, Two Tests with E-mail | 35](#)
- [Multiple Hosts, One Test with SQLite Database Storage | 36](#)

This example demonstrates how to create some basic Junos Snapshot Administrator in Python (jsnapy) configuration files. The examples in this topic use specific numbers of spaces sometimes before any other text is entered on a line. These spaces are required for proper formatting of the YAML file. When usernames and passwords need to be typed in these examples, replace the word **user** with a valid username and the **<password>** text with a valid password.

### Requirements

- Junos Snapshot Administrator in Python Release 1.0 is installed on the server.

## Overview

This topic describes, how to create multiple jsnapy configuration files:

- A configuration file that connects to one specific host and runs one specific test
- A configuration file that connects to one specific host, runs two tests, and sends the results by e-mail
- A configuration file that connects to a group of hosts, runs one test, and stores the snapshot in an SQLite database

Junos Snapshot Administrator in Python configuration files consist of two mandatory sections: hosts and tests, and two optional sections: sqlite and mail. The configuration files that direct jsnapy to connect (using Junos PyEZ and NETCONF) to a single host define the host IP address and credentials within the configuration file, while the configuration files that direct jsnapy to connect to multiple hosts use the include feature of YAML files to read in a list of hosts and credentials from a separate YAML file. The tests to be performed against the hosts are always defined in separate YAML test files whose names are specified within the tests section of the configuration files. Multiple test files can be specified.

For more information regarding test files, see the following:

- ["Understanding Junos Snapshot Administrator in Python Test Files" on page 11](#)
- ["Creating the Junos Snapshot Administrator in Python Test Files" on page 38](#)

SQLite configuration is done within the configuration file, while e-mail configuration is done in a separate mail configuration file, the name of which is specified in the configuration file. See <understanding mail config> and <creating mail config> for information about setting up jsnapy to use e-mail.

Comments can be inserted into the file at any location by starting the comment with the pound sign (#).

## One Host, One Test

### IN THIS SECTION

- [Procedure | 34](#)
- [Results | 34](#)

## Procedure

### Step-by-Step Procedure

Two sections are required for this configuration file: hosts and tests. For this example, use a text editor to create a new file named `configuration_one_host_one_test.yml`.

1. Create the hosts section.

```
hosts:
```

2. Specify the IP address and login credentials.

```
- device: 192.0.2.12
  username: user
  passwd: <password>
```

3. Create the tests section.

```
tests:
```

4. Specify the test file to use.

```
- test_exists.yml
```

## Results

The resulting configuration file can be shown in the terminal using the `cat` command.

```
user@jsnapy-server:~> cat configuration_one_host_one_test.yml
hosts:
- device: 192.0.2.12
  username: user
  password: <password>
tests:
- test_exists.yml
```



## One Host, Two Tests with E-mail

### IN THIS SECTION

- [Procedure](#) | 35

### Procedure

#### Step-by-Step Procedure

Three sections are required for this configuration file: hosts, tests and mail. For this example, use a text editor to create a new file named `configuration_one_host_two_tests_e-mail.yml`.

1. Create the hosts section.

```
hosts:
```

2. Specify the IP address and login credentials.

```
- device: 192.0.2.11
  username: user
  passwd: <password>
```

3. Create the tests section.

```
tests:
```

4. Specify the test file to use.

```
- test_not_less.yml
- test_not_more.yml
```

## 5. Specify the e-mail configuration file.

```
mail: send_mail.yml
```

## Results

The resulting configuration file can be shown in the terminal using the `cat` command.

```
user@jsnappy-server:~> cat configuration_one_host_two_tests_e-mail.yml
hosts:
  - device: 192.0.2.11
    username: user
    password: <password>
tests:
  - test_not_less.yml
  - test_not_more.yml
mail: send_mail.yml
```

## Multiple Hosts, One Test with SQLite Database Storage

### IN THIS SECTION

- [Procedure | 36](#)

## Procedure

### Step-by-Step Procedure

Three sections are required for this configuration file: `hosts`, `tests`, and `sqlite`. Use a text editor to create a new file named `configuration_multiple_hosts_one_test_sqlite`.

#### 1. Create the `hosts` section.

```
hosts:
```

2. Specify the file in which the host IP addresses and login credentials are contained.

```
- include: devices.yml
  group: MX
```

3. Create the tests section.

```
tests:
```

4. Specify the test file to use.

```
- test_diff.yml
```

5. Create the sqlite section.

```
sqlite:
```

6. Configure the sqlite parameters.

```
- store_in_sqlite: yes
  check_from_sqlite: yes
  database_name: jsnapy.db
```

## Results

The resulting configuration file can be shown in the terminal using the cat command.

```
user@jsnapy-server:~> cat configuration_multiple_hosts_one_tests_sqlite.yml
hosts:
  - include: devices.yml
    group: MX
tests:
  - test_diff.yml
sqlite:
  - store_in_sqlite: yes
```

```
check_from_sqlite: yes
database_name: jsnapy.db
```

## RELATED DOCUMENTATION

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

[Junos Snapshot Administrator in Python Overview | 2](#)

## Example: Creating the Junos Snapshot Administrator in Python Test Files

### IN THIS SECTION

- [Requirements | 38](#)
- [Overview | 38](#)
- [Capture Junos OS Software Release Version | 39](#)
- [Request Filtered Configuration Information | 41](#)

This example demonstrates how to create some basic Junos Snapshot Administrator in Python (jsnapy) test files. The examples in this topic use specific numbers of spaces sometimes before any other text is entered on a line. These spaces are required for proper formatting of the YAML file.

### Requirements

- Junos Snapshot Administrator in Python Release 1.0 is installed on the server.

### Overview

This topic describes how to create two test files using various elements available for test file creation:

- A test file named `test_sw_version.yml` that just captures the Junos OS software release version
- A test file named `filter_config_info.yml` that requests filtered information from the `get_config` RPC command.

Jsnapy test files contain the detailed commands, tests, hierarchy locations, and test elements necessary to create or compare snapshots of the runtime environments of Junos OS devices. You can create as

many test files as you want, store them wherever you want on the jsnapy server, and name them as you see fit (with the exception of spaces and special characters). There are two primary parts to a jsnapy test file: the named list of tests under a `tests_include` heading, and the detail sections, one detail section for each named test under the `tests_include` section.

Comments can be inserted into the test file at any location by starting the comment with the pound sign (#).

## Capture Junos OS Software Release Version

### IN THIS SECTION

- [Procedure | 39](#)
- [Results | 41](#)

### Procedure

#### Step-by-Step Procedure

For this example, use a text editor to create a new file named `test_sw_version.yml`. Create the file in the same directory as the configuration file that you intend to use or in the `/etc/jsnapy/testfiles/` directory.

1. Create the `tests_include` section.

```
tests_include:
```

2. Set the test name.

```
- test_sw_version
```

3. Start the test details section.

```
test_sw_version:
```

4. Set the command to be sent. In this case it is the Junos OS command `show version`.

```
- command: show version
```

5. Specify whether your tests look for the first instance of a value or all instances of a value. In this case we are looking for only the first instance.

```
- item:
```

6. Specify the XPATH location from which to start the snapshot or search.

```
xpath: '//software-information'
```

7. Begin the tests section, if there is one. In this case there will be a tests section.

```
tests:
```

8. Specify what tests will be run. In this case we will enable this test file to check whether the Junos OS version is the same between snapshots.

```
- all-same: junos-version
```

9. Set the error message to display. In the event that the test fails, this message will be displayed.

```
err: "Test Failed!!! The versions are not the same. From the PRE snapshot, the
version is: <{{pre['junos-version']}}>. From the POST snapshot, the version is
<{{post['junos-version']}}>!! "
```

10. Set the info message to display. In the event that the test succeeds, this message will be displayed.

```
info: "Test Succeeded!! The Junos OS version is: <{{post['junos-version']}}>!!!"
```

## Results

The resulting test file can be shown in the terminal using the cat command.

```
user@jsnappy-server:~> cat test_sw_version.yml
tests_include:
  - test_sw_version

test_sw_version:
  - command: show version
  - item:
      xpath: '//software-information'
      tests:
        - all-same: junos-version
          err: "Test Failed!!! The versions are not the same. From the PRE snapshot, the version
is: <{{pre['junos-version']}}>. From the POST snapshot, the version is <{{post['junos-
version']}}>!! "
          info: "Test Succeeded!! The Junos OS version is: <{{post['junos-version']}}>!!!"
```

## Request Filtered Configuration Information

### IN THIS SECTION

- [Procedure | 41](#)
- [Results | 42](#)

## Procedure

### Step-by-Step Procedure

This example creates a test file that uses an RPC command, `get-config`, to retrieve the device configuration. An argument is provided to the RPC command so that jsnappy filters that device configuration information so that the snapshot contains only the filtered information rather than the entire configuration. In this example we will configure the test file to return only the host-name information.

1. Create the tests\_include section.

```
tests_include:
```

2. Set the test name.

```
- test_rpc_filtering
```

3. Begin the test details section.

```
test_rpc_filterin:
```

4. Set the RPC command to be used.

```
- rpc: get-config
```

5. Provide the arguments keyword to tell jsnapy that arguments follow.

```
- kwargs:
```

6. Enter the argument name and value. In this case we are filtering for the host name.

```
filter_xml: configuration/system/host-name
```

## Results

The resulting configuration can be shown in the terminal using the cat command.

```
user@jsnapy-server:~> cat filter_config_info.yml
tests_include:
  - test_rpc_filtering

test_rpc_filtering:
  - rpc: get-config
```



```
- kwargs:  
  filter_xml: configuration/system/host-name
```

## RELATED DOCUMENTATION

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[Understanding Junos Snapshot Administrator in Python Test Files | 11](#)

---

[Understanding Junos Snapshot Administrator in Python Mail Files | 17](#)

---

[Understanding Junos Snapshot Administrator in Python Device Files | 15](#)

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[Junos Snapshot Administrator in Python Overview | 2](#)

# Junos Snapshot Administrator in Python Test Operators and Flags

## IN THIS CHAPTER

- Junos Snapshot Administrator in Python Test Operators Summary | 44
- all-same operator | 47
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- in-range operator | 60
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## Junos Snapshot Administrator in Python Test Operators Summary

Junos Snapshot Administrator in Python (jsnapy) enables you to capture and audit runtime environment snapshots of your networked devices running Junos OS. The Junos Snapshot Administrator configuration file defines the scope of a snapshot and the evaluation criteria for either a single snapshot

or a comparison of two snapshots. The configuration files reference the names of test files that define the details of the tests to be run. Within the test file, you can create test cases that evaluate or compare content from specific Junos OS commands. The test cases use test operators to either evaluate data elements in a single snapshot or compare data elements in two separate snapshots.

[Table 8 on page 45](#) lists the Junos Snapshot Administrator test operators along with a brief description of each operator. Operators are grouped by operand type.

You can also use the ["ignore-null" on page 55](#) flag in combination with other operators. If you set `ignore-null` to `True`, JSNAPy skips tests where nodes for any of the specified XPath's for the test are absent in the snapshot output. You can include the `ignore-null` flag at a global level to apply it to all tests or at a test level to apply it to an individual test only.

**Table 8: Junos Snapshot Administrator Test Operators**

Operator	Description
<b>Compare Elements or Element Values in Two Snapshots</b>	
<a href="#">delta</a>	Compare the change in value of a specified data element, which must be present in both snapshots, to a specified delta. You can specify the delta as an absolute, positive, or negative percentage, or an absolute, positive, or negative fixed value.
<a href="#">list-not-less</a>	Determine if the specified items are present in the first snapshot but are not present in the second snapshot.
<a href="#">list-not-more</a>	Determine if the specified items are present in the second snapshot but are not present in the first snapshot.
<a href="#">no-diff</a>	Compare specified data elements that are present in both snapshots, and verify that the value is the same.
<b>Operate on Elements with Numeric or String Values</b>	
<a href="#">all-same</a>	Check if all content values for the specified elements are the same. Optionally, you can check if all content values for the specified elements are the same as the content value of a reference item.
<a href="#">is-equal</a>	Test if an XML element string or integer value matches a given value.

Table 8: Junos Snapshot Administrator Test Operators (*Continued*)

Operator	Description
<code>not-equal</code>	Test if an XML element string or integer value does not match a given value.
<b>Operate on Elements with Numeric Values</b>	
<code>in-range</code>	Test if the XML element value is within a given numeric range.
<code>is-gt</code>	Test if the XML element value is greater than a given numeric value.
<code>is-lt</code>	Test if the XML element value is less than a given numeric value.
<code>not-range</code>	Test if the XML element value is outside a given numeric range.
<b>Operate on Elements with String Values</b>	
<code>contains</code>	Determine if an XML element string-value contains the provided string value.
<code>is-in</code>	Determine if an XML element string-value is included in a specified list of string values.
<code>not-in</code>	Determine if an XML element string value is excluded from a specified list of string values.
<b>Operate on XML Elements</b>	
<code>exists</code>	Verify the existence of an XML element in the snapshot.
<code>not-exists</code>	Verify the lack of existence of an XML element in the snapshot.

## RELATED DOCUMENTATION

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## all-same operator

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### Syntax

```
all-same xpath-expression, [ [reference-item] ] {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that checks if all content values for the specified elements are the same. If you include the optional reference item, the operator checks if all content values for the specified elements are the same as the content value of the reference item.

### Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>reference-item</i></b>	(Optional) XPath expression specifying the reference element against which value all other element values are compared.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following example code checks that all OSPF neighbors have the same priority value. If any priority values are different, the code generates the error message.

```
ospf-check {
  command show ospf neighbor;
  iterate ospf-neighbor {
    all-same neighbor-priority {
      info OSPF neighbors must have the same priority value;
      err "OSPF interface %s has mismatch priority %s", interface-name, neighbor-priority;
    }
  }
}
```

The following example code checks that all OSPF neighbors have the same priority value as that of interface ae19.0. If any priority values are different from that of the reference interface, the code generates the error message.

```
ospf-check {
  command show ospf neighbor;
  iterate ospf-neighbor {
    all-same neighbor-priority, [interface-name = 'ae19.0'] {
      info OSPF neighbors must have the same priority value as ae19;
      err "OSPF interface %s has mismatch priority %s", interface-name, neighbor-priority;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*is-equal operator*

| *not-equal operator*

## contains operator

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### Syntax

```
contains xpath-expression, test-string {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that determines if an XML element string value contains the provided *test-string* value.

### Parameters

- |                                |  |
|--------------------------------|--|
| <b><i>err string</i></b>       | Statement generated when the test case returns false.                                |
| <b><i>info string</i></b>      | Description of the test case.  |
| <b><i>test-string</i></b>      | String searched for in the XML element value. Enclose the string in quotation marks. |
| <b><i>xpath-expression</i></b> | XPath expression selecting the elements to evaluate.                                 |

## Usage Examples

Given the following partial XML output from the `show version operational` mode command:

```
<multi-routing-engine-results>
  <multi-routing-engine-item>
    <re-name>re0</re-name>
    <software-information>
      <host-name>R1</host-name>
      <product-model>mx960</product-model>
      <product-name>mx960</product-name>
      <package-information>
        <name>junos</name>
        <comment>JUNOS Base OS boot [10.4R7.5]</comment>
      </package-information>
      <package-information>
        <name>jbase</name>
        <comment>JUNOS Base OS Software Suite [10.4R7.5]</comment>
      </package-information>
    ...
```

The following test case selects the first `package-information` node set, and checks the child `comment` element for a Junos OS release number of 10.4. If the 10.4 release string is not found, the code generates the error message. The error string includes the comment value containing the release number found on that Routing Engine.

```
version-check {
  command show version invoke-on all-routing-engines;
  iterate //software-information {
    contains package-information[1]/comment, "10.4R" {
      info Checking Junos version for 10.4 release;
      err "Found %s on RE %s", package-information[1]/comment, ../re-name;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.



## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*is-in operator*

*not-in operator*

## delta operator

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### Syntax

```
id id;  
delta xpath-expression, delta-value {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that compares the change in value of a specified data element, which must be present in both snapshots, to a specified delta. You can specify the delta as an absolute, positive, or negative percentage, or as an absolute, positive, or negative fixed value.

## Parameters

<i>delta-value</i>	<p>Delta value expressed as a percentage or fixed value and against which the change in the element value is compared.</p> <p>Expressed as a percentage:</p> <ul style="list-style-type: none"> <li>• Absolute percentage—Indicates that either an increase or decrease in the value greater than the absolute percentage is an error, for example, 10%.</li> <li>• Positive percentage—Indicates that only an increase in the value greater than the absolute percentage is an error, for example, +10%.</li> <li>• Negative percentage—Indicates that only a decrease in the value greater than the absolute percentage is an error, for example, -10%.</li> </ul> <p>Expressed as a fixed value:</p> <ul style="list-style-type: none"> <li>• Absolute fixed value—Indicates that either an increase or decrease in the value greater than the absolute value is an error, for example, 500.</li> <li>• Positive fixed value—Indicates that only an increase in the value greater than the absolute value is an error, for example, +500.</li> <li>• Negative fixed value—Indicates that only a decrease in the value greater than the absolute value is an error, for example, -500.</li> </ul>
<i>err string</i>	Statement generated when the test case returns false.
<i>id id</i>	XPath expression relative to the data content that specifies a unique data element that maps the first snapshot data item to the second snapshot data item. To create a unique ID based on multiple element values, define multiple <i>id</i> statements.
<i>info string</i>	Description of the test case.
<i>xpath-expression</i>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following test cases check the BGP route prefix count after a maintenance window. To ensure that the BGP peers were restored, the code checks the prefix counts for a delta change of -10%. That is, if the new prefix count is less than 90% of the original prefix count, the test reports an error.

```

bgp-checks {
  command show bgp summary;
  iterate bgp-rib {
    id name;
    delta total-prefix-count, -10% {
      info BGP total prefix count should not change by more than -10%;
      err "  BGP rib: %s total prefix count has exceeded threshold", name;
      err "    pre-check: %s, post-check: %s", $PRE/total-prefix-count, $POST/total-prefix-
count;
    }
    delta active-prefix-count, -10% {
      info BGP active prefix count should not change by more than -10%;
      err "  BGP rib: %s total prefix count has exceeded threshold", name;
      err "    pre-check: %s, post-check: %s", $PRE/active-prefix-count, $POST/active-prefix-
count;
    }
  }
}

```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*list-not-less operator*

*list-not more operator*

*no-diff operator*

## exists operator

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### Syntax

```
exists xpath-expression {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that verifies the existence of an XML element in the snapshot.

### Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to test.

## Usage Examples

The following test case checks for active chassis alarms. If the `no-active-alarm` element exists, there are no active chassis alarms. Otherwise, the code reports an error indicating that there are active alarms.

```
alarm-checks {
  command show chassis alarms;
  item alarm-summary {
    exists no-active-alarm {
      info No chassis alarms;
      err "There are %s chassis alarms", active-alarm-count;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

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*Understanding Junos Snapshot Administrator Test Operators*

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*Junos Snapshot Administrator Test Operators Summary*

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*not-exists operator*

## ignore-null Flag

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## Syntax

```
test-name:
- command: command
- ignore-null: True
- (item | iterate):
  xpath: xpath-expression
  tests:
    - operator: <xpath-expression>, <args>
      info: "string"
      err: "string"
      ignore-null: True
```

## Description

The JSNAPy ignore-null: True flag instructs the tool to skip tests where nodes for any of the specified XPath expressions for the test are absent in the snapshot output. If you instead omit ignore-null and a node is absent, the test fails with an error message that the node is not found.

You can use the ignore-null flag with both check and snapcheck operations. In the test file, you can apply the ignore-null flag at two levels. You can include the global ignore-null flag to apply the flag to all test cases within a given tests: section. You can also include the ignore-null flag for individual test cases.

## Parameters

**ignore-null** Set to True to skip tests where the nodes for any of the specified XPath expressions in the test are absent in the snapshot output.

## Usage Examples

The following JSNAPy test parses show chassis fpc command output. The tests check that the cpu-total value is less than 8 and the beta-cpu-total value is greater than 2. In this example, the beta-cpu-total

element does not exist in the output. By setting `ignore-null` to `True`, JSNAPy skips the test case when the node is absent instead of reporting an error.

```
check_chassis_fpc:
  - command: show chassis fpc
  - ignore-null: True
  - iterate:
    xpath: //fpc[normalize-space(slot) = "0"]
    tests:
      - is-lt: cpu-total, 8
        info: "Test Succeeded!! cpu total is less than 8 and its value is {{post['cpu-
total']}}"
        err: "Test Failed!!! cpu total is greater than or equal to 8 and its value is
{{post['cpu-total']}}"
      - is-gt: beta-cpu-total, 2
        info: "Test Succeeded!! cpu total is greater than 2 and its value is {{post['beta-cpu-
total']}}"
        err: "Test Failed!!! cpu total is less than or equal to 2 and its value is
{{post['beta-cpu-total']}}"
```

The following example is identical to the previous example except that it applies the `ignore-null` flag to only the `is-gt` test instead of both tests.

```
check_chassis_fpc:
  - command: show chassis fpc
  - iterate:
    xpath: //fpc[normalize-space(slot) = "0"]
    tests:
      - is-lt: cpu-total, 8
        info: "Test Succeeded!! cpu total is less than 8 and its value is {{post['cpu-
total']}}"
        err: "Test Failed!!! cpu total is greater than or equal to 8 and its value is
{{post['cpu-total']}}"
      - is-gt: beta-cpu-total, 2
        info: "Test Succeeded!! cpu total is greater than 2 and its value is {{post['cpu-
total']}}"
        err: "Test Failed!!! cpu total is less than or equal to 2 and its value is {{post['cpu-
total']}}"
      ignore-null: True
```

## Sample Output

### Output with ignore-null: True

When you include `ignore-null: True`, JSNAPy skips the test when the node is not found. In the following output, JSNAPy skips the `is-gt` test because the `beta-cpu-total` node is absent.

```
user@host:~/jsnapy/testfiles$ jsnapy --snapcheck ignore-null-flag -f jsnapy-ignore-null-conf.yaml
```

```
Connecting to device 198.51.100.1 .....
Taking snapshot of COMMAND: show chassis fpc
***** Device: 198.51.100.1 *****
Tests Included: check_chassis_fpc
***** Command: show chassis fpc *****
PASS | All "cpu-total" is less than 8 [ 1 value matched ]
----- Final Result!! -----
check_chassis_fpc : Passed
Total No of tests passed: 1
Total No of tests failed: 0
Overall Tests passed!!!
```

If you include the `-v` command option to set the verbosity to include debug messages, the output includes the `SKIPPING!!` Node message for the `is-gt` test.

```
user@host:~/jsnapy/testfiles$ jsnapy --snapcheck ignore-null-flag -f jsnapy-ignore-null-conf.yaml -v
```

```
jsnapy.cfg file location used : /etc/jsnapy
Configuration file location used : /etc/jsnapy
Connecting to device 198.51.100.1 .....
Tests Included: check_chassis_fpc
Taking snapshot of COMMAND: show chassis fpc
***** Device: 198.51.100.1 *****
Tests Included: check_chassis_fpc
***** Command: show chassis fpc *****
-----Performing is-lt Test Operation-----
Test Succeeded!! cpu total is less than 8 and its value is 3
PASS | All "cpu-total" is less than 8 [ 1 value matched ]
```



```

-----Performing is-gt Test Operation-----
SKIPPING!! Node <beta-cpu-total> not found at xpath <fpc[normalize-space(slot) = "0"]> for
IDs: {}
----- Final Result!! -----
check_chassis_fpc : Passed
Total No of tests passed: 1
Total No of tests failed: 0
Overall Tests passed!!!

```

## Output with ignore-null Flag Omitted

If you omit the `ignore-null: True` flag and a node is absent, then the test case fails and generates an error for the absent node.

```

user@host:~/jsnapy/testfiles$ jsnapy --snapcheck ignore-null-flag -f jsnapy-ignore-null-conf.yaml

```

```

Connecting to device 198.51.100.1 .....
Taking snapshot of COMMAND: show chassis fpc
***** Device: 198.51.100.1 *****
Tests Included: check_chassis_fpc
***** Command: show chassis fpc *****
PASS | All "cpu-total" is less than 8 [ 1 value matched ]
ERROR!! Node <beta-cpu-total> not found at xpath <fpc[normalize-space(slot) = "0"]> for IDs: {}
FAIL | All "beta-cpu-total" is not greater than "2" [ 0 value matched / 1 value failed ]
----- Final Result!! -----
check_chassis_fpc : Failed
Total No of tests passed: 1
Total No of tests failed: 1
Overall Tests failed!!!

```

## Release Information

Flag introduced in Junos Snapshot Administrator in Python Release 1.1.0.

## RELATED DOCUMENTATION

| *Junos Snapshot Administrator Test Operators Summary*

## in-range operator

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### Syntax

```
in-range xpath-expression, integer-start, integer-end {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that tests if an XML element value is within a given numeric range.

### Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>integer-start</i></b>	Numeric value defining the start of the range.
<b><i>integer-end</i></b>	Numeric value defining the end of the range.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following test case checks the OSPF database and tests if each router has between 5 and 10 links. If the link-count value falls outside the specified range, the code reports an error.

```
ospf-db-checks {
  command show ospf database detail;
  iterate //ospf-router-lsa {
    in-range link-count, 5, 10 {
      info OSPF router links [5 - 10];
      err "Router %s has %s links", ../advertising-router, link-count;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*is-gt operator*

*is-lt operator*

*not-range operator*

## is-equal operator

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## Syntax

```
is-equal xpath-expression, value {  
    info string;  
    err "string";  
    [err "string";]  
}
```

## Description

Junos Snapshot Administrator test operator that tests if the XML element string or integer value matches a given value.

## Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>value</i></b>	String or integer value against which the element value is compared. Enclose string values in quotation marks.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following test case prints an error if the Routing Engine in slot 0 (re0) is not the primary Routing Engine.

```
re0-master {  
    command show chassis routing-engine;  
    item route-engine[slot = '0'] {  
        is-equal mastership-state, "master" {
```

```

        info re0 is always master;
        err "  re0 is not master, rather %s", mastership-state;
        err "    Correct so that re0 is the master Routing Engine!";
    }
}
}

```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*all-same operator*

*not-equal operator*

## is-gt operator

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## Syntax

```

is-gt xpath-expression, integer-value {
    info string;
    err "string";
}

```

```
[err "string";]
}
```

## Description

Junos Snapshot Administrator test operator that tests if an XML element value is greater than a given numeric value.

## Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>integer-value</i></b>	Numeric value against which to compare the XML element value.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following test case checks that each OSPF interface has at least 1 neighbor by verifying that the neighbor-count is greater than 0. If the neighbor count is 0, the code reports an error.

```
ospf-int-checks {
  command show ospf interface;
  iterate ospf-interface {
    is-gt neighbor-count, 0 {
      info OSPF interfaces must have at least 1 neighbor;
      err "OSPF interface %s does not have any neighbors", interface-name;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*in-range operator*

*is-lt operator*

*not-range operator*

## is-in operator

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### Syntax

```
is-in xpath-expression, string-list {  
    info string;  
    err "string";  
    [err "string";  
}
```

### Description

Junos Snapshot Administrator test operator that determines if an XML element string value is included in the specified list of string values.

## Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>string-list</i></b>	Comma-separated list of strings against which to compare the XML element value for inclusion. Enclose each string in quotation marks.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

Given the following XML output from the `show rsvp session operational mode` command:

```
<rsvp-session-data>
  <session-type>Ingress</session-type>
  <count>3</count>
  <rsvp-session junos:style="brief">
    <destination-address>10.255.20.137</destination-address>
    <source-address>10.255.20.167</source-address>
    <lsp-state>Dn</lsp-state>
    <route-count>0</route-count>
    <rsb-count>0</rsb-count>
    <resv-style>-</resv-style>
    <label-in>-</label-in>
    <label-out>-</label-out>
    <name>test</name>
  </rsvp-session>
  ...
```

The following test case checks if the RSVP session `lsp-state` has a value of either `Up` or `NotInService`. If the `lsp-state` value is not in the specified string list, the code reports an error.

```
rsvp-checks {
  command show rsvp session;
  iterate rsvp-session-data/rsvp-session {
    is-in lsp-state, "Up", "NotInService" {
      info RSVP LSP state is [Up | NotInService];
      err " RSVP session to %s has LSP state %s.", destination-address, lsp-state;
    }
  }
}
```



```
}
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*contains operator*

*not-in operator*

## is-lt operator

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## Syntax

```
is-lt xpath-expression, integer-value {
    info string;
    err "string";
    [err "string"];
}
```

## Description

Junos Snapshot Administrator test operator that tests if an XML element value is less than a given numeric value.

## Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>integer-value</i></b>	Numeric value against which to compare the XML element value.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following test case checks whether a BGP peer flaps by testing if the flap-count is less than 5. If the flap-count is greater than 5, the code reports an error.

```
bgp-peer-checks {
  command show bgp neighbor;
  iterate bgp-peer {
    is-lt flap-count, 5 {
      info BGP peer flap-count < 5;
      err "BGP peer %s has %s flaps", peer-address, flap-count;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

---

*Understanding Junos Snapshot Administrator Test Operators*

---

*Junos Snapshot Administrator Test Operators Summary*

---

*in-range operator*

---

---

*is-gt operator**not-range operator*

## list-not-less operator

### IN THIS SECTION

- [Syntax | 69](#)
- [Description | 69](#)
- [Parameters | 69](#)
- [Usage Examples | 70](#)
- [Release Information | 70](#)

### Syntax

```
id id;  
list-not-less {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that determines if the specified XML elements are present in the first snapshot but are not present in the second snapshot. The `list-not-less` test-operator validates the existence in the second snapshot of the elements defined by the `id` statement.

### Parameters

**err *string*** Statement generated when the test case returns false.

**id** *id* XPath expression relative to the data content that specifies a unique data element that maps the first snapshot data item to the second snapshot data item. To create a unique ID based on multiple element values, define multiple **id** statements.

**info** *string* Description of the test case.

## Usage Examples

The following test case checks if the OSPF neighbors that existed before the device maintenance are present after the device maintenance. If any OSPF neighbors present in the first snapshot are missing from the second snapshot, the code reports an error.

```
ospf-check {
  command show ospf neighbor;
  iterate ospf-neighbor {
    id interface-name;
    list-not-less {
      info OSPF interface list check;
      err "OSPF interface gone missing: %s going to %s", interface-name, neighbor-
address;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*delta operator*

*list-not more operator*

*no-diff operator*

## list-not-more operator

### IN THIS SECTION

- [Syntax | 71](#)
- [Description | 71](#)
- [Parameters | 71](#)
- [Usage Examples | 72](#)
- [Release Information | 72](#)

### Syntax

```
id id;  
list-not-more {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that determines if the specified XML elements are present in the second snapshot but are not present in the first snapshot. The `list-not-more` test-operator validates the existence in the first snapshot of the elements defined by the `id` statement.

### Parameters

**err *string*** Statement generated when the test case returns false.

**id *id*** XPath expression relative to the data content that specifies a unique data element that maps the first snapshot data item to the second snapshot data item. To create a unique ID based on multiple element values, define multiple `id` statements.

**info *string*** Description of the test case.

## Usage Examples

The following example check chassis alarms. This configuration uses both `list-not-less` and `list-not-more` to check for any changes in the alarms. The data elements referenced in the `list-not-more` `err` section are elements from the second snapshot that were not present in the first snapshot.

```
alarm-checks {
  command show chassis alarms;
  item alarm-summary {
    not-exists active-alarm-count {
      info No chassis alarms;
      err "There are %s chassis alarms", active-alarm-count;
    }
  }
  iterate alarm-detail {
    id alarm-description;
    list-not-less {
      info Alarm Gone Missing;
      err "-Alarm: %s", alarm-description;
    }
    list-not-more {
      info Alarm Got More;
      err "+Alarm: %s", alarm-description;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

---

*Understanding Junos Snapshot Administrator Test Operators*

---

*Junos Snapshot Administrator Test Operators Summary*

---

*delta operator*

---

*list-not-less operator*

---

*no-diff operator*

## no-diff operator

### IN THIS SECTION

- [Syntax | 73](#)
- [Description | 73](#)
- [Parameters | 73](#)
- [Usage Examples | 74](#)
- [Release Information | 74](#)

### Syntax

```
id id;  
no-diff xpath-expression {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that compares specified data elements that are present in both the first and second snapshot collections and verifies that the value is the same.

### Parameters

- |                                |   |
|--------------------------------|---|
| <b><i>err string</i></b>       | Statement generated when the test case returns false.   |
| <b><i>id id</i></b>            | XPath expression relative to the data content that specifies a unique data element that maps the first snapshot data item to the second snapshot data item. To create a unique ID based on multiple element values, define multiple <i>id</i> statements. |
| <b><i>info string</i></b>      | Description of the test case.   |
| <b><i>xpath-expression</i></b> | XPath expression selecting the elements to evaluate.  |

## Usage Examples

The following test case reports an error if the OSPF neighbor address has changed. The \$PRE and \$POST variables in the second err statement reference the first and second data collections, respectively.

```
ospf-check {
  command show ospf neighbor;
  iterate ospf-neighbor {
    id interface-name;
    no-diff neighbor-address {
      info OSPF neighbor change check;
      err "OSPF interface %s neighbor changed!", interface-name;
      err "  was going to %s, now going to %s", $PRE/neighbor-address, $POST/neighbor-
address;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

---

*Understanding Junos Snapshot Administrator Test Operators*

---

*Junos Snapshot Administrator Test Operators Summary*

---

*delta operator*

---

*list-not-less operator*

---

*list-not more operator*



## not-equal operator

### IN THIS SECTION

- [Syntax | 75](#)
- [Description | 75](#)
- [Parameters | 75](#)
- [Usage Examples | 76](#)
- [Release Information | 76](#)

### Syntax

```
not-equal xpath-expression, value {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that tests if the XML element string or integer value does not match a given value.

### Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>value</i></b>	String or integer value against which the element value is compared. Enclose string values in quotation marks.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following test case prints an error if the Routing Engine in slot 0 (re0) is the primary Routing Engine.

```
re0-master {
  command show chassis routing-engine;
  item route-engine[slot = '0'] {
    not-equal mastership-state, "master" {
      info re0 must not be master;
      err "    Correct so that re0 is not the master Routing Engine!";
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

*Understanding Junos Snapshot Administrator Test Operators*

*Junos Snapshot Administrator Test Operators Summary*

*all-same operator*

*is-equal operator*

## not-exists operator

### IN THIS SECTION

- [Syntax | 77](#)
- [Description | 77](#)
- [Parameters | 77](#)
- [Usage Examples | 77](#)
- [Release Information | 78](#)

## Syntax

```
not-exists xpath-expression {
    info string;
    err "string";
    [err "string";]
}
```

## Description

Junos Snapshot Administrator test operator that verifies the lack of existence of an XML element in the snapshot.

## Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>xpath-expression</i></b>	XPath expression specifying the elements to test.

## Usage Examples

The following test case checks for active chassis alarms. If the active-alarm-count element does not exist, there are no active chassis alarms. Otherwise, the code reports an error indicating that there are active alarms.

```
alarm-checks {
    command show chassis alarms;
    item alarm-summary {
        not-exists active-alarm-count {
            info No chassis alarms;
            err "There are %s chassis alarms", active-alarm-count;
        }
    }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

### RELATED DOCUMENTATION

---

*Understanding Junos Snapshot Administrator Test Operators*

---

*Junos Snapshot Administrator Test Operators Summary*

---

*exists operator*

## not-in operator

### IN THIS SECTION

- [Syntax | 78](#)
- [Description | 78](#)
- [Parameters | 79](#)
- [Usage Examples | 79](#)
- [Release Information | 79](#)

## Syntax

```
not-in xpath-expression, string-list {  
    info string;  
    err "string";  
    [err "string";]  
}
```

## Description

Junos Snapshot Administrator test operator that determines if an XML element string value is excluded from the specified list of string values.

## Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>string-list</i></b>	Comma-separated list of strings against which to compare the XML element value for exclusion. Enclose each string in quotation marks.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following test case checks that the RSVP session `lsp-state` element does not have a value of `Dn` or `Failed`. If the `lsp-state` value is in the specified string list, the code reports an error.

```

rsvp-checks {
  command show rsvp session;
  iterate rsvp-session-data/rsvp-session {
    not-in lsp-state, "Dn", "Failed" {
      info RSVP LSP state is not [Dn | Failed];
      err " RSVP session to %s has LSP state %s.", destination-address, lsp-state;
    }
  }
}

```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

---

*Understanding Junos Snapshot Administrator Test Operators*

---

*Junos Snapshot Administrator Test Operators Summary*

---

*contains operator*

---

*is-in operator*

## not-range operator

### IN THIS SECTION

- [Syntax | 80](#)
- [Description | 80](#)
- [Parameters | 80](#)
- [Usage Examples | 81](#)
- [Release Information | 81](#)

### Syntax

```
not-range xpath-expression, integer-start, integer-end {  
    info string;  
    err "string";  
    [err "string";]  
}
```

### Description

Junos Snapshot Administrator test operator that tests if an XML element value is outside of a given numeric range.

### Parameters

<b><i>err string</i></b>	Statement generated when the test case returns false.
<b><i>info string</i></b>	Description of the test case.
<b><i>integer-start</i></b>	Numeric value defining the start of the range.
<b><i>integer-end</i></b>	Numeric value defining the end of the range.
<b><i>xpath-expression</i></b>	XPath expression selecting the elements to evaluate.

## Usage Examples

The following example checks the OSPF database and tests if each router has either less than 5 links or greater than 10 links. If the link-count value falls inside the specified range, the code reports an error.

```
ospf-db-checks {
  command show ospf database detail;
  iterate //ospf-router-lsa {
    not-range link-count, 5, 10 {
      info OSPF router links < 5 or > 10;
      err "Router %s has %s links", ../advertising-router, link-count;
    }
  }
}
```

## Release Information

Operator introduced in Junos Snapshot Administrator Release 1.0.

## RELATED DOCUMENTATION

---

*Understanding Junos Snapshot Administrator Test Operators*

---

*Junos Snapshot Administrator Test Operators Summary*

---

*in-range operator*

---

*is-gt operator*

---

*is-lt operator*

# 4

PART

## Administration

---

- [Using Junos Snapshot Administrator in Python | 83](#)
-



# Using Junos Snapshot Administrator in Python

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## Using Junos Snapshot Administrator in Python

### IN THIS SECTION

- [Taking a Snapshot | 84](#)
- [Comparing Two Snapshots | 85](#)
- [Taking and Evaluating a Snapshot | 86](#)

You can use Junos Snapshot Administrator in Python (jsnapy) on a device running Junos OS to capture and save a runtime environment snapshot, compare two snapshots, or capture a snapshot and immediately evaluate it.

When you take a snapshot, you provide a snapshot name. Jsnapy uses the snapshot name, target device name from the configuration.yml or device.yml file, and test file test section strings to generate snapshot filenames that uniquely identify that snapshot. For example, say you are collecting data from device junos-device.example.com, you define the snapshot name SNAP1, and your test file has two test sections named ospf-checks and bgp-checks. When you take a snapshot, Junos Snapshot Administrator creates the following output files:

- junos-device.example.com\_SNAP1\_ospf\_checks.xml
- junos-device.example.com\_SNAP1\_bgp\_checks.xml

The snapshot files are stored on the jsnapy server in the location specified by the snapshot\_path parameter in the YAML file /etc/jsnapy/jsnapy.cfg. By default, the location is /etc/jsnapy/snapshots.

The following sections outline the Junos Snapshot Administrator commands:

- ["Taking a Snapshot" on page 84](#)
- ["Comparing Two Snapshots" on page 85](#)
- ["Taking and Evaluating a Snapshot" on page 86](#)

## Taking a Snapshot

To take a snapshot of a device, enter the following on the jsnapy server's command line:

```
user@jsnapy-server$ jsnapy --snap snapshot-name -f configuration-filename
```

The command parameters are:

- *snapshot-name*—String used in the output filenames to uniquely identify that snapshot.
- *configuration-filename*—Snapshot configuration filename.

For example, prior to a maintenance upgrade, user bsmith takes a snapshot of the device. The snapshot name is `preupgrade` and the configuration filename is **`config-snapshot.conf`**. Since bsmith did not specify his password in the configuration file `config-snapshot.yml`, upon connecting, the device prompts for the user's password.

```
bsmith@server$ jsnap --snap preupgrade -f config-snapshot.yml
```

```
Connecting to device junos-device.example.com .....
```

```
Enter Password for username <bsmith> :
```

```
Connecting to device junos-device.example.com .....
```

```
Tests Included: test_version_check
```

```
Taking snapshot of COMMAND: show version
```

```
Tests Included: check_chassis_fpc
```

```
Taking snapshot of COMMAND: show chassis fpc
```

## Comparing Two Snapshots

To compare two existing snapshots using the test criteria, enter the following on the jsnapy server's command line:

```
user@jsnapy-server$ jsnapy --check snapshot1 snapshot2 -f configuration-filename
```

The command parameters are:

- *snapshot1*—String used in the output filename to uniquely identify the first snapshot. Often this is entered as PRE, preupgrade, pre-change, or some name to denote that this snapshot came first.
- *snapshot2*—String used in the output filename to uniquely identify the second snapshot. Often this is entered as POST, postupgrade, post-change, or some name to denote that this snapshot came second.
- *configuration-filename*—Snapshot configuration file name.

For example, prior to and immediately following a maintenance upgrade, user bsmith takes a snapshot of the device. The snapshot names are preupgrade and postupgrade. To compare these two snapshots using the criteria defined in the configuration file **config-snapshot.yml**, bsmith issues the following command:

```
bsmith@server$ jsnap --check preupgrade postupgrade -f config-snapshot.yml
```

The Junos Snapshot Administrator output displays the target router and the test results for each of the active test sections in the configuration file. Sample output is shown here:

```
***** Device: junos-device.example.com *****
Tests Included: test_version_check
***** Command: show version *****
PASS | All "junos-version" was changed between the pre and post snapshot. It is now 15.1R3.3 [ 1
matched ]
----- Final Result!! -----
Total No of tests passed: 1
Total No of tests failed: 0
Overall Tests passed!!!
```

## Taking and Evaluating a Snapshot

To take a snapshot and immediately evaluate it based on a pre-defined set of criteria, enter the following on the jsnapy server's command line:

```
user@jsnapy-server$ jsnap --snapcheck snapshot-name -f configuration-filename
```

The command parameters are:

- *snapshot-name*—String used in the output filenames to uniquely identify that snapshot.
- *configuration-filename*—Snapshot configuration filename.

For example, a user wants to confirm the number of software packages installed on the router junos-device.example.com. To do this, he runs the following command on the jsnapy server's command line:

```
user@jsnapy-server$ jsnapy --snapcheck postupgrade -f config-software-check.yml
```

The Junos Snapshot Administrator output displays the target router and the test results for each of the active test sections in the configuration file. Sample output is shown here:

```
Connecting to device junos-device.example.com .....

Taking snapshot of COMMAND: show version
***** Device: junos-device.example.com *****
Tests Included: test_version_check
***** Command: show version *****
PASS | All "//package-information/name" exists at xpath "//software-information" [ 59 matched ]
----- Final Result!! -----

Total No of tests passed: 1
Total No of tests failed: 0
Overall Tests passed!!!
```

## RELATED DOCUMENTATION

[Junos Snapshot Administrator in Python Overview | 2](#)

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

[Understanding Junos Snapshot Administrator in Python Test Operators | 19](#)

## Example: Use Jsnapy as a Python module

### IN THIS SECTION

- [Requirements | 87](#)
- [Overview | 88](#)
- [Examining the Python Script | 88](#)
- [Verification | 93](#)

This example shows how to use the features of Junos Snapshot Administrator in Python (jsnapy) in a python script or program. When username and password entries are required in this script, replace <username> and <password> with appropriate values.

A default installation of jsnapy includes many sample configuration and test files in the `/etc/jsnapy/samples/` directory, including several Python script examples named `module_check.py`, `module_data.py`, `module_device.py`, and `module_snapcheck.py`. These files each demonstrate different features of jsnapy running as a module within a python script.

This example will use a slightly modified version of the Python script file, `module_data.py`, to demonstrate running jsnapy with the `snapcheck` option. The script demonstrates how to pass YAML configuration data from within the Python script.

### Requirements

This example uses the following hardware and software components:

- A device running Junos OS
- An instance of jsnapy installed on a server (jsnapy server)
- A text editor with which to view and change the script

Before you write your own Python scripts for jsnapy, be sure you have a thorough understanding of both Python programming concepts and jsnapy operation.

## Overview

### IN THIS SECTION

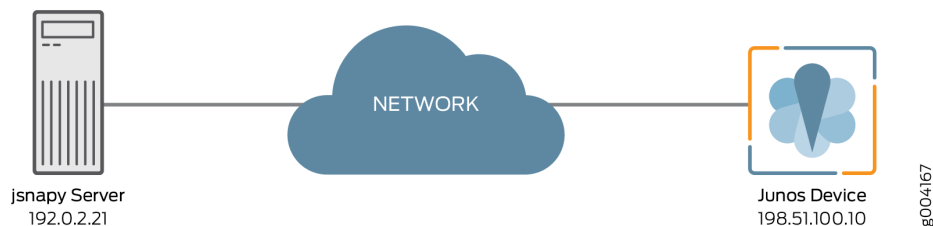
- [Topology | 88](#)

In this example, we examine the provided Python script `/etc/jsnapy/samples/module_data.py`. We will see how the script imports jsnapy as a module, how it defines jsnapy configuration parameters, and how it displays the results of the snapcheck operation on a remote Junos OS device.

### Topology

This example uses a simple topology where the jsnapy server connects to a single remote Junos OS device. Connections to more than one device can be achieved but will not be discussed in this example.

**Figure 2: jsnapy Topology**



## Examining the Python Script

### IN THIS SECTION

- [Note the Comments | 89](#)
- [Import Python Modules | 90](#)
- [Define a Variable for the Call to SnapAdmin | 90](#)
- [Define jsnapy Configuration Parameters | 90](#)
- [Call jsnapy With the Defined Configuration Data | 91](#)
- [Print the Results to the Terminal | 92](#)

The python script performs these tasks:

- Imports the required Python modules into the script.
- Defines a variable that is used to call the SnapAdmin() function from the jsnapy module.
- Defines the jsnapy configuration parameters and assigns them to a variable.
- Calls jsnapy with the snapcheck option using the previously defined configuration variable as the configuration argument and the snapshot filename pre.
- Prints the results to the terminal of the jsnapy server.



**NOTE:** In its original form, the Python script, `module_data.py`, imports and calls the Data pretty printer module, `pprint`. When called from the script, this module causes python to print all of the snapshot data that jsnapy receives from the Junos OS device to the terminal of the jsnapy server. Due to the length of this data, the call to `pprint` is commented out for this example by prepending the call with the pound sign (`#`).

### Note the Comments

### Step-by-Step Procedure

- Because we are examining an existing script in this example, we will point out the comments that appear as the first line of the file. Comments can be placed anywhere within the script by beginning the comment with the pound sign (`#`).

```
### Example showing how to pass yaml data in same file ###  
  
from jnpr.junos import Device
```

## Import Python Modules

### Step-by-Step Procedure

- This script uses three imported modules, one for jsnapy, one for printing complex data to the terminal, and one for working with Junos OS devices.

```
from jnpr.jsnapy import SnapAdmin
from pprint import pprint
from jnpr.junos import Device
```

## Define a Variable for the Call to SnapAdmin

### Step-by-Step Procedure

- Here the script assigns the SnapAdmin() function from the jsnapy module to a variable named js for ease of use and to be able to pass arguments when calling jsnapy.

```
js = SnapAdmin()
```

## Define jsnapy Configuration Parameters

### Step-by-Step Procedure

- Here the script defines the Junos OS host and which tests will be performed on that host. It assigns these parameters to the variable config\_data. The triple quotes allow config\_data to contain new-line characters.



**NOTE:** Another way to specify the hosts and tests to be performed is to reference a jsnapy configuration file. The configuration file can define one or more hosts and one or more test files. Because the configuration data is contained within the Python script in this example, the config\_data variable does not reference a configuration file outside of



the script but is filled with the key-value pairs that appear between the triple-quotes (""").

```
config_data = """
hosts:
  - device: 198.51.100.10
    username : <username>
    passwd: <password>
tests:
  - test_exists.yml
  - test_contains.yml
  - test_is_equal.yml
"""
```

## Call jsnappy With the Defined Configuration Data

### Step-by-Step Procedure

- Here the script calls jsnappy with the snapcheck option and passes the configuration information and the name of the snapshot file. The information returned as a result of this call is stored as values in the snapchk variable.



**NOTE:** You can access all of the available jsnappy options, check, snap, and snapcheck by appending the option after the call to SnapAdmin(). For example, `js.check(config_file, "snapshot1", "snapshot2")`, `js.snap(config_file, "snapshot_name")`, and `js.snapcheck(config_file, "snapshot_name")`.

```
snapchk = js.snapcheck(config_data, "pre")
```

## Print the Results to the Terminal

### Step-by-Step Procedure

- Here the script loops through the returned values and prints them to the jsnapy server terminal in a readable format. This is also where we alter the script to prevent it from printing the entire snapshot to the terminal.

```
for val in snapchk:
    print "Tested on", val.device
    print "Final result: ", val.result
    print "Total passed: ", val.no_passed
    print "Total failed:", val.no_failed
    #pprint(dict(val.test_details))
```

## Results

For ease of viewing, the contents of the modified script are shown below by running the cat command on the file `module_data.py`.

```
user@jsnapy-server$ cat module_data.py
```

```
### Example showing how to pass yaml data in same file ###
from jnpr.jsnapy import SnapAdmin
from pprint import pprint
from jnpr.junos import Device

js = SnapAdmin()

config_data = """
hosts:
  - device: 198.51.100.10
    username : <username>
    passwd: <password>
tests:
  - test_exists.yml
  - test_contains.yml
  - test_is_equal.yml
"""
```

```

snapchk = js.snapcheck(config_data, "pre")
for val in snapchk:
    print "Tested on", val.device
    print "Final result: ", val.result
    print "Total passed: ", val.no_passed
    print "Total failed:", val.no_failed
    #pprint(dict(val.test_details))

```

## Verification

### IN THIS SECTION

- [Verifying the Operation of the Script | 93](#)

## Verifying the Operation of the Script

### Purpose

Once your Python script and the needed jsnapy configuration and test files are complete, you can verify the operation of the script by running it from the jsnapy server terminal.

### Action

```

user@jsnapy-server$ python module_data.py
Connecting to device 198.51.100.10 .....
Taking snapshot of COMMAND: show version
Taking snapshot of COMMAND: show version invoke-on all-routing-engines
Taking snapshot of COMMAND: show interfaces terse lo*
***** Device: 198.51.100.10 *****
Tests Included: test_version_check
***** Command: show version *****
PASS | All "//package-information/name" exists at xpath "//software-information" [ 59 matched ]
***** Device: 198.51.100.10 *****
Tests Included: test_version_check
***** Command: show version invoke-on all-routing-engines *****
Test Failed!!! Junos version does not contains package name as jbase
Test Failed!!! Junos version does not contains package name as jbase

```

```

FAIL | All "//package-information/name[1]" do not contains j" [ 57 matched / 2 failed ]
***** Device: 198.51.100.10 *****
Tests Included: test_interfaces_terse
***** Command: show interfaces terse lo* *****
PASS | All "admin-status" is equal to "up" [ 1 matched ]
----- Final Result!! -----
Total No of tests passed: 2
Total No of tests failed: 1
Overall Tests failed!!!
Tested on 198.51.100.10
Final result: Failed
Total passed: 2
Total failed: 1

```

## RELATED DOCUMENTATION

[Understanding Junos Snapshot Administrator in Python Configuration Files | 7](#)

[Understanding Junos Snapshot Administrator in Python Test Files | 11](#)

[Example: Creating the Junos Snapshot Administrator in Python Configuration Files | 32](#)