

Salt for Junos OS Quick Start Guide

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Salt for Junos OS Quick Start Guide

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About This Guide

Use this guide to set up Salt to manage devices running Junos OS.

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Disclaimer

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CHAPTER

Learn About Salt for Junos OS

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Salt for Junos OS Overview

Salt, or the SaltStack Platform, is a Python-based, open-source remote execution and configuration management tool. You can use Salt to define and enforce the state of a system or execute ad hoc commands on a device. Salt is highly scalable and can manage thousands of devices, including devices running Junos OS.

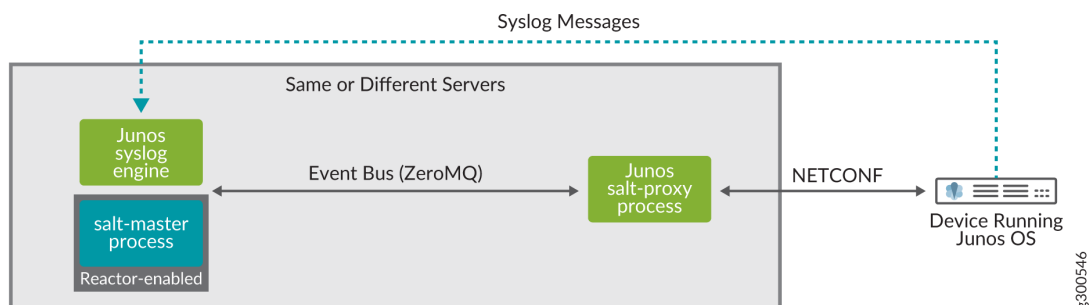
The *Salt master* is the main control server that manages one or more nodes, or *Salt minions*. The Salt master can manage devices running Junos OS through a Salt proxy minion. A proxy minion enables you to manage a device that does not directly run a Salt minion but can be managed through another protocol, for example, the Network Configuration Protocol (NETCONF).

The Salt installation includes the following components and modules, which enable you to use Salt to manage devices running Junos OS:

- **Junos proxy**—Translates Salt operations into Junos OS-specific instructions and enables the Salt system to connect to and manage devices running Junos OS.
- **Junos execution module**—Defines execution functions that enable you to perform ad hoc tasks on devices running Junos OS from the Salt master command line.
- **Junos state module**—Defines state functions that enable you to declare and enforce the desired state of a device running Junos OS.
- **Junos syslog engine**—Monitors system log messages sent from devices running Junos OS, extracts the event information, and publishes it in Salt format on the Salt event bus.

The Junos proxy connects to the Salt master using the ZeroMQ event bus and uses the Juniper **Junos PyEZ** library to establish a NETCONF session over SSH with the device running Junos OS. Junos PyEZ is a microframework for Python that enables you to manage and automate devices running Junos OS. [Figure 1 on page 4](#) illustrates a typical Salt setup with devices running Junos OS.

Figure 1: Junos Syslog Engine



RELATED DOCUMENTATION

Understanding Salt for Junos OS

Understanding the Salt for Junos OS Components

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How to Install Salt for Junos OS

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You can use Salt version 3001 (Sodium) or later to manage devices running Junos OS. The Salt master can manage devices running Junos OS through a Salt proxy minion, which can run on either the Salt master or a separate server. You must have one proxy minion per managed device, and each proxy minion requires approximately 40 MB to 100 MB of RAM.

The general installation process is:

1. On each device running Junos OS:
 - Enable NETCONF over SSH.
 - Configure the user account and authentication method that Salt will use to connect to the device.
2. On the Salt master:
 - Install Salt and its dependencies.
 - Define the proxy configuration for each managed device.
 - Start the salt-master process.
3. On each Junos proxy minion server:
 - Install Junos PyEZ and the `jxmlease` and `yamlordereddictloader` Python modules.
 - Install Salt and its dependencies, if the server is separate from the Salt master.
 - Start the Junos proxy minion process for each managed device.
4. On the Salt master, accept the keys for each Junos proxy minion.

5. (Optional) Enable the Junos syslog engine (for Salt).

The following sections provide details for each part of the installation process for a server running Ubuntu 18.04. If you are running a different operating system, use the commands appropriate for your OS. We recommend using Python 3.

Configure the Device Running Junos OS

The Junos proxy minion accesses the NETCONF server on devices running Junos OS using the SSH protocol and standard SSH authentication mechanisms. To establish an SSHv2 connection with a device running Junos OS, you must ensure that the following requirements are met:

- The NETCONF service over SSH is enabled on each device where a NETCONF session will be established.
- The client application has a user account and can log in to each device where a NETCONF session will be established.
- The login account used by the client application has an SSH public/private key pair or a text-based password configured.
- The client application can access the public/private keys or text-based password.

If you are using SSH keys to authenticate with the device running Junos OS and the keys do not already exist, generate the public and private SSH key pair for the desired user on the proxy minion server, and provide any required or desired options, for example:

```
saltuser@minion:~$ cd ~/.ssh
saltuser@minion:~/.ssh$ ssh-keygen -t rsa -b 2048
Generating public/private rsa key pair.
Enter file in which to save the key (/home/saltuser/.ssh/id_rsa): id_rsa_salt
Enter passphrase (empty for no passphrase): *****
Enter same passphrase again: *****
```

To configure the device running Junos OS:

1. Configure the NETCONF-over-SSH service.

```
[edit]
user@router1# set system services netconf ssh
```

2. Configure the user account and authentication method that Salt will use to connect to the device.
For example:

```
[edit]
user@router1# set system login user saltuser class super-user uid 5555 authentication plain-
text-password
New password:
Retype new password:
user@router1# set system login user saltuser authentication ssh-rsa "public-key"
```

3. Commit the configuration.

```
[edit]
user@router1# commit
commit complete
```

4. Verify that the password or SSH key works by logging in to the device from the proxy minion server using the configured username and authentication method.

```
saltuser@minion:~$ ssh router1.example.com
Password: *****
saltuser@router1>
```

```
saltuser@minion:~$ ssh -i ~/.ssh/id_rsa_salt router1.example.com
Enter passphrase for key '/home/saltuser/.ssh/id_rsa_salt': *****
saltuser@router1>
```

5. Repeat this process for each managed device running Junos OS.

For information about enabling NETCONF on a device running Junos OS and satisfying the requirements for establishing an SSH session, see the [NETCONF XML Management Protocol Developer Guide](#).

SEE ALSO

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Set Up the Salt Master

The Salt master is the main control server that manages one or more nodes, or minions. SaltStack recommends installing a Salt master on a dedicated management server or virtual machine (VM). You must install Salt Release 3001 (Sodium) or later to manage devices running Junos OS.

To install and configure a Salt master:

1. Install the Salt dependencies and Salt master on the Salt master server.

To install a Salt master, either manually install the packages and dependencies for your platform or run the Salt bootstrap script.

- For a list of dependencies and platform-specific installation instructions, see <https://docs.saltproject.io/salt/install-guide/en/latest/>.
- To use the Salt bootstrap script, which performs a series of checks and installs Salt binaries, see https://docs.saltproject.io/en/latest/topics/tutorials/salt_bootstrap.html.

For example, to use the bootstrap script to install the Python 3 packages for a Salt master, issue the following commands:

```
saltuser@salt-master~$ curl -o bootstrap_salt.sh -L https://bootstrap.saltstack.com
saltuser@salt-master~$ sudo sh bootstrap_salt.sh -M -x python3
```

2. Customize the Salt master configuration file, which is typically located at `/etc/salt/master`, for your environments.

```
#/etc/salt/master
file_roots:
  base:
    - /srv/salt

pillar_roots:
  base:
    - /srv/pillar
```



NOTE: For detailed information about customizing the Salt master configuration file, see <https://docs.saltproject.io/en/latest/ref/configuration/master.html>.

3. Create the necessary directory structure as defined in the Salt master configuration file.

```
saltuser@salt-master:~$ sudo mkdir /srv/salt
saltuser@salt-master:~$ sudo mkdir /srv/pillar
```

4. Define the proxy configuration by creating a pillar file for each managed device that specifies proxytype: junos, the hostname or IP address of the corresponding managed device running Junos OS, and the appropriate connection and authentication parameters for that device.

See [salt.proxy.junos](#) for more information about the proxy configuration.

```
saltuser@salt-master:~$ cat /srv/pillar/router1-proxy.sls
proxy:
  proxytype: junos
  host: router1.example.com
  username: saltuser
  password: lab123 # SSH password or SSH key file password
  ssh_private_key_file: /home/saltuser/.ssh/id_rsa_salt # non-default SSH key location
  port: 830 # NETCONF port
```

```
saltuser@salt-master:~$ cat /srv/pillar/router2-proxy.sls
proxy:
  proxytype: junos
  host: router2.example.com
  username: saltuser
  password: lab123 # SSH password or SSH key file password
  ssh_private_key_file: /home/saltuser/.ssh/id_rsa_salt # non-default SSH key location
  port: 830 # NETCONF port
```



NOTE: For information about securely storing sensitive data in Salt, see https://docs.saltproject.io/en/latest/topics/best_practices.html#storing-secure-data.

5. Create the pillar top file, and for each managed device, define a proxy minion name and map it to the pillar file containing the proxy configuration for that device.

In the following example, the Junos proxy minion identified as 'router1' is mapped to the **router1-proxy.sls** file.

```
saltuser@salt-master:~$ cat /srv/pillar/top.sls
base:
```

```
'router1':    # proxy minion name
  - router1-proxy  # pillar file
'router2':
  - router2-proxy
```

6. Start the salt-master process, if it is not already running.

```
saltuser@salt-master:~$ sudo salt-master -d
```



NOTE: To start the process in debug mode for troubleshooting purposes, use `sudo salt-master -l debug`.

Set Up the Junos Proxy Minion Server

You must install the following software on a proxy minion server that will manage devices running Junos OS:

- Salt software
- Juniper Network's [Junos PyEZ](#) library
- `jxmlease` and `yamlordereddictloader` Python modules

The [Junos proxy](#) minion uses the Junos PyEZ library to connect to the device's NETCONF server and perform management tasks.



NOTE: If you run the Salt master and Junos proxy minions on the same server, the minion hostname in this section will be identical to the Salt master hostname in the previous section.

To set up a Junos proxy minion on either the Salt master server or a separate server:

1. Install the Python package manager for the same Python version that Salt uses.

```
saltuser@minion:~$ sudo apt install python3-pip
```

2. Install Junos PyEZ (`junos-eznc`) under the same Python version that Salt uses.

For platform-specific requirements, prerequisite software, and installation instructions, see:

- [Install Junos PyEZ](#)
- [Junos PyEZ GitHub repository](#)

```
saltuser@minion:~$ sudo pip3 install junos-eznc
```

3. Install the `jxmlease` and `yamlordereddictloader` Python modules under the same Python version that Salt uses.

```
saltuser@minion:~$ sudo pip3 install jxmlease yamlordereddictloader
```

4. If the proxy minion server is separate from the Salt master server, install Salt and its dependencies on the server.

To install Salt, either manually install the packages and dependencies for your platform or run the Salt bootstrap script.

- For a list of dependencies and platform-specific installation instructions, see <https://docs.saltproject.io/salt/install-guide/en/latest/>.
- To use the Salt bootstrap script, which performs a series of checks and installs Salt binaries, see https://docs.saltproject.io/en/latest/topics/tutorials/salt_bootstrap.html.

For example, to use the bootstrap script to install the Python 3 packages for Salt, issue the following commands:

```
saltuser@minion:~$ curl -o bootstrap_salt.sh -L https://bootstrap.saltstack.com
saltuser@minion:~$ sudo sh bootstrap_salt.sh -x python3
```

5. Configure the `master` parameter in the `/etc/salt/proxy` file with the Salt master's hostname or IP address, which enables the proxy minion process to find the Salt master.

If the salt-master and proxy minion processes run on the same server, you can specify `localhost` instead.

```
# Set the location of the salt master server. If the master server cannot be
# resolved, then the minion will fail to start.
#master: salt
master: 198.51.100.1
```

6. Start the Junos proxy minion process for each device running Junos OS, and include the `-d` option to run it as a daemon.

The proxy IDs should be the same as those defined in the pillar top file on the Salt master.

```
saltuser@minion:~$ sudo salt-proxy --proxyid=router1 -d
saltuser@minion:~$ sudo salt-proxy --proxyid=router2 -d
```



NOTE: If you encounter an `AttributeError: 'module' object has no attribute 'SSL_ST_INIT'` error when starting the proxy process, you might need to update the OpenSSL package on your platform.



NOTE: To start the process in debug mode for troubleshooting purposes, use `sudo salt-proxy --proxyid=router1 -l debug`.

The proxy minion connects to the Salt master and sends its public key. The Salt master must accept the key before the Salt master and proxy minion can communicate.

Authorize the Proxy Minion Keys on the Salt Master

Salt uses public keys for authentication with the Salt master process. By default, the Salt master does not authorize any minion or proxy minion keys. You must accept the keys before you can manage the corresponding devices.

You can accept the keys manually, as described in this section. Alternatively, if you know that the incoming keys do not pose a security threat, for example, if the salt-master and salt-proxy processes run on the same server, you can include the `auto_accept: True` option in the Salt master configuration file to accept all incoming keys automatically. For security purposes, this option is disabled by default.

To list and accept the pending keys:

1. View the proxy minions' public key status.

```
saltuser@salt-master:~$ sudo salt-key --list-all
Accepted Keys:
Denied Keys:
Unaccepted Keys:
router1
router2
Rejected Keys:
```

2. Accept the key for each Junos proxy minion.

```
saltuser@salt-master:~$ sudo salt-key -a router1
The following keys are going to be accepted:
Unaccepted Keys:
router1
Proceed? [n/Y] y
Key for minion router1 accepted.
```

```
saltuser@salt-master:~$ sudo salt-key -a router2
The following keys are going to be accepted:
Unaccepted Keys:
router2
Proceed? [n/Y] y
Key for minion router2 accepted.
```



TIP: Use the `-A` option to accept all pending keys, for example, `sudo salt-key -A`.

Verify the Connection to the Managed Device

After accepting the keys on the Salt master, call the `test.ping` execution function to ping the proxy minion over the message bus and verify that the minion is up and communicating. You can specify a target minion or use `'*'` to ping all minions.

The following example pings the device running Junos OS that is associated with the Junos proxy minion `router1`.

```
saltuser@salt-master:~$ sudo salt 'router1' test.ping
router1:
True
```

The following example pings all minions that the Salt master manages:

```
saltuser@salt-master:~$ sudo salt '*' test.ping
router1:
True
```

```
router2:
    True
```

The following example uses the `junos.cli` function to issue the `show version` command on the specified device running Junos OS:

```
saltuser@salt-master:~$ sudo salt 'router1' junos.cli 'show version'
router1:
    -----
    message:

        Hostname: router1
        Model: mx104
        Junos: 18.4R1.8
        JUNOS Base OS boot [18.4R1.8]
        JUNOS Base OS Software Suite [18.4R1.8]
        JUNOS Crypto Software Suite [18.4R1.8]
        JUNOS Packet Forwarding Engine Support (TRIO) [18.4R1.8]
        JUNOS Web Management [18.4R1.8]
        JUNOS Online Documentation [18.4R1.8]
        JUNOS SDN Software Suite [18.4R1.8]
        JUNOS Services Application Level Gateways [18.4R1.8]
        JUNOS Services COS [18.4R1.8]
        JUNOS Services Jflow Container package [18.4R1.8]
        JUNOS Services Stateful Firewall [18.4R1.8]
        JUNOS Services NAT [18.4R1.8]
        JUNOS Services RPM [18.4R1.8]
        JUNOS Services SOFTWIRE [18.4R1.8]
        JUNOS Services Captive Portal and Content Delivery Container package [18.4R1.8]
        JUNOS Macsec Software Suite [18.4R1.8]
        JUNOS Services Crypto [18.4R1.8]
        JUNOS Services IPSec [18.4R1.8]
        JUNOS DP Crypto Software Software Suite [18.4R1.8]
        JUNOS py-base-powerpc [18.4R1.8]
        JUNOS py-extensions-powerpc [18.4R1.8]
        JUNOS jsd [powerpc-18.4R1.8-jet-1]
        JUNOS Kernel Software Suite [18.4R1.8]
        JUNOS Routing Software Suite [18.4R1.8]
    out:
        True
```



NOTE: If you encounter the error 'junos' __virtual__ returned False: The junos or dependent module could not be loaded: junos-eznc or jxmlease or yamlordereddictloader or proxy could not be loaded, the Junos proxy minion server might not have Junos PyEZ or the jxmlease or yamlordereddictloader modules installed, or the Junos proxy minion process might not be running or it can't authenticate with the device.

(Optional) Configure the Junos Syslog Engine

The Junos syslog engine (for Salt) can be used for event-based state management of devices running Junos OS. When you enable the Junos syslog engine, it listens for syslog events, extracts the event information, translates it to Salt format, and publishes it on the Salt event bus. To enable the Junos syslog engine, you must configure the Junos syslog engine on the Salt master, and you must also configure the device running Junos OS to send syslog events to the configured port on the Salt server.



NOTE: The Junos syslog engine can also run on the proxy minion server.

To enable the Junos syslog engine on the Salt master:

1. Install the Python package manager for the same Python version that Salt uses.

```
saltuser@salt-master:~$ sudo apt install python3-pip
```

2. Install the pyparsing and twisted Python modules for the same Python version that Salt uses.

```
saltuser@salt-master:~$ sudo pip3 install pyparsing
saltuser@salt-master:~$ sudo pip3 install twisted
```

3. Configure the Junos syslog engine under the `engines` section in the Salt master configuration file, and configure the port on which the engine listens for events.

```
#/etc/salt/master
engines:
  - junos_syslog:
      port: 9999
```

4. (Optional) Configure the `topic` parameter to specify the fields that appear after `jnpr/syslog/` in the event's topic title when it is published to the event bus.

```
#/etc/salt/master
engines:
  - junos_syslog:
      port: 9999
      topic: jnpr/syslog/hostname/daemon/event
```

5. (Optional) Configure the `daemon` parameter to instruct the engine to only subscribe to and publish the events that are generated by specific Junos OS processes.

```
#/etc/salt/master
engines:
  - junos_syslog:
      port: 9999
      topic: jnpr/syslog/hostname/daemon/event
      daemon:
        - mgd
        - sshd
```

6. Restart the Salt master process to apply the new configuration.

```
saltuser@salt-master:~$ sudo killall salt-master
saltuser@salt-master:~$ sudo salt-master -d
```

To configure the device running Junos OS to send syslog events to the host on which the Junos syslog engine is running:

1. Configure the hostname or IP address of the server on which the Junos syslog engine is running, and configure the port on which it is listening.

```
[edit]
saltuser@router1# set system syslog host salt-master.example.com port 9999
```

2. Configure the types of events to send.

- To send all events, configure any any to indicate all facilities and all message severity levels.

```
[edit]
saltuser@router1# set system syslog host salt-master.example.com any any
```

- To send only specific events, configure the facility and message severity level of the events to capture, for example:

```
[edit]
saltuser@router1# set system syslog host salt-master.example.com kernel info
saltuser@router1# set system syslog host salt-master.example.com security any
```

3. Commit the configuration.

```
[edit]
saltuser@router1# commit
```

SEE ALSO

| *Junos Syslog Engine for Salt*

RELATED DOCUMENTATION

| [How to Authenticate Salt for Junos OS Users | 19](#)

| *Understanding the Salt for Junos OS Components*

How to Authenticate Salt for Junos OS Users

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Salt for Junos OS User Authentication Overview

When you use Salt to manage devices running Junos OS, the Junos proxy minion connects to the Salt master using the ZeroMQ event bus and uses the Juniper [Junos PyEZ](#) library to establish a NETCONF session over SSH with the device running Junos OS. The managed device must be able to authenticate the Salt user by using either a password or other standard SSH authentication mechanisms, depending on the connection method. When you use Salt to manage devices running Junos OS, the most convenient and secure way to access a device is to configure SSH keys, which enable the remote device to identify trusted users. Alternatively, you can provide username and password authentication credentials in the proxy configuration file for a given device.

To use Salt to connect to and manage a device running Junos OS, you define the necessary connection and authentication information for the device under the `proxy` key in a pillar file on the Salt master. When you specify `proxytype: junos`, you can define many of the same connection and authentication parameters in the pillar data that you can specify in the Junos PyEZ [Device\(\)](#) constructor.

The following sample pillar file shows the general connection and authentication parameters that you can define under the `proxy` key when you specify `proxytype: junos`. [Table 1 on page 21](#) outlines the parameters.

```
# /srv/pillar/router1-proxy.sls
proxy:
  proxytype: junos
  host: router1.example.com
  username: saltuser
  password: lab123 # SSH password or SSH key file password
  ssh_config: /home/saltuser/.ssh/my_config # non-default SSH configuration file
  ssh_private_key_file: /home/saltuser/.ssh/id_rsa_salt # non-default SSH key location
  port: 830
```


Table 1: Junos Proxy Parameters

Parameter	Description
host: <i>hostname</i>	Hostname or IP address of the device running Junos OS.
password: <i>secret</i>	Passphrase for the user or the user's SSH private key file used to authenticate with the device running Junos OS.
port: <i>port</i>	Port on which to establish the connection to the device running Junos OS.
proxytype: junos	Specify that Salt should use the Junos proxy module to interface with the device running Junos OS.
ssh_config: <i>file-path</i>	Path to the Salt user's SSH configuration file on the proxy minion server. You can omit this parameter if the SSH configuration file is in the default path.
ssh_private_key_file: <i>file-path</i>	Path to the Salt user's SSH private key file on the proxy minion server that the Junos proxy uses to authenticate with the device running Junos OS. You can omit this parameter if the user's SSH key file is in the default path or if the path is already defined in the SSH configuration file.
username: <i>user</i>	Username used to authenticate with the device running Junos OS and under whose Junos OS account privileges the Salt operations are performed.

Salt can perform device operations using any user account that has access to the managed device running Junos OS. You can explicitly specify the user by including the `username` parameter in the proxy configuration for a given device running Junos OS. You can also specify the user within an SSH configuration file. If you do not specify a user, it defaults to the current user.

The Salt connection through Junos PyEZ automatically queries the user's default SSH configuration file at `~/.ssh/config` on the proxy minion server, if one exists, unless the proxy configuration for that device includes the `ssh_config` argument to specify a different configuration file. Salt uses any relevant settings in the SSH configuration file for the given connection that are not overridden by the parameters defined in the proxy configuration for that device, such as the user or the identity file.

The Junos proxy first attempts SSH public key-based authentication and then tries password-based authentication. The Junos proxy checks for SSH keys that are actively loaded in the SSH key agent and then checks for SSH keys in the default location. When SSH keys are in use, the supplied password is used as the passphrase for unlocking the private key. When password-based authentication is used, the

supplied password is used as the device password. If SSH public key-based authentication is being used and the SSH private key has an empty passphrase, then a password is not required. However, we don't recommend using an SSH private key with an empty passphrase.

On the Salt master, the pillar top file maps the proxy ID to the pillar file containing the device's proxy configuration.

```
saltuser@salt-master:~$ cat /srv/pillar/top.sls
base:
  'router1':
    - router1-proxy
```

When you start the Junos proxy minion process for the device running Junos OS and authorize the keys on the Salt master, it connects using the configured authentication method.

```
saltuser@minion:~$ sudo salt-proxy --proxyid=router1 -d
```

```
saltuser@salt-master:~$ sudo salt-key -a router1
```

For detailed information about configuring the Salt servers, see ["How to Install Salt for Junos OS" on page 7](#).

Authenticating the Salt User By Using a Password

To authenticate a Salt user by using a password:

1. On the device running Junos OS, configure the user account with the password that will be used to connect to the device, and commit the configuration. For example:

```
[edit]
admin@router1# set system login user saltuser class super-user uid 5555 authentication plain-
text-password
New password:
Retype new password:
admin@router1# commit
```

2. On the Salt master, in the pillar file containing the device's proxy configuration, set the username and password parameters to the Junos OS login credentials for that device.

```
saltuser@salt-master:~$ cat /srv/pillar/router1-proxy.sls
proxy:
  proxytype: junos
  host: router1.example.com
  username: saltuser
  password: lab123
  port: 830
```



NOTE: For information about securely storing sensitive data in Salt, see https://docs.saltproject.io/en/latest/topics/best_practices.html#storing-secure-data.

Authenticating the Salt User By Using SSH Keys

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To use SSH keys to authenticate the Salt user, you must first generate the keys on the Salt proxy minion server and configure the public key on each device running Junos OS to which Salt will connect. To use the keys, you must include the appropriate parameters in the device's proxy configuration on the Salt master. Salt connections through Junos PyEZ can use SSH keys that are actively loaded into an SSH key agent, SSH keys that are generated in either the default location or a user-defined location, and keys that either use or forgo password protection. The Junos proxy first checks for SSH keys that are actively loaded in the SSH key agent and then checks for SSH keys in the default location under the user's **.ssh** directory.

The following sections outline the steps for generating the SSH keys, configuring the keys on a device running Junos OS, and using the keys to connect to the managed device.

Generating and Configuring SSH Keys

To generate SSH keys on the Salt proxy minion server and configure the public key on devices running Junos OS:

1. On the Salt proxy minion server, generate the public and private SSH key pair for the desired user, and provide any required or desired options, for example:

```
saltuser@minion:~$ cd ~/.ssh
saltuser@minion:~/.ssh$ ssh-keygen -t rsa -b 2048
Generating public/private rsa key pair.
Enter file in which to save the key (/home/saltuser/.ssh/id_rsa): id_rsa_salt
Enter passphrase (empty for no passphrase): *****
Enter same passphrase again: *****
```

2. (Optional) Load the key into the native SSH key agent using the commands specific to your OS and agent. For example:

```
saltuser@minion:~$ ssh-add /home/saltuser/.ssh/id_rsa_salt
Enter passphrase for /home/saltuser/.ssh/id_rsa_salt
Identity added: /home/saltuser/.ssh/id_rsa_salt (/home/saltuser/.ssh/id_rsa_salt)
```

3. Configure the public key under the appropriate user account on each device running Junos OS to which Salt will connect.

The easiest method to configure the public key on a device running Junos OS is to load a file containing the public key.

```
[edit]
admin@router1# set system login user saltuser authentication load-key-file id-rsa-salt.pub
admin@router1# commit
```

4. Verify that the key works by logging in to the device using the key.

```
saltuser@minion:~$ ssh -i ~/.ssh/id_rsa_salt router1.example.com
Enter passphrase for key '/home/saltuser/.ssh/id_rsa_salt':
saltuser@router1>
```

Referencing SSH Keys in the Salt Proxy Configuration File

After generating the SSH key pair and configuring the public key on the managed device running Junos OS, the Junos proxy can use the key to connect to the device. To use the key, you must include the

appropriate parameters in the device's proxy configuration on the Salt master. In addition to the required `proxytype` and `host` parameters, the parameters required to use the SSH key are determined by the location of the key, whether the key is password-protected, whether the key is actively loaded into an SSH key agent, and whether the user's SSH configuration file already defines settings for that host.

The Junos proxy queries the default SSH configuration file at `~/.ssh/config` on the proxy minion server, if one exists, unless the proxy configuration for that device includes the `ssh_config` argument to specify a different configuration file. Salt uses any relevant settings in the SSH configuration file for the given connection that are not overridden by the parameters defined in the proxy configuration for that device. When connecting to a device, the Junos proxy first checks for SSH keys that are actively loaded in the SSH key agent and then checks for SSH keys in the default location under the user's `.ssh` directory.

To use an SSH key that is actively loaded into the native SSH key agent:

- In the pillar file containing the device's proxy configuration, you must define the `username` parameter.

```
saltuser@salt-master:~$ cat /srv/pillar/router1-proxy.sls
proxy:
  proxytype: junos
  host: router1.example.com
  username: saltuser
  port: 830
```

To use an SSH key that is in the default location and does not have password protection:

- In the pillar file containing the device's proxy configuration, you only need to supply the `username` parameter when it does not default to the user whose keys are used to authenticate with the device.

```
saltuser@salt-master:~$ cat /srv/pillar/router1-proxy.sls
proxy:
  proxytype: junos
  host: router1.example.com
  username: saltuser
  port: 830
```

To use an SSH key that is not in the default location or that uses password protection:

- In the pillar file containing the device's proxy configuration, set the `ssh_private_key_file` parameter to the path of the SSH private key on the proxy minion server, and set the `password` parameter to the SSH key file password, if the key is password protected.

```
saltuser@salt-master:~$ cat /srv/pillar/router1-proxy.sls
proxy:
  proxytype: junos
  host: router1.example.com
  username: saltuser
  password: ssh123  # SSH key file password
  ssh_private_key_file: /home/saltuser/.ssh/id_rsa_salt  # SSH key in non-default location
  port: 830
```



NOTE: If the user's SSH configuration file already specifies the SSH private key file path for a given host, you can omit the `ssh_private_key_file` parameter in the proxy configuration. Including the `ssh_private_key_file` parameter overrides any existing `IdentityFile` value defined for a host in the SSH configuration file.