Juniper Networks | Engineering Simplicity

Junos® OS

Chef for Junos OS Getting Started Guide

Published
2022-05-03

RELEASE
11.10

Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

Juniper Networks, the Juniper Networks logo, Juniper, and Junos are registered trademarks of Juniper Networks, Inc. in the United States and other countries. All other trademarks, service marks, registered marks, or registered service marks are the property of their respective owners.

Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

Junos® OS Chef for Junos OS Getting Started Guide
11.10
Copyright © 2022 Juniper Networks, Inc. All rights reserved.

The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at https://support.juniper.net/support/eula/. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

About This Guide | v

1 Overview

Chef for Junos OS Overview | 2

- Chef Overview | 2
- Chef for Junos OS Overview | 3
- Benefits of Chef for Junos OS | 3
- Features of Chef for Junos OS | 4

2 Deploying and Configuring Chef for Junos OS

Deploying Chef for Junos OS | 7

- Chef for Junos OS Deployment Overview | 7
- Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS | 10
  - Devices Supporting Chef for Junos OS | 10
  - Installing the Chef Client Overview | 14
  - Installing or Upgrading the Chef Client on Junos | 14
  - Installing the Chef Client on Junos OS evolved | 16
  - Using the Chef Client Docker Container | 16
  - Uninstalling the Chef Client from the Juniper Networks Device | 19
- Configuring the Chef Client on Juniper Networks Devices Running Junos OS | 19
- Configuring the Chef Client on Juniper Networks Devices Running Junos OS Evolved | 21

Using Chef to Configure Juniper Networks Devices | 23

- Example: Using Chef for Junos OS to Configure Ethernet Switching on EX Series, OCX Series, and QFX Series Switches | 23
  - Requirements | 24
  - Overview | 24
  - Configuration | 26
  - Verification | 34
- Example: Using Chef for Junos OS to Configure Ethernet Switching on MX Series Routers | 36

Requirements | 36

Overview | 37

Configuration | 38

Verification | 47

Example: Using Chef for Junos OS to Configure Any Hierarchy Level | 48

Requirements | 48

Overview | 49

Configuration | 49

Verification | 52

About This Guide

Chef for Junos OS 11.10

Use this guide to automate the provisioning and management of compute, networking, and storage resources with Chef software. These resources could be on site, in the cloud, or both.

1
CHAPTER

Overview

Chef for Junos OS Overview | 2

Chef for Junos OS Overview

IN THIS SECTION

- Chef Overview | 2
- Chef for Junos OS Overview | 3
- Benefits of Chef for Junos OS | 3
- Features of Chef for Junos OS | 4

Chef Overview

IN THIS SECTION

- Understanding Cookbooks, Recipes, Resources, and Providers | 2

Chef software automates the provisioning and management of compute, networking, and storage resources, whether these resources are on site, in the cloud, or both. Chef software transforms infrastructure into code, enabling you to configure, deploy, and scale in real time, while reducing the risk of human error.

Using Chef, you can write abstract definitions of your infrastructure in Ruby and manage these definitions like you manage source code. These abstract definitions are applied to the nodes in your infrastructure by the Chef clients running on those nodes. When you bring a new node online, the Chef client running on that node needs only to determine which definitions to apply.

DISCLAIMER: Use of Chef for Junos OS software implies acceptance of the terms of the following disclaimer: Chef for Junos OS Disclaimer.

Understanding Cookbooks, Recipes, Resources, and Providers

Within the Chef framework, the abstract infrastructure definitions are contained in reusable cookbooks and recipes:

- *Cookbooks* are packages that contain the *recipes*, files, attribute definitions, and so on that describe a portion of your infrastructure and how to deploy, configure, and manage it. For example, the apache2 cookbook maintained by Chef contains recipes for installing and configuring an Apache HTTP Server.
- *Recipes* are written in Ruby and describe the installation, configuration, and management of the infrastructure elements.
- *Resources* are the major building blocks of recipes. A resource is a platform-neutral representation of an element of the system and its desired state—for example, a service that should be started or a file that should be written into the file system.
- *Providers* are the underlying platform-specific implementations that bring resources to their desired states. For example, a resource might specify a particular software package to be installed, without describing how it is installed. The providers associated with the resource direct the Chef client how to perform the installation on specific platforms.

Chef for Junos OS Overview

Chef for Junos OS allows Juniper Networks devices running Junos OS to be managed by the Chef server. You can use Chef for Junos OS to automate common switching network configurations, such as physical and logical Ethernet link properties and VLANs. See the *Chef for Junos OS Release Notes* for information about which Juniper Network devices support Chef clients.

Chef for Junos OS supports providers that are specific to Junos OS for the switching resources. These providers translate the configuration modeled by the resources into the Network Configuration Protocol (NETCONF) XML code required to implement the configuration on the device the Chef client is running on.

The netdev cookbook provides a set of vendor-agnostic resources for managing networking devices. Together, the netdev cookbook resources and Junos OS providers enable you to automate your configuration of Juniper Networks devices running Junos OS without requiring knowledge of specific Junos OS CLI commands or XML code.

The netdev cookbook is available at the Chef supermarket website at https://supermarket.getchef.com/cookbooks/netdev. For more information about the netdev cookbook resources, see *Chef for Junos OS* at https://docs.chef.io/junos.html.

Benefits of Chef for Junos OS

Benefits of Chef for Junos OS are as follows:

- Simplifies management and reduces duplication of effort by enabling you to make orchestrated configuration changes across multiple types of devices.
- Lowers risk and improves compliance through infrastructure automation. For example, by encoding your compliance and security policies as part of a Chef recipe, you can automatically test them before deployment.
- Automates common switching network configurations, such as physical and logical Ethernet link properties and VLANs.

Features of Chef for Junos OS

IN THIS SECTION

- netdev Cookbook Resources | 4
- Native Chef Client | 5
- Native Ohai | 5
- Ruby Interpreter and junos-ez-stdlib | 5

Chef for Junos OS provides the following features:

netdev Cookbook Resources

The netdev cookbook, developed and maintained by Chef, contains platform-neutral primitives for the following network resources:

- Physical interfaces—Physical Ethernet interface attributes, such as administrative state, description, speed, duplex mode, and MTU with the **netdev_interface** resource
- Layer 2 Ethernet switching services—Logical Ethernet switching interface attributes, such as description, VLAN membership, and port mode (access or trunk) with the **netdev_l2_interface** resource
- Link aggregation groups (LAGs)—LAG interface attributes, such as name, member links, Link Aggregation Control Protocol (LACP) mode, and minimum up links required with the **netdev_lag** resource
- VLANs—VLAN attributes, such as name, ID, and description with the **netdev_vlan** resource

- Configuration at any hierarchy level—Custom configuration with the **netdev_group** resource

> **NOTE**: Juniper Networks OCX1100 switches support only the **netdev_interface** physical interface resource.

Native Chef Client

The Chef client (chef-client) is an agent that runs locally on every managed node in a Chef deployment and performs the configuration defined in recipes. Chef for Junos OS provides a Chef client that runs natively on supported Juniper Networks devices running Junos OS.

Native Ohai

Ohai is a tool that collects detailed data about a node, such as hardware properties, memory and processor usage, networking statistics, kernel data, and hostname. It provides this data to the Chef client at the start of every Chef client run. This data is also uploaded to the Chef server at the end of each Chef client run, making it available to searches.

Chef for Junos OS provides a version of Ohai that runs natively on supported Juniper Networks devices running Junos OS. This version includes a plug-in that extends Ohai to collect Junos OS and platform-specific attributes. For a description of Ohai options and an example of using Ohai, see the Chef website at https://docs.chef.io/ctl_ohai.html.

Ruby Interpreter and junos-ez-stdlib

Chef for Junos OS provides a version of the Ruby Interpreter that is compatible with the Chef client. It also provides junos-ez-stdlib, which contains libraries used by the netdev cookbook providers and by Ohai.

RELATED DOCUMENTATION

Chef for Junos OS Deployment Overview | 7

Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS | 10

Configuring the Chef Client on Juniper Networks Devices Running Junos OS | 19

2

CHAPTER

Deploying and Configuring Chef for Junos OS

Deploying Chef for Junos OS | 7

Using Chef to Configure Juniper Networks Devices | 23

Deploying Chef for Junos OS

IN THIS SECTION

- Chef for Junos OS Deployment Overview | 7
- Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS | 10
- Configuring the Chef Client on Juniper Networks Devices Running Junos OS | 19
- Configuring the Chef Client on Juniper Networks Devices Running Junos OS Evolved | 21

Chef for Junos OS Deployment Overview

IN THIS SECTION

- Chef for Junos OS Deployment Overview | 8

A Chef for Junos OS deployment consists of the following major components:

- Chef server—The server acts as a hub for configuration data. The server stores cookbooks and the node object metadata that describes each registered node managed by the Chef client.
- Workstations—You can perform most of your work on a workstation. Use the Chef CLI, called knife, to develop cookbooks and recipes and store them in a local Chef repository. From the workstation, you can synchronize the local repository with your version-control system, upload cookbooks to the Chef server, and perform operations on nodes.
- Nodes—A node is any physical or virtual device that is configured for the Chef client to manage. Ruby Interpreter, Native Ohai and junos-ez-stdlib (Ruby Gems) are also installed on all nodes to aid the Chef client in managing the node.

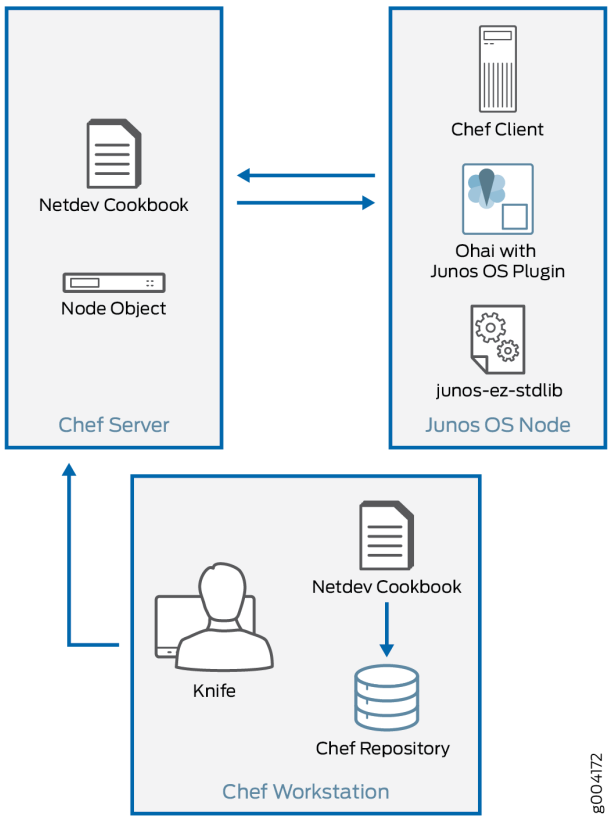
  To manage a node, the Chef client running on the node obtains the configuration details, such as recipes, templates, and file distributions, from the Chef server. It also collects detailed data about a node, such as hardware properties, memory and processor usage, networking statistics, kernel data, and hostname using Ohai. The Chef client performs as much of the configuration as possible on the

node using Ruby Interpreter and junos-ez-stdlib to help interpret Chef recipes into configuration details.

For a Juniper Networks device to be a Chef node, it must have the Chef client installed and configured on it. See the *Chef for Junos OS Release Notes* for information about Juniper Networks devices running Junos OS that support the Chef client.

Figure 1 on page 8 shows the major components of a Chef for Junos OS deployment. For more details about all the components that constitute a Chef deployment, see the Chef documentation at https://docs.chef.io/.

Figure 1: Major Components of a Chef for Junos OS Deployment



Chef for Junos OS Deployment Overview

The following major steps describe how you deploy Chef for Junos OS:

1. Set up the Chef server. For more information on setting up the Chef server, see the Chef documentation at https://docs.chef.io/.

2. Set up the Chef workstation. The major steps for doing so are:

   a. Install the Chef client from https://docs.chef.io/ and Ruby Interpreter on your workstation. You can install both at the same time by using the Chef installer. install the Chef Client for the Workstation installation

   b. Set up the Chef repository (chef-repro) and the version-control system.

   c. Install authentication keys and verify that you can connect to the Chef server from your workstation.

      For more information about setting up the Chef workstation, see the Chef documentation at https://docs.chef.io/.

   d. After you have set up the workstation, download the netdev cookbook to the chef-repro repository and extract the cookbook files.

      ```
      knife cookbook site download netdev

      tar -zxvf netdev-n.n.n.tar.gz -C cookbooks
      ```

      The netdev cookbook is available at the Chef supermarket website at https://supermarket.getchef.com/cookbooks/netdev.

3. If the Chef client is not already installed on the Junos OS nodes, install the client by using the Chef for Junos OS installation package as described in "Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS" on page 10.

   NOTE: On Juniper Networks switches running Junos OS with Junos Automation Enhancements, you do not need to install the Chef client because the Chef client and related components are installed with the Junos OS software.

   For more information on Junos Automation Enhancements, see Junos Automation Enhancements Documentation.

4. Configure the Chef client on the Junos OS nodes so that it can connect with the Chef server. For more information, see "Configuring the Chef Client on Juniper Networks Devices Running Junos OS" on page 19.

SEE ALSO

Chef Overview | 2

Chef for Junos OS Overview | 3

Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS | 10

Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS

IN THIS SECTION

- Devices Supporting Chef for Junos OS | 10
- Installing the Chef Client Overview | 14
- Installing or Upgrading the Chef Client on Junos | 14
- Installing the Chef Client on Junos OS evolved | 16
- Using the Chef Client Docker Container | 16
- Uninstalling the Chef Client from the Juniper Networks Device | 19

This topic describes how to install, upgrade, or uninstall the Chef client on Juniper Networks devices running Junos OS.

NOTE: The Chef client is automatically installed on Juniper Networks switches running Junos OS with Junos Automation Enhancements. If your switch is running Junos OS with Junos Automation Enhancements, skip this installation procedure and configure the Chef client as described in "Configuring the Chef Client on Juniper Networks Devices Running Junos OS" on page 19.

For more information on Junos Automation Enhancements, see Junos Automation Enhancements Documentation.

This topic covers:

Devices Supporting Chef for Junos OS

Table 1 shows devices running the Junos OS release and the installation package that we recommend you use to install the Chef client. You can download the package or bundle at Chef for Junos Software Download. .

Table 1: Supported Devices and Junos OS Versions

Device	Junos OS Version	Chef Client Installation Package Example	Support for agent as Docker container	Compatible Versions of netdev
EX4300	Release 15.1X53-D10 or later	chef-powerpc-11.10.4_1.0.tgz	–	–
MX80 MX104	Release 14.2R2 or later	chef-powerpc-11.10.4_1.1.tgz	–	–
MX240 MX480 MX960	Release 14.2R2 or later 14.2 release	chef-i386-11.10.4_1.1.tgz	–	–
	Release 15.1R1 or later 15.1 release	Chef not supported	–	–
	Release 16.1R1 through 17.4	chef-x86-32-11.10.4_2.0.tgz	–	–
	Release 18.1R1	chef-x86-32-11.10.4_2.1.tgz	–	–
	Release 18.2R1 through 21.1	chef-x86-32-11.10.4_3.0.tgz	–	–
OCX1100	Release 14.1X53-D20 or later	Not Applicable	–	–

Table 1: Supported Devices and Junos OS Versions *(Continued)*

Device	Junos OS Version	Chef Client Installation Package Example	Support for agent as Docker container	Compatible Versions of netdev
PTX10003-80C PTX10003-160C	Release 19.1R1 through 21.4	Not Applicable	–	–
	Release 19.4R2 through 21.4 (Junos OS Evolved only)	Not Applicable	Y	2.1.0 or later
PTX10008	Release 19.4R2 through 21.4 (Junos OS Evolved only)	Not Applicable	Y	2.1.0 or later
QFX5100	Release 13.2X51-D15 or later	Not Applicable	–	–
	Release 15.1X53-D70 or later (Non-TVP based images using JET based packages)	chef-x86-32-11.10.4_2.0.tgz	–	–
	Release 18.1R1	chef-x86-32-11.10.4_2.1.tgz	–	–
	Release 18.2R1 through 21.1	chef-x86-32-11.10.4_3.0.tgz	–	–

Table 1: Supported Devices and Junos OS Versions *(Continued)*

Device	Junos OS Version	Chef Client Installation Package Example	Support for agent as Docker container	Compatible Versions of netdev
QFX10002	Release 15.1X53-D20 or later	Not Applicable	Not Applicable	Not Applicable
	Release 15.1X53-D70 or later (TVP Unix SDK based packages across all the branches)	chef-x86-32-11.10.4_2.0.tgz	–	–
	Release 18.1R1	chef-x86-32-11.10.4_2.1.tgz	–	–
	Release 18.2R1 through 21.1	chef-x86-32-11.10.4_3.0.tgz	–	–
QFX10008	Release 17.1R1 through 21.1	Not Applicable	–	–
QFX10016	Release 17.1R1 through 21.1	Not Applicable	–	–
QFX5220-32CD QFX5220-128C	Release 19.4R2 through 21.4 (Junos OS Evolved only)	Not Applicable	Y	2.1.0 or later

See the *Chef for Junos OS Release Notes* for information about which Juniper Network devices support Chef clients.

Installing the Chef Client Overview

The Chef client is part of an installation package that includes the Chef client, Ohai, the Ruby Interpreter, and junos-ez-stdlib.

On a device with redundant Routing Engines, you must run the Chef client from the primary Routing Engine.

When the Chef client runs, it obtains an exclusive configuration lock, which it releases after it commits all pending configuration changes. If you enable the reporting add-on on your Enterprise Chef server, the Chef client reports the results of the run back to the server. On successful Chef client runs, the Chef client sends a list of updated resources to the server; on failed Chef client runs, it sends a full exception stacktrace to the server.

The configuration of a resource on a managed node always reflects the resource state defined in the last recipe that was run that contains that resource. For example, if you run a recipe that defines a LAG resource as containing the member links ge-0/0/0 and ge-0/0/1 and then later run a recipe that defines the same LAG resource as containing the member links ge-0/0/2 and ge-0/0/03, the resulting configuration for the LAG on the managed node contains only the member links ge-0/0/2 and ge-0/0/3.

Installing or Upgrading the Chef Client on Junos

To install or upgrade the Chef client on a Juniper Networks device:

> **NOTE**: The procedure to upgrade a Chef client is the same as that of installation. During an upgrade, the previous version of the Chef client is overwritten with the latest version.

1. Access the Chef for Junos OS download page at https://www.juniper.net/support/downloads/?p=chefforjunos#sw.

   The *Chef for Junos OS Release Notes* are also available at the download site. Consult them for information about what package to install on your platform.
2. Download the Chef for Junos OS software package that is specific to your platform to the **/var/tmp/** directory on the device.

   > **BEST PRACTICE**: We recommend you install the software package from the **/var/tmp/** directory on your device to ensure the maximum amount of disk space and RAM for the installation.

   The following template describes the package naming format of Chef Bundles for Junos:

chef-*<platform>*-*<chef version>*_*<SDK indicator>*.*<Release count>*.tgz

where:

- *platform* is the platform microprocessor architecture whose values can be i386 , powerpc or x86-32.
- *chef version* is the version of the Chef client (for example, 11.10.4).
- *SDK indicator* indicates the Junos OS SDK infrastructure used to create the package. A 1 indicates the Junos SDK; a 2 indicates the Junos Extension Toolkit (JET).
- *Release count* is the version of Juniper Networks version of the package.

You must use the installation package that matches the microprocessor architecture of your device. If you do not know the architecture used by your device, you can use the UNIX shell command uname -a to determine it.

3. If you are accessing a Juniper device externally through remote access, you must configure the device for external remote access through SSH. For more information on configuring a Juniper device for external remote access, see Configuring SSH Service for Remote Access to the Router or Switch.
4. In the Junos OS CLI, enter configuration mode.

   user@host> **configure**
5. Configure the provider name, license type, and deployment scope associated with the application.

   [edit]
   user@host# **set system extensions providers chef license-type juniper deployment-scope commercial**
   user@host# **commit and-quit**
6. Install the software package by using the request system software add operational mode command.

   user@host> **request system software add /var/tmp/*chef-package*.tgz**
7. Verify that the installation is successful by issuing the show version operational mode command.

   If the installation is successful, the list of installed software includes the Chef, Ruby Interpreter, and junos-ez-stdlib packages. For example:

   - If your installation package was built with the Junos Extension Toolkit, only one package is installed, JET app chef. This package includes all the required components, including the Ruby Interpreter and junos-ez-stdlib. To verify the installation:

     ```
     user@host> show version | match chef
     JET app chef [11.10.4_2.0]
     ```

- If your installation package was built with the Junos SDK, three packages are installed: the Chef, Ruby Interpreter, and junos-ez-stdlib packages. To verify the installation:

```
user@host> show version

fpc0:
-
Hostname: host
Model: ex4300-24p
Junos: 14.1X53-D10.2
JUNOS EX  Software Suite [14.1X53-D10.2]
JUNOS FIPS mode utilities [14.1X53-D10.2]
JUNOS Online Documentation [14.1X53-D10.2]
JUNOS EX 4300 Software Suite [14.1X53-D10.2]
JUNOS Web Management Platform Package [14.1X53-D10.2]
JUNOS py-base-powerpc [14.1X53-D10.2]
Ruby Interpreter [11.10.4_1.junos.powerpc]
Chef [11.10.4_1.junos.powerpc]
junos-ez-stdlib [11.10.4_1.junos.powerpc]
```

After you install the Chef client, you must configure it as described in "Configuring the Chef Client on Juniper Networks Devices Running Junos OS" on page 19.

Installing the Chef Client on Junos OS evolved

Starting in Junos OS evolved Release 19.1R1, the Junos OS evolved image includes the Chef client package; therefore, you do not need to install Chef client package separately on your device.

Using the Chef Client Docker Container

Starting in Junos OS Evolved Release 19.4R2, certain devices running Junos OS Evolved support running the Chef client as a Docker container. As an alternative to using the Chef client that is integrated into the Junos OS Evolved software image, you can use the Chef client Docker container provided by Juniper Networks. Using a container enables you to use standard Docker tools to manage the container and mount or unmount the Chef client as needed

Docker is a software container platform that is used to package and run an application and its dependencies in an isolated container. Juniper Networks provides a Docker image for the Chef client on Docker Hub.

When you run the Chef client using the Docker container, the container:

- Shares the hostname and network namespace of the host

- Uses the host network to communicate with the Chef server
- Authenticates to the host using key-based SSH authentication

To use the Chef client Docker container on supported devices:

1. Log in as the root user.
2. Switch to the default VRF for management traffic, vrf0.

```
[vrf:none] root@host:~# switchvrf $$ vrf0
```

3. Start the Docker service, and bind it to the default VRF for management traffic, vrf0.

```
[vrf:none] root@host:~# systemctl start docker@vrf0
```

4. Set the `DOCKER_HOST` environment variable.

```
[vrf:none] root@host:~# export DOCKER_HOST=unix:///run/docker-vrf0.sock
```

5. Start the Chef client Docker container as follows, and set the `NETCONF_USER` to the Junos OS user account that was set up to run the client.

```
[vrf:none] root@host:~# docker run -d -e PATH="/usr/local/bundle/bin:$PATH" -e
NETCONF_USER=chef --network=host --name=chef-client juniper/chef-client:latest
```

6. Generate the SSH key pair that will be used to authenticate the container to the host.

```
[vrf:none] root@host:~# docker exec -it chef-client ssh-keygen -t rsa -N "" -f /root/.ssh/
id_rsa
Generating public/private rsa key pair.
Created directory '/root/.ssh'.
Your identification has been saved in /root/.ssh/id_rsa.
Your public key has been saved in /root/.ssh/id_rsa.pub.
The key fingerprint is:
aa:69:77:b0:47:b0:c4:8f:90:39:f7:0d:04:61:ca:d1 root@host
The key's randomart image is:
+---[RSA 2048]----+
...
```

7. Copy the public key to the host, and add it to the root user's **authorized_keys** file.

```
[vrf:none] root@host:~# docker cp chef-client:/root/.ssh/id_rsa.pub .
[vrf:none] root@host:~# cat id_rsa.pub >> .ssh/authorized_keys
```

8. Verify the connection from the container to the host.

```
[vrf:none] root@host:~# docker exec -it chef-client ssh chef@localhost
The authenticity of host 'localhost (127.0.0.1)' can't be established.
ECDSA key fingerprint is 3c:3c:ed:5c:ce:ee:34:09:79:22:d3:cd:af:d0:68:4a.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'localhost' (ECDSA) to the list of known hosts.
--- JUNOS 19.4-20191105.0-EVO Linux (none) 4.8.28-WR2.2.1_standard #1 SMP PREEMPT Thu Jun
13 00:19:16 PDT 2019 x86_64 x86_64 x86_64 GNU/Linux
[vrf:none] chef@host:~#
```

9. Create a **client.rb** configuration file and copy the file to container's working directory**/chef-client**.

```
[vrf:none] root@host:~# docker cp /var/tmp/client.rb chef-client:/chef-client
```

```
current_dir = File.dirname(__FILE__)
log_level                :auto
log_location              STDOUT
chef_server_url          "  value"
validation_client_name   "value"
node_name                "value"
validation_key           "#{current_dir}/value"
file_cache_path          "#{current_dir}/cache"
trusted_certs_dir        "/home/root/trusted_certs"
verbose_logging          true
ssl_verify_mode          :verify_none
Ohai::Config[:disabled_plugins] = [ :Network ]
```

where:

- `chef_server_url` is the URL of your Chef server
- `validation_client_name` is `chef-validator` if you are using Open Source Chef and *`orgname`*`-validator` if you are using Enterprise Chef
- `node_name` is optional if the switch has a hostname configured

- validation_key is chef-validator.pem if you are using Open Source Chef and *orgname*-validator.pem if you are using Enterprise Chef

10. Copy the validation key before chef-client run. For more details about validation key, see Step 3 in"Configuring the Chef Client on Juniper Networks Devices Running Junos OS" on page 19 .
11. Start the chef client.

```
[vrf:none] root@host:~# docker exec -it chef-client -c client.rb
```

Uninstalling the Chef Client from the Juniper Networks Device

To uninstall the Chef client from the Juniper Networks device, use the request system software delete CLI command to delete the installed packages. For example:

- To delete a Chef client package built by the Junos Extension Toolkit (JET), enter:

  user@host> **request system software delete chef**

- To delete the Chef client and related packages built by the Junos SDK, enter:

  user@host> **request system software delete chef** user@host> **request system software delete junos-ez-stdlib** user@host> **request system software delete ruby**

RELATED DOCUMENTATION

Using Chef to Configure Juniper Networks Devices | 23

Chef Overview | 2

Configuring the Chef Client on Juniper Networks Devices Running Junos OS

To enable the Chef client to communicate with the Chef server, you must configure the Chef client after it is installed on the Juniper Networks device.

NOTE: You must set up the Chef workstation and the Chef server so that they can communicate before you perform this procedure.

To configure the Chef client:

1. On your Juniper Networks device that is running Junos OS, log in as the root user and create the **/var/db/chef** directory.

   mkdir -p /var/db/chef

2. Copy your validation key into the **/var/db/chef** directory.

   If you do not have your validation key, you can obtain it as follows:

   - If you are using Open Source Chef, you can obtain your validation key from **/etc/chef** on your server. The key is named **chef-validator.pem**.
   - If you are using Enterprise Chef (hosted or on-premise), you can obtain your validation key from the Enterprise Chef management console. The key is named ***orgname*-validator.pem**, where *orgname* is your organization name.

3. Create a **client.rb** file with the following statements in **/var/db/chef** directory:

```
current_dir = File.dirname(__FILE__)
log_level               :auto
log_location            STDOUT
chef_server_url         "value"
validation_client_name  "value"
node_name               "value"
validation_key          "#{current_dir}/value"
client_key              "#{current_dir}/client.pem"
file_cache_path         "#{current_dir}/cache"
verbose_logging         true
```

   where:

   - `chef_server_url` is the URL of your Chef server
   - `validation_client_name` is `chef-validator` if you are using Open Source Chef and *orgname*`-validator` if you are using Enterprise Chef
   - `node_name` is optional if the switch has a hostname configured
   - `validation_key` is `chef-validator.pem` if you are using Open Source Chef and *orgname*`-validator.pem` if you are using Enterprise Chef

   For more information about the settings in the **client.rb** file, see https://docs.chef.io/config_rb_client.html.

4. Run the Chef client on Junos OS.

   - If the Juniper Networks version of the Chef client is 2.x (for example, Chef client version 11.10.4_**2.0**), enter:

%/opt/jet/chef/bin/ruby /opt/jet/chef/bin/chef-client -c /var/db/chef/client.rb

- If the Juniper Networks version of the Chef client is 1.x (for example, Chef client version 11.10.4_**1.1**), enter:

  %/opt/sdk/chef/bin/ruby /opt/sdk/chef/bin/chef-client -c /var/db/chef/client.rb

These commands assume that your **client.rb** file resides in the **/var/db** directory. We recommend using this directory.

SEE ALSO

Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS | **10**

Using Chef to Configure Juniper Networks Devices | **23**

Chef Overview | **2**

Configuring the Chef Client on Juniper Networks Devices Running Junos OS Evolved

To enable the Chef client to communicate with the Chef server, you must configure the Chef client on the Juniper Networks device.

NOTE: You must set up the Chef workstation and the Chef server so that they can communicate before you perform this procedure.

To configure the Chef client:

1. On your Juniper Networks device that is running Junos OS evolved, log in as the root user and create the **/etc/chef** directory.

   mkdir /etc/chef

2. Copy your validation key into the **/etc/chef** directory.

   If you do not have your validation key, you can obtain it as follows:

   - If you are using Open Source Chef, you can obtain your validation key from **/etc/chef** on your server. The key is named **chef-validator.pem**.
   - If you are using Enterprise Chef (hosted or on-premise), you can obtain your validation key from the Enterprise Chef management console. The key is named ***orgname*-validator.pem**, where *orgname* is your organization name.

3. Create a **client.rb** file with the following statements in **/etc/chef** directory:

```
current_dir = File.dirname(__FILE__)
log_level               :auto
log_location            STDOUT
chef_server_url         "value"
validation_client_name  "value"
node_name               "value"
validation_key          "#{current_dir}/value"
client_key              "#{current_dir}/client.pem"
file_cache_path         "#{current_dir}/cache"
verbose_logging         true
ssl_verify_mode                 verify_peer
verify_api_cert               true
```

where:

- `chef_server_url` is the URL of your Chef server
- `validation_client_name` is `chef-validator` if you are using Open Source Chef and *orgname*`-validator` if you are using Enterprise Chef
- `node_name` is optional if the switch has a hostname configured
- `validation_key` is `chef-validator.pem` if you are using Open Source Chef and *orgname*`-validator.pem` if you are using Enterprise Chef

For more information about the settings in the **client.rb** file, see https://docs.chef.io/config_rb_client.html.

4. Fetch certificate from Chef server.

   From the **/etc/chef** directory, type **knife ssl fetch -s *server-name*** statement, to fetch the certificate from the Chef server.

5. Check certificate.

   From the **/etc/chef** directory, type **knife ssl check -s *server-name*** statement, to verify the certificate fetched from the Chef server.

```
Connecting to host <server-name>
Successfully verified certificates from `<server-name>'
```

6. Run the Chef client on Junos OS evolved.

   On devices running Junos OS evolved, to start the Chef client:

- Enter the shell.

```
user@host> start shell
```

- switch to the default VRF for management traffic, vrf0, and then start the client.

```
[vrf:none] user@host:~# switchvrf $$ vrf0

[vrf:vrf0] user@host:~# /usr/bin/chef-client -c /etc/chef/client.rb
```

These commands assume that your **client.rb** file resides in the **/etc/chef** directory. We recommend using this directory.

SEE ALSO

Using Chef to Configure Juniper Networks Devices | 23

Chef Overview | 2

Using Chef to Configure Juniper Networks Devices

IN THIS SECTION

- Example: Using Chef for Junos OS to Configure Ethernet Switching on EX Series, OCX Series, and QFX Series Switches | 23
- Example: Using Chef for Junos OS to Configure Ethernet Switching on MX Series Routers | 36
- Example: Using Chef for Junos OS to Configure Any Hierarchy Level | 48

Example: Using Chef for Junos OS to Configure Ethernet Switching on EX Series, OCX Series, and QFX Series Switches

IN THIS SECTION

- Requirements | 24

Overview | 24
Configuration | 26
Verification | 34

This example shows how you can use resources in the netdev cookbook to write recipes that configure the switching interfaces on EX Series switches, OCX Series switches, and QFX Series switches running the Chef client. For more information about the light-weight resources in the netdev cookbook, see *Chef for Junos OS* at https://docs.chef.io/junos.html.

Requirements

This example uses the following hardware and software components:

- A properly set up and configured Chef workstation and Chef server
- A supported Junos OS release (as specified in the *Chef for Junos OS Release Notes*)
- A Juniper Networks switch that the Chef client manages

> **NOTE**: This example uses netdev resources not supported on an OCX1100 switch. Only the `netdev_interface` resource is supported on an OCX1100 switch.

Before you begin, the number of aggregated Ethernet interfaces supported on the switch must have been already configured before you run the Chef client. To verify that a sufficient number of aggregated Ethernet interfaces has been configured, use the `show chassis aggregated-devices` configuration mode CLI command. Use the `set chassis aggregated-devices ethernet device-count` command to set the number of supported aggregated Ethernet interfaces.

Overview

This example takes you through using Chef for Junos OS to configure the switching interfaces on an access switch.

In this example, you create a cookbook, called netdev_access_switch, that is based on the netdev cookbook. Within the cookbook, you create three recipes:

- `vlan_create` recipe—Defines `netdev_vlan` resources for the VLANs shown in Table 2 on page 25.
- `access_interface_create` recipe—Defines `netdev_interface` and `netdev_l2_interface` resources for the access interfaces shown in Table 3 on page 25.

- `uplink_interface_create` recipe—Defines `netdev_lag` and `netdev_l2_interface` resources for the link aggregation group (LAG) interfaces shown in Table 4 on page 25.

Table 2: VLANs Defined in the vlan_create Recipe

Name	VLAN ID	Description
blue	100	the blue VLAN
green	200	the green VLAN
red	300	the red VLAN

Table 3: Access Interfaces Defined in the access_interface_create Recipe

Name	Port Mode	VLAN Membership	Description
et-0/0/4	Access	blue	Access interface
et-0/0/5	Access	green	Access interface
et-0/0/6	Access	red	Access interface

Table 4: LAGs Defined in the uplink_interface_create Recipe

Name	Member Interfaces	Mininum Links	LACP	Port Mode	VLAN Membership	Description
ae0	et-0/1/0 et-0/1/2	1	Active	Trunk	blue, green, red	Uplink interface
ae1	et-0/2/0 et-0/2/2	1	Active	Trunk	blue, green, red	Uplink interface

In your own implementation of Chef for Junos OS, you can structure recipes in any way that makes sense for deploying and managing your switching resources. The recipes used in this example are simply one way of doing so.

After you create the recipes, you upload the cookbook to the Chef server and add the recipes to the run list for the access switch. Finally, you run the Chef client on the access switch. The client then uses the Junos OS providers in the netdev cookbook to implement the configuration described in the recipes.

Configuration

IN THIS SECTION

- Procedure | 26
- Results | 32

Procedure

Step-by-Step Procedure

To configure the access switch by using Chef for Junos OS:

1. From the **chef-repo** directory on the Chef workstation, download the netdev cookbook and extract the cookbook files to the cookbooks directory:

   ```
   knife cookbook site download netdev
   ```

   ```
   tar -zxvf netdev-n.n.n.tar.gz -C cookbooks
   ```

2. Copy the netdev cookbook to create a new cookbook, netdev_access_switch, in the cookbooks directory.

3. In an editor of your choice, write the `vlan_create` recipe for creating the blue, green, and red VLANs.

   ```
   #
   # Cookbook Name:: netdev_access_switch
   # Recipe:: vlan_create
   #
   # Copyright 2013, YOUR_COMPANY_NAME
   #
   # All rights reserved - Do Not Redistribute
   #

   netdev_vlan "blue" do
           vlan_id 100
           description "the blue VLAN"
   ```

```
        action :create
end

netdev_vlan "green" do
        vlan_id 200
        description "the green VLAN"
        action :create
end

netdev_vlan "red" do
        vlan_id 300
        description "the red VLAN"
        action :create
end
```

4. Save the recipe in **cookbooks/netdev_access_switch/recipes/ vlan_create.rb**.

5. In an editor of your choice, write the access_interface_create recipe, which configures the physical and Layer 2 properties of the access interfaces.

```
#
# Cookbook Name:: netdev_access_switch
# Recipe:: access_interface_create
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
#

# Physical interface creation using the following defaults:
# auto-negotiation on, MTU 1500, administratively up

netdev_interface "et-0/0/4" do
        description "access interface"
        action :create
end

netdev_interface "et-0/0/5" do
        description "access interface"
        action :create
end
```

```
netdev_interface "et-0/0/6" do
        description "access interface"
        action :create
end

# Logical interface creation, setting port mode to access (vlan_tagging false)
# and assigning interface to a VLAN

netdev_l2_interface "et-0/0/4" do
        description "belongs to blue VLAN"
        untagged_vlan "blue"
        vlan_tagging false
        action :create
end

netdev_l2_interface "et-0/0/5" do
        description "belongs to green VLAN"
        untagged_vlan "green"
        vlan_tagging false
        action :create
end

netdev_l2_interface "et-0/0/6" do
        description "belongs to red VLAN"
        untagged_vlan "red"
        vlan_tagging false
        action :create
end
```

6. Save the recipe in **cookbooks/netdev_access_switch/recipes/ access_interface_create.rb**.

7. In an editor of your choice, write the uplink_interface_create recipe, which configures the LAG trunk interfaces.

```
#
# Cookbook Name:: netdev-access-switch
# Recipe:: uplink_interface_create
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
```

```
#

netdev_l2_interface "et-0/1/0" do
  action :delete
end

netdev_l2_interface "et-0/1/2" do
  action :delete
end

netdev_l2_interface "et-0/2/0" do
  action :delete
end

netdev_l2_interface "et-0/2/2" do
  action :delete
end

# Create the LAGs

netdev_lag "ae0" do
        links [ "et-0/1/0", "et-0/2/0" ]
        minimum_links 1
        lacp "active"
        action :create
end

netdev_lag "ae1" do
        links [ "et-0/2/2", "et-0/1/2" ]
        minimum_links 1
        lacp "active"
        action :create
end

# Configure Layer 2 switching on the LAGs. Define the port mode as trunk
# (vlan_tagging true), with membership in the blue, green, and red VLANs.

netdev_l2_interface "ae0" do
        description "Uplink interface"
        tagged_vlans [ "blue", "green", "red" ]
        vlan_tagging true
        action :create
end
```

```
netdev_l2_interface "ae1" do
        description "Uplink interface"
        tagged_vlans ["blue", "green", "red" ]
        vlan_tagging true
        action :create
end
```

8. Save the recipe in **cookbooks/netdev_access_switch /recipes/uplink_interface_create.rb**.

9. Upload the netdev_access_switch cookbook to the Chef server.

```
$ knife cookbook upload netdev_access_switch
```

10. Edit the node object that represents the access switch.

```
$ knife node edit  access_switch_node_name
```

Knife starts your editor and opens a JSON file that contains the node attributes.

11. Enter the recipes in the run-list attribute and then save the JSON file.

```
{
  "name": "access_switch_node_name",
  "chef_environment": "_default",
  "normal": {
  },
   "run_list": [
        "recipe[netdev_access_switch::vlan_create]",
        "recipe[netdev_access_switch::access_interface_create]",
        "recipe[netdev_access_switch::uplink_interface_create]"
  ]
}
```

The order in which you enter the recipes matters—for example, the Chef client runs the vlans_create recipe first because it is listed first.

12. If the number of aggregated Ethernet interfaces supported on the switch is not already configured, log in to the access switch, enter configuration mode, and configure the number of aggregated Ethernet interfaces supported.

```
root@access-switch-node# set chassis aggregated-devices ethernet device-count 2

root@access-switch-node# commit and-quit
```

13. On the access switch, log in as the root user.

14. From the UNIX-level shell, run the Chef client.

    - If the Juniper Networks version of the Chef client is 2.x (for example, Chef client version 11.10.4_**2.0**), enter:

      %/opt/jet/chef/bin/ruby /opt/jet/chef/bin/chef-client -c /var/db/chef/client.rb

    - If the Juniper Networks version of the Chef client is 1.x (for example, Chef client version 11.10.4_**1.1**), enter:

      %/opt/sdk/chef/bin/ruby /opt/sdk/chef/bin/chef-client -c /var/db/chef/client.rb

    The Chef client displays status messages during its run to indicate its progress in performing the configuration. For example:

```
[2014-02-24T15:17:53-08:00] INFO: Forking chef instance to converge...
Starting Chef Client, version 11.10.4
[2014-02-24T15:17:53-08:00] INFO: *** Chef 11.10.4 ***
[2014-02-24T15:17:53-08:00] INFO: Chef-client pid: 41108
[2014-02-24T15:17:54-08:00] INFO: Run List is [recipe[netdev::vlan_create_doc],
recipe[netdev::access_interface_create_doc], recipe[netdev::uplink_interface_create_doc]]
[2014-02-24T15:17:54-08:00] INFO: Run List expands to [netdev::vlan_create_doc,
netdev::access_interface_create_doc, netdev::uplink_interface_create_doc]
[2014-02-24T15:17:54-08:00] INFO: Starting Chef Run for access-switch-node

.
.
.
2014-02-24T15:18:07-08:00] INFO: Chef Run complete in 12.618406061 seconds
Running handlers:
[2014-02-24T15:18:07-08:00] INFO: Running report handlers
[2014-02-24T15:18:09-08:00] INFO: Committed pending Junos candidate configuration changes
[2014-02-24T15:18:09-08:00] INFO: Released exclusive Junos configuration lock
  - JunosCommitTransactionHandler
Running handlers complete
```

Results

To check the results of the configuration:

1. On the access switch, enter the CLI.

```
% cli
```

2. Enter the following CLI operational mode command:

```
root@access-switch-node> show configuration | compare rollback 1
[edit]
+  interfaces {
+      et-0/0/4 {
+          description "access interface";
+          unit 0 {
+              description "belongs to blue VLAN";
+              family ethernet-switching {
+                  interface-mode access;
+                  vlan {
+                      members blue;
+                  }
+              }
+          }
+      }
+      et-0/0/5 {
+          description "access interface";
+          unit 0 {
+              description "belongs to green VLAN";
+              family ethernet-switching {
+                  interface-mode access;
+                  vlan {
+                      members green;
+                  }
+              }
+          }
+      }
+      et-0/0/6 {
+          description "access interface";
+          unit 0 {
+              description "belongs to red VLAN";
+              family ethernet-switching {
+                  interface-mode access;
```

```
+                 vlan {
+                     members red;
+                 }
+             }
+         }
+     }
+     et-0/1/0 {
+         ether-options {
+             802.3ad ae0;
+         }
+     }
+     et-0/1/2 {
+         ether-options {
+             802.3ad ae1;
+         }
+     }
+     et-0/2/0 {
+         ether-options {
+             802.3ad ae0;
+         }
+     }
+     et-0/2/2 {
+         ether-options {
+             802.3ad ae1;
+         }
+     }
+     ae0 {
+         aggregated-ether-options {
+             minimum-links 1;
+             lacp {
+                 active;
+             }
+         }
+         unit 0 {
+             description "Uplink interface";
+             family ethernet-switching {
+                 interface-mode trunk;
+                 vlan {
+                     members [ blue green red ];
+                 }
+             }
+         }
+     }
```

```
+      ae1 {
+          aggregated-ether-options {
+              minimum-links 1;
+              lacp {
+                  active;
+              }
+          }
+          unit 0 {
+              description "Uplink interface";
+              family ethernet-switching {
+                  interface-mode trunk;
+                  vlan {
+                      members [ blue green red ];
+                  }
+              }
+          }
+      }
+  }
+  vlans {
+      blue {
+          description "the blue VLAN";
+          vlan-id 100;
+      }
+      green {
+          description "the green VLAN";
+          vlan-id 200;
+      }
+      red {
+          description "the red VLAN";
+          vlan-id 300;
+      }
+  }
```

Verification

IN THIS SECTION

- Verifying the Status of the VLANs | 35

Verifying the Status of the VLANs

Purpose

Verify the VLANs and VLAN memberships are correct.

Action

Use the `show vlans` command to verify VLAN membership.

```
root@access-switch-node> show vlans

Routing instance        VLAN name             Tag          Interfaces
default-switch          blue                  100
                                                             ae0.0*
                                                             ae1.0*
                                                             et-0/0/4.0*
default-switch          green                 200
                                                             ae0.0*
                                                             ae1.0*
                                                             et-0/0/5.0*
default-switch          red                   300
                                                             ae0.0*
                                                             ae1.0*
                                                             et-0/0/6.0*
```

Meaning

The output shows that the VLANs have been created correctly and contain the correct member interfaces.

SEE ALSO

- Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS | 10
- Configuring the Chef Client on Juniper Networks Devices Running Junos OS | 19
- Example: Using Chef for Junos OS to Configure Ethernet Switching on MX Series Routers | 36
- Example: Using Chef for Junos OS to Configure Any Hierarchy Level | 48
- Chef Overview | 2

Example: Using Chef for Junos OS to Configure Ethernet Switching on MX Series Routers

IN THIS SECTION

- Requirements | 36
- Overview | 37
- Configuration | 38
- Verification | 47

This example shows how you can use resources in the netdev cookbook to write recipes that configure the switching interfaces on MX Series routers running the Chef client. For more information about the light-weight resources in the netdev cookbook, see *Chef for Junos OS* at https://docs.chef.io/junos.html.

Requirements

This example uses the following hardware and software components:

- A properly set up and configured Chef workstation and Chef server
- An MX Series router that the Chef client manages
- Junos OS Release 16.1 or later

Before you begin, the number of aggregated Ethernet interfaces supported on the router must already be configured before you run the Chef client.

- To verify that a sufficient number of aggregated Ethernet interfaces has been configured, use the `show chassis aggregated-devices` configuration mode CLI command. Use the `set chassis aggregated-devices ethernet device-count` command to set the number of supported aggregated Ethernet interfaces.
- If the number of aggregated Ethernet interfaces supported on the router is not already configured, log in to the router, enter configuration mode, and configure the number of aggregated Ethernet interfaces supported:

  ```
  root@router-node# set chassis aggregated-devices ethernet device-count 2

  root@router-node# commit and-quit
  ```

Overview

This example takes you through using Chef for Junos OS to configure the switching interfaces on an MX Series router.

In this example, you create a cookbook, called netdev_router, that is based on the netdev cookbook. Within the cookbook, you create four recipes:

- `vlan_create` recipe—Defines `netdev_vlan` resources for the VLANs shown in Table 5 on page 37.
- `interface_create` recipe—Defines the `netdev_interface` resources for the interfaces shown in Table 6 on page 37.
- `l2interface_create` recipe—Defines the `netdev_l2_interface` resources for the interfaces shown in Table 6 on page 37.
- `lag_interface_create` recipe—Defines `netdev_lag` and `netdev_l2_interface` resources for the link aggregation group (LAG) interfaces shown in Table 7 on page 38.

Table 5: VLANs Defined in the vlan_create Recipe

Name	VLAN ID	Description
blue	100	Chef-created blue VLAN
green	200	Chef-created green VLAN
red	300	Chef-created red VLAN

Table 6: Interfaces Defined in the interface_create and l2interface_create Recipes

Name	Port Mode	VLAN Membership	Description
ge-1/0/1	Access	blue	Chef-created interface
ge-1/0/2	Access	green	Chef-created interface
ge-1/0/3	Access	red	Chef-created interface

Table 7: LAGs Defined in the lag_interface_create Recipe

Name	Member Interfaces	Mininum Links	LACP	Port Mode	VLAN Membership	Description
ae0	ge-1/0/6 ge-1/0/7	1	Active	Trunk	blue, green, red	Chef-created LAG interface
ae1	ge-1/0/8 ge-1/0/9	1	Active	Trunk	blue, green, red	Chef-created LAG interface

In your own implementation of Chef for Junos OS, you can structure recipes in any way that makes sense for deploying and managing your switching resources. The recipes used in this example are simply one way of doing so.

After you create the recipes, you upload the cookbook to the Chef server and add the recipes to the run list for the managed router. Finally, you run the Chef client on the router. The client then uses the Junos OS providers in the netdev cookbook to implement the configuration described in the recipes.

NOTE: The number of aggregated Ethernet interfaces supported on the router must already be configured before you run the Chef client.

Configuration

IN THIS SECTION

- Procedure | 38
- Results | 44

Procedure

Step-by-Step Procedure

To configure the router by using Chef for Junos OS:

1. From the **chef-repo** directory on the Chef workstation, download the netdev cookbook and extract the cookbook files to the **cookbooks** directory.

```
knife cookbook site download netdev

tar -zxvf netdev-n.n.n.tar.gz -C cookbooks
```

2. Copy the netdev cookbook to create a new cookbook, netdev_router, in the cookbooks directory.

3. In an editor of your choice, write the `vlan_create` recipe for creating the blue, green, and red VLANs.

```
#
# Cookbook Name:: netdev_router
# Recipe:: vlan_create
#

netdev_vlan "blue" do
        vlan_id 100
        description "Chef-created blue VLAN"
        action :create
end

netdev_vlan "green" do
        vlan_id 200
        description "Chef-created green VLAN"
        action :create
end

netdev_vlan "red" do
        vlan_id 300
        description "Chef-created red VLAN"
        action :create
end
```

4. Save the recipe in **cookbooks/netdev_router/recipes/vlan_create.rb**.

5. In an editor of your choice, write the `interface_create` recipe, which configures the physical properties of the interfaces.

```
#
# Cookbook Name:: netdev_router
# Recipe:: interface_create
#

# Physical interface creation using the following defaults:
```

```
# auto-negotiation on, MTU 1500, administratively up

netdev_interface "ge-1/0/1" do
        description "Chef-created interface"
        action :create
end

netdev_interface "ge-1/0/2" do
        description "Chef-created interface"
        action :create
end

netdev_interface "ge-1/0/3" do
        description "Chef-created interface"
        action :create
end
```

6. Save the recipe in **cookbooks/netdev_router/recipes/interface_create.rb**.

7. In an editor of your choice, write the `l2interface_create` recipe, which configures the Layer 2 properties of the interfaces.

```
#
# Cookbook Name:: netdev_router
# Recipe:: l2interface_create
#

# Logical interface creation, setting port mode to access (vlan_tagging false)
# and assigning interface to a VLAN

netdev_l2_interface "ge-1/0/1" do
        description "belongs to blue VLAN"
        untagged_vlan "blue"
        vlan_tagging false
        action :create
end

netdev_l2_interface "ge-1/0/2" do
        description "belongs to green VLAN"
        untagged_vlan "green"
        vlan_tagging false
        action :create
```

```
end

netdev_l2_interface "ge-1/0/3" do
        description "belongs to red VLAN"
        untagged_vlan "red"
        vlan_tagging false
        action :create
end
```

8. Save the recipe in **cookbooks/netdev_router/recipes/l2interface_create.rb**.

9. In an editor of your choice, write the `lag_interface_create` recipe, which configures the LAG trunk interfaces.

```
#
# Cookbook Name:: netdev-router
# Recipe:: lag_interface_create
#

netdev_l2_interface "ge-1/0/6" do
  action :delete
end

netdev_l2_interface "ge-1/0/7" do
  action :delete
end

netdev_l2_interface "ge-1/0/8" do
  action :delete
end

netdev_l2_interface "ge-1/0/9" do
  action :delete
end

# Create the LAGs

netdev_lag "ae0" do
        links [ "ge-1/0/6", "ge-1/0/7" ]
        minimum_links 1
        lacp "active"
        action :create
```

```
end

netdev_lag "ae1" do
        links [ "ge-1/0/8", "ge-1/0/9" ]
        minimum_links 1
        lacp "active"
        action :create
end

# Configure Layer 2 switching on the LAGs. Define the port mode as trunk
# (vlan_tagging true), with membership in the blue, green, and red VLANs.

netdev_l2_interface "ae0" do
        description "Chef-created LAG interface"
        tagged_vlans [ "blue", "green", "red" ]
        vlan_tagging true
        action :create
end

netdev_l2_interface "ae1" do
        description "Chef-created LAG interface"
        tagged_vlans ["blue", "green", "red" ]
        vlan_tagging true
        action :create
end
```

10. Save the recipe in **cookbooks/netdev_router /recipes/lag_interface_create.rb**.

11. Upload the netdev_router cookbook to the Chef server.

    ```
    $ knife cookbook upload netdev_router
    ```

12. Edit the node object that represents the router.

    ```
    $ knife node edit router_node_name
    ```

    Knife starts your editor and opens a JSON file that contains the node attributes.

13. Enter the recipes in the `run-list` attribute and then save the JSON file.

    ```
    {
      "name": "router_node_name",
      "chef_environment": "_default",
      "normal": {
    ```

```
  },
   "run_list": [
        "recipe[netdev_router::interface_create]",
        "recipe[netdev_router::vlan_create]",
        "recipe[netdev_router::l2interface_create]",
        "recipe[netdev_router::lag_interface_create]"
  ]
}
```

The order in which you enter the recipes matters—for example, the Chef client runs the `interfaces_create` recipe first because it is listed first.

14. Log in as the root user.

15. From the UNIX-level shell, run the Chef client.

    - If the Juniper Networks version of the Chef client is 2.x (for example, Chef client version 11.10.4_**2.0**), enter:

      %/opt/jet/chef/bin/ruby /opt/jet/chef/bin/chef-client -c /var/db/chef/client.rb

    - If the Juniper Networks version of the Chef client is 1.x (for example, Chef client version 11.10.4_**1.1**), enter:

      %/opt/sdk/chef/bin/ruby /opt/sdk/chef/bin/chef-client -c /var/db/chef/client.rb

    The Chef client displays status messages during its run to indicate its progress in performing the configuration. For example:

```
[2015-08-21T18:07:27+05:30] INFO: Forking chef instance to converge...
Starting Chef Client, version 11.10.4
[2015-08-21T18:07:28+05:30] INFO: *** Chef 11.10.4 ***
[2015-08-21T18:07:28+05:30] INFO: Chef-client pid: 9351
[2015-08-21T18:07:32+05:30] INFO: Run List is [recipe[netdev::interface_create],
recipe[netdev::vlan_create], recipe[netdev::l2interface_create],
recipe[netdev::lag_interface_create]]
[2015-08-21T18:07:32+05:30] INFO: Run List expands to [netdev::interface_create,
netdev::vlan_create, netdev::l2interface_create, netdev::lag_interface_create]
[2015-08-21T18:07:32+05:30] INFO: Starting Chef Run for router-node
.
.
.
[2015-08-21T18:09:36+05:30] INFO: Chef Run complete in 123.446606904 seconds
```

```
Running handlers:
[2015-08-21T18:09:36+05:30] INFO: Running report handlers
[2015-08-21T18:09:54+05:30] INFO: Committed pending Junos candidate configuration changes
[2015-08-21T18:09:58+05:30] INFO: Released exclusive Junos configuration lock
  - JunosCommitTransactionHandler
Running handlers complete

[2015-08-21T18:09:58+05:30] INFO: Report handlers complete
Chef Client finished, 13/17 resources updated in 150.983654211 seconds
```

Results

From operational mode, confirm your configuration by entering the **show configuration | compare rollback 1** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
root@router-node> show configuration | compare rollback 1
[edit]
+  interfaces {
+      ge-1/0/1 {
+          description "Chef-created interface";
+          unit 0 {
+              description "belongs to blue VLAN";
+              family bridge {
+                  interface-mode access;
+                  vlan-id 100;
+              }
+          }
+      }
+      ge-1/0/2  {
+          description "Chef-created interface";
+          unit 0 {
+              description "belongs to green VLAN";
+              family bridge {
+                  interface-mode access;
+                  vlan-id 200;
+              }
+          }
+      }
+      ge-1/0/3  {
+          description "Chef-created interface";
```

```
+          unit 0 {
+              description "belongs to red VLAN";
+              family bridge {
+                  interface-mode access;
+                  vlan-id 300;
+              }
+          }
+      }
+      ge-1/0/6  {
+          gigether-options {
+              802.3ad ae0;
+          }
+      }
+      ge-1/0/7 {
+          gigether-options {
+              802.3ad ae0;
+          }
+      }
+      ge-1/0/8 {
+          giether-options {
+              802.3ad ae1;
+          }
+      }
+      ge-1/0/9 {
+          gigether-options {
+              802.3ad ae1;
+          }
+      }
+      ae0 {
+          aggregated-ether-options {
+              minimum-links 1;
+              lacp {
+                  active;
+              }
+          }
+          apply-macro "netdev_lag[:links]" {
+             ge-1/0/6;
+             ge-1/0/7;
+           }
+           unit 0 {
+              description "Chef-created LAG interface";
+              family bridge {
+                  interface-mode trunk;
```

```
+                 vlan-id-list [ 100 200 300 ];
+             }
+         }
+     }
+     ae1 {
+         aggregated-ether-options {
+             minimum-links 1;
+             lacp {
+                 active;
+             }
+         }
+         apply-macro "netdev_lag[:links]" {
+            ge-1/0/8;
+            ge-1/0/9;
+         }
+       unit 0 {
+             description "Chef-created LAG interface";
+             family bridge  {
+                 interface-mode trunk;
+                 vlan-id-list [ 100 200 300 ];
+             }
+         }
+     }
+ }
+ bridge-domains {
+     blue {
+         description "Chef-created blue VLAN";
+         domain-type bridge;
+         vlan-id 100;
+     }
+     green {
+         description "Chef-created green VLAN";
+         domain-tye bridge;
+         vlan-id 200;
+     }
+     red {
+         description "Chef-created blue VLAN";
+         domain-type bridge;
+         vlan-id 300;
+     }
+ }
```

NOTE: The `apply-macro` statement under the ae0 and ae1 interface configuration is a normally hidden statement that is exposed when the configuration is generated by a Chef client.

Verification

IN THIS SECTION

- Verifying the Status of the VLANs | 47

Verifying the Status of the VLANs

Purpose

Verify the VLANs and VLAN memberships are correct.

Action

Use the `show bridge domain` command to verify VLAN membership.

```
root@mx-node> show bridge domain
Routing instance        Bridge domain            VLAN ID
Interfaces
default-switch          blue
100
                                                      ae0.0*
                                                      ae1.0*
                                                      ge-1/0/1.0*
default-switch          green
200
                                                      ae0.0*
                                                      ae1.0*

ge-1/0/2.0*
default-switch          red
300
                                                      ae0.0*
```

```
                                                    ae1.0*
                                                    ge-1/0/3.0*
```

Meaning

The output shows that the VLANs have been created correctly and contain the correct member interfaces.

SEE ALSO

- Installing or Uninstalling the Chef Client on Juniper Networks Devices Running Junos OS | 10
- Configuring the Chef Client on Juniper Networks Devices Running Junos OS | 19
- Example: Using Chef for Junos OS to Configure Ethernet Switching on EX Series, OCX Series, and QFX Series Switches | 23
- Example: Using Chef for Junos OS to Configure Any Hierarchy Level | 48
- Chef Overview | 2

Example: Using Chef for Junos OS to Configure Any Hierarchy Level

IN THIS SECTION

- Requirements | 48
- Overview | 49
- Configuration | 49
- Verification | 52

This example shows how you can use the `netdev_group` resource in the netdev cookbook to write recipes that configure any hierarchy level on devices running Chef for Junos OS. For more information about the light-weight resources in the netdev cookbook, see *Chef for Junos OS* at https://docs.chef.io/junos.html .

Requirements

This example uses the following hardware and software components:

- A properly set up and configured Chef workstation and Chef server
- Junos OS Release 16.1
- A Juniper Networks device that the Chef client manages

> **NOTE**: This example uses the `netdev_group` resource that is not supported on an OCX1100 switch. Only the `netdev_interface` resource is supported on an OCX1100 switch.

Before you begin, make sure that the local autonomous system number is already defined on the device.

Overview

The `netdev_group` resource specifies an Embedded Ruby (ERB) template file that defines a Junos OS configuration to be applied to the `groups` hierarchy level on the device. For information about Chef cookbook templates, see https://docs.chef.io/templates.html. When the client downloads the catalog, it adds the configuration data generated by the template under the `[edit groups]` hierarchy level and configures the `apply-groups` statement to include the group name. If the commit succeeds, the configuration inherits the statements in the configuration group. The configuration file is created in **/var/tmp/*name***, where *name* is the name of a Junos OS group on the Chef client.

The `netdev_group` resource has the following actions:

- `:create`–Create a Junos OS group (default).
- `:delete`–Delete a Junos OS group.

The `netdev_group` resource has the following attributes:

- `name`–The name of the Junos OS group under which configuration is applied.
- `template_path`–The path of the template used to create the Junos OS configuration file in the format ***template-file-name.config-format*.erb**, where *template-file-name* is the name of the file and *config-format* is one of `xml`, `set`, or `text`. If *config-format* is not specified, `xml` is the default format.
- `variables`–(Optional) Variables input to the template file.

Configuration

IN THIS SECTION

- Creating the netdev_group Resource | 50
- Creating the ERB Template | 51

Creating the Attributes for the Template | 51
Configuring the Device by Using Chef for Junos OS | 51

This example creates a ntedev_group resource named **bgp_create.rb** that configures statements for internal and external BGP peering. The netdev_group resource references the **bgp.xml.erb** template that generates the configuration data for the resource. The template is located in the **netdev/templates/junos** directory. The attributes that apply to the template are defined in **netdev/attributes/default.rb** under the variable name bgp.

The BGP variable definition contains the node-specific configuration values that the template uses to generate the configuration data for that group. The data is provided in a hash that uses the BGP group names as keys. Each key maps to another hash that contains the details for that group including the group type, and the IP addresses and AS number of the peers. When the template is referenced, it iterates over the hash and generates the Junos OS configuration data for the groups command.

Creating the netdev_group Resource

Step-by-Step Procedure

To create the netdev_group resource:

1. From the **chef-repo** directory on the Chef workstation, download the netdev cookbook and extract the cookbook files to the **cookbooks** directory.

   ```
   knife cookbook site download netdev

   tar -zxvf netdev-n.n.n.tar.gz -C cookbooks
   ```

2. Copy the netdev cookbook to create a new cookbook, netdev_device, in the **cookbooks** directory.

3. In an editor of your choice, write the bgp_group recipe for creating the BGP configuration in the **cookbooks/netdev_device/recipes/ bgp_create.rb** file.

   ```
   #
   # Cookbook Name:: netdev_device
   # Recipe:: bgp_create
   #
   netdev_group 'bgp_create' do
           template_path 'bgp.xml.erb'
           action :create
   ```

```
        variables({
          :bgp => node[:netdev][:bgp]
        })
end
```

Creating the ERB Template

Creating the Attributes for the Template

Configuring the Device by Using Chef for Junos OS

Step-by-Step Procedure

To configure the device by using Chef for Junos OS:

1. Upload the netdev_device cookbook to the Chef server.

   $ **knife cookbook upload netdev_device**

2. Edit the node object that represents the device.

   $ **knife node edit device_node_name**

   Knife starts your editor and opens a JSON file that contains the node attributes.

3. Enter the recipe in the `run-list` attribute and then save the JSON file.

```
{
  "name": "device_node_name",
  "chef_environment": "_default",
  "normal": {
  },
   "run_list": [
        "recipe[netdev_group:bgp_create]",
  ]
}
```

   The order in which you enter the recipes matters. The last configuration overrides any previous configuration.

4. Log in as the root user.

5. From the UNIX-level shell, run the Chef client.

   - If the Juniper Networks version of the Chef client is 2.x (for example, Chef client version 11.10.4_**2.0**), enter:

     %/opt/jet/chef/bin/ruby /opt/jet/chef/bin/chef-client -c /var/db/chef/client.rb

   - If the Juniper Networks version of the Chef client is 1.x (for example, Chef client version 11.10.4_**1.1**), enter:

     %/opt/sdk/chef/bin/ruby /opt/sdk/chef/bin/chef-client -c /var/db/chef/client.rb

   The Chef client displays status messages during its run to indicate its progress in performing the configuration.

Verification

IN THIS SECTION

- Verifying the Commit | **52**
- Verifying the Configuration | **53**

To verify that the commit was successful and the configuration reflects the new BGP resource, perform these tasks:

Verifying the Commit

Purpose

Action

Meaning

The `JUNOS: OK: COMMIT success!` message and the commit log indicate that the Chef client successfully applied the configuration changes generated by the template.

Verifying the Configuration

Purpose

Verify that the BGP configuration group is in the active configuration on the device and that the configuration group name is configured for the `apply-groups` statement.

Action

From operational mode, enter the `show configuration groups bgp_group` and the `show configuration apply-groups` commands.

```
chef@chef-client> show configuration groups bgp_group

protocols {
    bgp {
        group internal {
            type internal;
            local-address 20.20.20.20;
            peer-as 100;
            neighbor 10.10.10.10;
            neighbor 10.10.10.11;
        }
        group external {
            type external;
            local-address 20.20.20.20;
            peer-as 200;
            neighbor 30.30.10.10;
            neighbor 30.30.10.11;
        }
    }
}
```

```
chef@chef-client> show configuration apply-groups
apply-groups [ global re0 re1 bgp_group ];
```

Meaning

The output shows that the BGP configuration was successfully configured in the `groups` hierarchy and that `bgp_group` was added to the `apply-groups` hierarchy.

SEE ALSO

Example: Using Chef for Junos OS to Configure Ethernet Switching on MX Series Routers | **36**

Example: Using Chef for Junos OS to Configure Ethernet Switching on EX Series, OCX Series, and QFX Series Switches | **23**

groups