

# NSX Container Plug-in for OpenShift - Installation and Administration Guide

VMware NSX Container Plug-in 2.3, 2.3.1, 2.3.2

VMware NSX-T Data Center 2.3

VMware NSX-T Data Center 2.3.1



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# NSX-T Container Plug-in for OpenShift - Installation and Administration Guide

This guide describes how to install and administer NSX-T Container Plug-in (NCP) to provide integration between NSX-T Data Center and OpenShift.

## Intended Audience

This guide is intended for system and network administrators. A familiarity with the installation and administration of NSX-T Data Center and OpenShift is assumed.

## VMware Technical Publications Glossary

VMware Technical Publications provides a glossary of terms that might be unfamiliar to you. For definitions of terms as they are used in VMware technical documentation, go to <http://www.vmware.com/support/pubs>.

# Overview of NSX-T Container Plug-in

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NSX-T Container Plug-in (NCP) provides integration between NSX-T Data Center and container orchestrators such as Kubernetes, as well as integration between NSX-T Data Center and container-based PaaS (platform as a service) software products such as OpenShift. This guide describes setting up NCP with OpenShift.

The main component of NCP runs in a container and communicates with NSX Manager and with the OpenShift control plane. NCP monitors changes to containers and other resources and manages networking resources such as logical ports, switches, routers, and security groups for the containers by calling the NSX API.

The NSX CNI plug-in runs on each OpenShift node. It monitors container life cycle events, connects a container interface to the guest vSwitch, and programs the guest vSwitch to tag and forward container traffic between the container interfaces and the VNIC.

NCP provides the following functionalities:

- Automatically creates an NSX-T logical topology for a OpenShift cluster, and creates a separate logical network for each OpenShift namespace.
- Connects OpenShift pods to the logical network, and allocates IP and MAC addresses.
- Supports network address translation (NAT) and allocates a separate SNAT IP for each OpenShift namespace.

---

**Note** When configuring NAT, the total number of translated IPs cannot exceed 1000.

---

- Implements OpenShift network policies with NSX-T distributed firewall.
  - Support for ingress and egress network policies.
  - Support for IPBlock selector in network policies.
  - Support for `matchLabels` and `matchExpression` when specifying label selectors for network policies.
- Implements OpenShift route with NSX-T layer 7 load balancer.
  - Support for HTTP route and HTTPS route with TLS edge termination.
  - Support for routes with alternate backends and wildcard subdomains.

- Creates tags on the NSX-T logical switch port for the namespace, pod name, and labels of a pod, and allows the administrator to define NSX-T Data Center security groups and policies based on the tags.

In this release, NCP supports a single OpenShift cluster.

This chapter includes the following topics:

- [Compatibility Requirements](#)
- [Installation Overview](#)
- [Upgrading NCP](#)

## Compatibility Requirements

NSX-T Container Plug-in (NCP) has the following compatibility requirements.

Software Product	Version
NSX-T Data Center	2.2, 2.3
Hypervisor for Container Host VMs	<ul style="list-style-type: none"> <li>■ <a href="#">Supported vSphere version</a></li> <li>■ RHEL KVM 7.4, 7.5</li> </ul>
Container Host Operating System	RHEL 7.4, 7.5
Platform as a Service	OpenShift 3.9, 3.10
Container Host Open vSwitch	2.9.1 (packaged with NSX-T 2.3 and 2.2)

## Installation Overview

Installing and configuring NCP involves the following steps. To perform the steps successfully, you must be familiar with NSX-T Data Center and OpenShift installation and administration.

- 1 Install NSX-T Data Center.
- 2 Create an overlay transport zone.
- 3 Create an overlay logical switch and connect the nodes to the switch.
- 4 Create a tier-0 logical router.
- 5 Create IP blocks for the pods.
- 6 Create IP pools for SNAT (source network address translation).
- 7 Deploy OpenShift VMs.
- 8 Prepare the Ansible hosts file.
- 9 (Option 1) Install NCP and OpenShift using a single playbook.  
(Option 2) Install CNI plug-in, OVS (Open vSwitch), and NCP docker image. Then Install OpenShift Container Platform.
- 10 Run NCP and NSX node agent.

Steps 2 to 6 are not needed if you install NCP using playbooks that are provided. See [Install NCP and OpenShift Using a Single Playbook](#) and [Install CNI Plug-in, OVS, and NCP Docker Image](#).

## Upgrading NCP

To upgrade NCP to 2.3.0, perform the following steps.

- 1 Upgrade the CNI RPM package, NSX Node Agent DaemonSet, and NCP ReplicationController.
- 2 (Optional) Upgrade NSX-T Data Center to 2.3.

NCP 2.3.0 supports NSX-T 2.2 but you can also upgrade to NSX-T Data Center 2.3.

# Setting Up NSX-T Resources

NSX-T Data Center resources must be created to provide networking to OpenShift nodes. You can configure these resources manually using the NSX Manager GUI, or automate the process using an Ansible playbook.

This section describes creating the NSX-T resources manually. To automate the process, see [Install CNI Plug-in, OVS, and NCP Docker Image](#).

This chapter includes the following topics:

- [Configuring NSX-T Resources](#)
- [Create and Configure a Tier-0 Logical Router](#)

## Configuring NSX-T Resources

NSX-T Data Center resources that you need to configure include an overlay transport zone, a tier-0 logical router, a logical switch to connect the node VMs, IP blocks for Kubernetes nodes, and an IP pool for SNAT.

You configure NSX-T Data Center resources using UUIDs or names in the configuration file `ncp.ini`.

### Overlay Transport Zone

Log in to NSX Manager and navigate to **Fabric > Transport Zones**. Find the overlay transport zone that is used for container networking or create a new one.

Specify an overlay transport zone for a cluster by setting the `overlay_tz` option in the `[nsx_v3]` section of `ncp.ini`. This step is optional. If you do not set `overlay_tz`, NCP will automatically retrieve the overlay transport zone ID from the tier-0 router.

### Tier-0 Logical Routing

Log in to NSX Manager and navigate to **Networking > Routing > Routers**. Find the router that is used for container networking or create a new one.

Specify a tier-0 logical router for a cluster by setting the `tier0_router` option in the `[nsx_v3]` section of `ncp.ini`.

---

**Note** The router must be created in active-standby mode.

---



## Logical Switch

The vNICs used by the node for data traffic must be connected to an overlay logical switch. It is not mandatory for the node's management interface to be connected to NSX-T Data Center, although doing so will make setting up easier. You can create a logical switch by logging in to NSX Manager and navigating to **Networking > Switching > Switches**. On the switch, create logical ports and attach the node vNICs to them. The logical ports must have the following tags:

- tag: <cluster\_name>, scope: ncp/cluster
- tag: <node\_name>, scope: ncp/node\_name

The <cluster\_name> value must match the value of the `cluster` option in the `[coe]` section in `ncp.ini`.

## IP Blocks for Kubernetes Pods

Log in to NSX Manager and navigate to **Networking > IPAM** to create one or more IP blocks. Specify the IP block in CIDR format.

Specify IP blocks for Kubernetes pods by setting the `container_ip_blocks` option in the `[nsx_v3]` section of `ncp.ini`.

You can also create IP blocks specifically for no-SNAT namespaces.

Specify no-SNAT IP blocks by setting the `no_snat_ip_blocks` option in the `[nsx_v3]` section of `ncp.ini`.

If you create no-SNAT IP blocks while NCP is running, you must restart NCP. Otherwise, NCP will keep using the shared IP blocks until they are exhausted.

---

**Note** When you create an IP block, the prefix must not be larger than the value of the parameter `subnet_prefix` in NCP's configuration file `ncp.ini`.

---

## IP Pool for SNAT

The IP pool is used for allocating IP addresses which will be used for translating pod IPs via SNAT rules, and for exposing ingress controllers via SNAT/DNAT rules, just like Openstack floating IPs. These IP addresses are also referred to as external IPs.

Multiple Kubernetes clusters use the same external IP pool. Each NCP instance uses a subset of this pool for the Kubernetes cluster that it manages. By default, the same subnet prefix for pod subnets will be used. To use a different subnet size, update the `external_subnet_prefix` option in the `[nsx_v3]` section in `ncp.ini`.

Log in to NSX Manager and navigate to **Inventory > Groups > IP Pools** to create a pool or find an existing pool.

Specify IP pools for SNAT by setting the `external_ip_pools` option in the `[nsx_v3]` section of `ncp.ini`.

You can also configure SNAT for a specific service by adding an annotation to the service. For example,

```
apiVersion: v1
kind: Service
metadata:
  name: svc-example
  annotations:
    ncp/snat_pool: <external IP pool ID or name>
  selector:
    app: example
...
```

NCP will configure the SNAT rule for this service. The rule's source IP is the set of backend pods. The destination IP is the SNAT IP allocated from the specified external IP pool. Note the following:

- The IP pool specified by `ncp/snat_pool` should already exist in NSX-T Data Center before the service is configured. Starting with NCP 2.3.1, the IP pool must have the tag `{"ncp/owner": cluster:<cluster>}`.
- In NSX-T Data Center, the priority of the SNAT rule for the service is higher than that for the project.
- If a pod is configured with multiple SNAT rules, only one will work.

You can specify which namespace can be allocated IPs from the SNAT IP pool by adding the following tag to the IP pool.

- `scope: ncp/owner, tag: ns:<namespace_UUID>`

You can get the namespace UUID with one of the following command:

```
oc get ns -o yaml
```

Note the following:

- Each tag should specify one UUID. You can create multiple tags for the same pool.
- If you change the tags after some namespaces have been allocated IPs based on the old tags, those IPs will not be reclaimed until the SNAT configurations of the services change or NCP restarts..
- The namespace owner tag is optional. Without this tag, any namespace can have IPs allocated from the SNAT IP pool.

## (Optional) Firewall Marker Sections

To allow the administrator to create firewall rules and not have them interfere with NCP-created firewall sections based on network policies, log in to NSX Manager, navigate to **Security > Distributed Firewall > General** and create two firewall sections.

Specify marker firewall sections by setting the `bottom_firewall_section_marker` and `top_firewall_section_marker` options in the `[nsx_v3]` section of `ncp.ini`.

The bottom firewall section must be below the top firewall section. With these firewall sections created, all firewall sections created by NCP for isolation will be created above the bottom firewall section, and all firewall sections created by NCP for policy will be created below the top firewall section. If these marker sections are not created, all isolation rules will be created at the bottom, and all policy sections will be created at the top. Multiple marker firewall sections with the same value per cluster are not supported and will cause an error.

## Create and Configure a Tier-0 Logical Router

The tier-0 logical router connects the Kubernetes nodes to external networks.

### Procedure

- 1 From a browser, log in to NSX Manager at <https://nsx-manager-ip-address>.
- 2 Navigate to **Networking > Routing > Routers** and click **Add > Tier-0 Router**.
- 3 Enter a name and optionally a description.
- 4 Select an existing edge cluster from the drop-down menu to back this tier-0 logical router.
- 5 Select a high-availability mode.  
Select active-standby.
- 6 Click **Save**.  
The new logical router appears as a link.
- 7 Click the logical router link.
- 8 Click **Routing > Route Redistribution**.
- 9 Click **Add** to add a new redistribution criterion.  
For sources, in a routed (non-NAT) topology, select **NSX Static**. In a NAT topology, select **Tier-0 NAT**.
- 10 Click **Save**.
- 11 Click the newly created router.
- 12 Click **Configuration > Router Ports**
- 13 Click **Add** to add an uplink port.
- 14 Select a transport node.
- 15 Select the logical switch that was previously created.
- 16 Specify an IP address in your external network.
- 17 Click **Save**.  
The new logical router appears as a link.

# Installing NCP in an OpenShift Environment

This chapter describes installing and configuring NSX-T Container Plug-in (NCP) and OpenShift.

This chapter includes the following topics:

- [Deploy OpenShift VMs](#)
- [Prepare the Ansible Hosts File](#)
- [Install NCP and OpenShift Using a Single Playbook](#)
- [Install CNI Plug-in, OVS, and NCP Docker Image](#)
- [Install OpenShift Container Platform](#)
- [Run NCP and NSX Node Agent](#)
- [Setup Notes](#)

## Deploy OpenShift VMs

Before installing NSX-T Container Plug-in, OpenShift must be installed. You must deploy at least one master.

For more information, see <https://docs.openshift.com>.

### What to do next

Prepare the Ansible hosts file. See [Prepare the Ansible Hosts File](#).

## Prepare the Ansible Hosts File

The Ansible hosts file defines the nodes in the OpenShift cluster.

### Procedure

- 1 Clone the NCP GitHub repository at <https://github.com/vmware/nsx-integration-for-openshift>. The hosts file is in the `openshift-ansible-nsx` directory. You must keep the hosts file in the `openshift-ansible-nsx` directory. Some playbooks assume that this is the path for the hosts file.

- 2 In the [masters] and [nodes] sections, specify the host names and IP addresses of the OpenShift VMs. For example,

```
[masters]
admin.rhel.osmaster ansible_ssh_host=101.101.101.4

[single_master]
admin.rhel.osmaster ansible_ssh_host=101.101.101.4

[nodes]
admin.rhel.osmaster ansible_ssh_host=101.101.101.4 openshift_ip=101.101.101.4
openshift_schedulable=true openshift_hostname=admin.rhel.osmaster
admin.rhel.osnode ansible_ssh_host=101.101.101.5 openshift_ip=101.101.101.5
openshift_hostname=admin.rhel.osnode

[etcd]

[OSEv3:children]
masters
nodes
etcd
```

Note that `openshift_ip` identifies the cluster internal IP and needs to be set if the interface to be used is not the default one. The `single_master` variable is used by ncp-related roles from a master node to perform certain tasks only once, e.g. NSX-T Data Center management plane resource configuration.

- 3 Set up SSH access so that all the nodes can be accessed without password from the node where the Ansible role is run (typically it is the master node):

```
ssh-keygen
ssh-copy-id -i ~/.ssh/id_rsa.pub root@admin.rhel.osnode
```

- 4 Update the [OSEv3:vars] section. Details about all the parameters can be found in the OpenShift Container Platform Documentation for the Advanced Installation (search for "advanced installation" in <https://docs.openshift.com>). For example,

```
# Set the default route fqdn
openshift_master_default_subdomain=apps.corp.local

os_sdn_network_plugin_name=cni
openshift_use_openshift_sdn=false
openshift_node_sdn_mtu=1500

# If ansible_ssh_user is not root, ansible_become must be set to true
ansible_become=true

openshift_master_default_subdomain
    This is the default subdomain used in the OpenShift routes for External LB

os_sdn_network_plugin_name
    Set to 'cni' for the NSX Integration
```

```
openshift_use_openshift_sdn
```

Set to false to disable the built-in OpenShift SDN solution

```
openshift_hosted_manage_router
```

Set to false to disable creation of router during installation. The router has to be manually started after NCP and nsx-node-agent are running.

```
openshift_hosted_manage_registry
```

Set to false to disable creation of registry during installation. The registry has to be manually started after NCP and nsx-node-agent are running.

```
deployment_type
```

Set to openshift-enterprise

```
openshift_hosted_manage_registry
```

Set to false to disable auto creation of registry

```
openshift_hosted_manage_router
```

Set to false to disable auto creation of router

```
openshift_enable_service_catalog
```

Set to false to disable service\_catalog

```
(For OpenShift 3.9 only) skip_sanity_checks
```

Set to true

```
(For OpenShift 3.9 only) openshift_web_console_install
```

Set to false

## 5 Check that you have connectivity to all hosts:

```
ansible OSEv3 -i /PATH/TO/HOSTS/hosts -m ping
```

The results should look like the following. If not, resolve the connectivity problem.

```
openshift-node1 | SUCCESS => {
  "changed": false,
  "ping": "pong"
}
openshift-master | SUCCESS => {
  "changed": false,
  "ping": "pong"
}
```

### What to do next

Install CNI plug-in and OVS. See [Install CNI Plug-in, OVS, and NCP Docker Image](#).

## Install NCP and OpenShift Using a Single Playbook

You can install NCP and OpenShift using a single playbook or perform the installation in separate steps.

The single Ansible playbook `install.yaml` performs the following tasks:

- NCP preparation
- OpenShift installation
- NCP installation

Alternatively, you can install NCP and OpenShift using the instructions in the following two sections:

[Install CNI Plug-in, OVS, and NCP Docker Image](#) and [Install OpenShift Container Platform](#).

Before running the `install.yaml` playbook, set the required and optional parameters for the `ncp_prep` and `ncp` plabook roles. The parameters are described in [Install CNI Plug-in, OVS, and NCP Docker Image](#).

The following command runs the playbook:

```
ansible-playbook -i /PATH/TO/HOSTS/hosts install.yaml
```

## Install CNI Plug-in, OVS, and NCP Docker Image

The container network interface (CNI) plug-in, Open vSwitch (OVS), and the NCP Docker image must be installed on the OpenShift nodes. The installation is performed by running an Ansible playbook.

---

**Note** This step is not necessary if you install NCP and OpenShift using a single playbook. See [Install NCP and OpenShift Using a Single Playbook](#).

---

The playbook contains instructions to configure NSX-T resources for the nodes. You can also configure the NSX-T Data Center resources manually as described in [Chapter 2 Setting Up NSX-T Resources](#). The parameter `perform_nsx_config` indicates whether or not to configure the resources when the playbook is run.

### Procedure

- 1 Update the parameter values in `roles/ncp_prep/default/main.yaml` and `roles/nsx_config/default/main.yaml`, including the URLs where CNI plugin RPM, OVS and its corresponding kernel module RPM can be downloaded. In addition, `uplink_port` is the name of the uplink port VNIC on the node VM. The remaining variables pertain to the NSX-T Data Center management plane configuration.

Parameters that need to be specified:

- `perform_nsx_config`: whether to perform the resource configuration. Set it to false if the configuration will be done manually, and `nsx_config` script will not be run.
- `nsx_manager_ip`: IP of NSX Manager
- `nsx_edge_cluster_name`: name of the Edge Cluster to be used by the tier-0 router
- `nsx_transport_zone_name`: name of the overlay Transport Zone

- `os_node_name_list`: comma-separated list of node names  
For example, `node1,node2,node3`
- `subnet_cidr`: CIDR address for IP administrator will assign to br-int on the node
- `vc_host`: IP address of vCenter Server
- `vc_user`: user name of vCenter Server administrator
- `vc_password`: password of vCenter Server administrator
- `vms`: comma-separated list of VM names. The order must match `os_node_name_list`.

The following parameters have default values. You can modify them as needed.

- `nsx_t0_router_name`: name of tier-0 Logical Router for the cluster. Default: **t0**
- `pod_ipblock_name`: name of IP block for pods. Default: **podIPBlock**
- `pod_ipblock_cidr`: CIDR address for this IP block. Default: **172.20.0.0/16**
- `snat_ippool_name`: name of the IP block for SNAT. Default is `externalIP`.
- `snat_ippool_cidr`: CIDR address for this IP block. Default: **172.30.0.0/16**
- `start_range`: the start IP address of CIDR specified for this IP pool. Default: **172.30.0.1**
- `end_range`: the end IP address of CIDR specified for this IP pool. Default: **172.30.255.254**
- `os_cluster_name`: name of the OpenShift cluster. Default: **occl-one**
- `nsx_node_ls_name`: name of Logical switch connected to the nodes. Default: **node\_ls**
- `nsx_node_lr_name`: name of logical router for the switch **node\_ls**. Default: **node\_lr**

The `nsx-config` playbook supports creating only one IP pool and one IP block. If you want more, you must create them manually.

## 2 Change to the `openshift-ansible-nsx` directory and run the `ncp_prep` role.

```
ansible-playbook -i /PATH/TO/HOSTS/hosts ncp_prep.yaml
```

The playbook contains instructions to perform the following actions:

- Download the CNI plug-in installation file.  
The filename is `nsx-cni-1.0.0.0.0.xxxxxxx-1.x86_64.rpm`, where `xxxxxxx` is the build number.
- Install the CNI plug-in installation file.  
The plug-in is installed in `/opt/cni/bin`. The CNI configuration file `10.net.conf` is copied to `/etc/cni/net.d`. The rpm will also install the configuration file `/etc/cni/net.d/99-loopback.conf` for the loopback plug-in.
- Download and install the OVS installation files.  
The files are `openvswitch-2.9.1.xxxxxxx-1.x86_64.rpm` and `openvswitch-kmod-2.9.1.xxxxxxx-1.el7.x86_64.rpm`, where `xxxxxxx` is the build number.



- Create the *br-int* instance if it is not already created.

```
# ovs-vsctl add-br br-int
```

- Add the network interface (*node-if*) that is attached to the node logical switch to *br-int*.
- Make sure that the *br-int* and *node-if link* status is up.

```
# ip link set br-int up
# ip link set <node-if> up
```

- Update the network configuration file to ensure that the network interface is up after a reboot.
- Download the NCP tar file and load the Docker image from the tar file.
- Download the *ncp-rbac* yaml file and change the *apiVersion* to **v1**.
- Create a logical topology and related resources in NSX-T Data Center, and create tags on them so that they can be recognized by NCP.
- Update *ncp.ini* with NSX-T Data Center resource information.

#### What to do next

Install OpenShift Container Platform. See [Install OpenShift Container Platform](#).

## Install OpenShift Container Platform

OpenShift Container Platform (OCP) is a platform as a service (PaaS) product that brings together Docker and Kubernetes.

---

**Note** This step is not necessary if you install NCP and OpenShift using a single playbook. See [Install NCP and OpenShift Using a Single Playbook](#).

---

For information about installing OCP, see <https://docs.openshift.com>.

#### What to do next

Run NCP and NSX node agent. See [Run NCP and NSX Node Agent](#).

## Run NCP and NSX Node Agent

Set up and run NCP and NSX node agent.

#### Procedure

- 1 Edit *roles/ncp/defaults/main.yaml* and specify the OpenShift API server IP, NSX manager IP, and URL's for downloading NCP ReplicationController yaml and *nsx-node-agent* DaemonSet yaml.
- 2 From the *openshift-ansible-nsx* directory, run the *ncp* role:

```
ansible-playbook -i /PATH/TO/HOSTS/hosts ncp.yaml
```

The ncp role performs the following steps:

- Check if nsx-system project exists, and create one if it does not.

```
oc new-project nsx-system
```

- Download the ncp-rbac yaml file and change the apiVersion to v1.
- Create the service account for the NCP pod, create a cluster role that specifies resources that NCP can access and bind the cluster role with the NCP service account.
- Create the service account for the nsx-node-agent pod, create a cluster role that specifies the resources that the node agent can access and bind the cluster role with the node agent service account.

```
oc apply -f /tmp/ncp-rbac.yaml
```

- Obtain the token associated with the above service accounts, and store it under /etc/nsx-  
ujo/<service\_account>\_token:

```
secret=`kubectl get serviceaccount ncp-svc-account -o yaml | grep -A1 secrets | tail -n1 | awk
{'print $3'}`
kubectl get secret $secret -o yaml | grep 'token:' | awk {'print $2'} | base64 -d > /etc/nsx-
ujo/ncp_token
secret=`kubectl get serviceaccount nsx-node-agent-svc-account -o yaml | grep -A1 secrets |
tail -n1 | awk {'print $3'}`
kubectl get secret $secret -o yaml | grep 'token:' | awk {'print $2'} | base64 -d > /etc/nsx-
ujo/node_agent_token
```

- Download the SecurityContextConstraint (SCC) yaml file ncp-os-scc.yaml for NCP and create the SCC based on the yaml.

```
oc apply -f ncp-os-scc.yaml
```

The SCC yaml file specifies SELinux type as spc\_t to ensure that NCP/nsx-node-agent has access permissions under SELinux. That is,

```
seLinuxContext:
  seLinuxOptions:
    type: spc_t
```

In the SCC yaml file, under seLinuxContext's seLinuxOptions, the SELinux label-based access control level is set to s0:c0:c1023 to allow ncp/node-agent access to targets from different file categories.

- Add the SCC to the user who creates the NCP and NSX node agent pods. For example, to add the SCC to the default user in the current project:

```
oc adm policy add-scc-to-user ncp-scc -z default
```

- Add the SCC to the NCP and NSX node agent service accounts:

```
oc adm policy add-scc-to-user ncp-scc -z ncp-svc-account
oc adm policy add-scc-to-user ncp-scc -z nsx-node-agent-svc-account
```

- Download the yaml files for NCP ReplicationController (RC) and nsx-node-agent DaemonSet (DS) and update the ConfigMap.
- Download and load the NCP image (nsx-node-agent uses the same image).
- Configure the service account and set up the required SecurityContextConstraint for NCP and nsx\_node\_agent.
- Create the NCP ReplicationController and nsx-node-agent DaemonSet.

---

**Note** NCP opens persistent HTTP connections to the Kubernetes API server to watch for life cycle events of Kubernetes resources. If an API server failure or a network failure causes NCP's TCP connections to become stale, you must restart NCP so that it can re-establish connections to the API server. Otherwise, NCP will miss the new events.

---

## Setup Notes

Before setting up OpenShift and NCP, take note of the following information.

- A pod must have no more than 11 labels and a namespace must have no more than 12 labels.
- Labels added for OpenShift internal usage, for example, a label with prefix openshift.io in its key, will be disregarded by NCP and thus user won't see the corresponding tags created on the related NSX resources. Here is a list of label prefixes used by OpenShift, and you should avoid using a label key starting with any of the following:

```
openshift.io
pod-template
```

- The nodes will need access to the pods, for example, for Kubelet health-checks. Make sure the host management interface is able to access the pod network.
- Linux capabilities NET\_ADMIN and NET\_RAW can be exploited by attackers to compromise the pod network. You should disable these two capabilities of untrusted containers. By default, with restricted and anyuid SCC, NET\_ADMIN is not granted. Be wary of any SCC that enables NET\_ADMIN explicitly, or enables the pod to run in privileged mode. In addition, for untrusted containers, create a separate SCC based on, for example, anyuid SCC, with NET\_RAW capability removed. This can be done by adding NET\_RAW to `requiredDropCapabilities` list in the SCC definition.
- Allow root access in PODs/Containers (only for testing). Commands below will require root access in all PODs of the oc project you are currently logged in to.

```
oc new-project test-project
oc project test-project
oc adm policy add-scc-to-user anyuid -z default
```

- Configure (add) the OpenShift Registry.

```
oc login -u system:admin -n default
oc adm registry --service-account=registry --config=/etc/origin/master/admin.kubeconfig
```

- Delete the OpenShift Registry

```
oc login -u system:admin -n default
oc delete svc/docker-registry dc/docker-registry
```

- There is a missing IPtables firewall rule to allow DNS requests from the Docker default bridge containers to the dnsmasq process on the Node. It needs to be opened manually. Edit `/etc/sysconfig/iptables` and add the following Rules at the bottom of the file before COMMIT:

```
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m tcp --dport 53 -j ACCEPT
-A OS_FIREWALL_ALLOW -p udp -m state --state NEW -m udp --dport 53 -j ACCEPT
COMMIT
```

- Restart iptables, docker and origin-node (restarts kube-proxy and kubelet).

```
systemctl restart iptables
systemctl restart docker
systemctl restart origin-node
```

- The internal docker registry of OpenShift needs to be allowed to use non-TLS for OpenShift to work. Normally this should be added automatically by the OpenShift Ansible installer, but it seems that this is currently not working. Edit `/etc/sysconfig/docker` and add:

```
INSECURE_REGISTRY='--insecure-registry 172.30.0.0/16'
```

- Restart Docker.

```
systemctl restart docker
```

- NCP's support for network policies is the same as the support provided by Kubernetes and depends on the Kubernetes version used by OpenShift.
  - OpenShift 3.9 - The rule clauses in the network policy may contain at most one selector from namespaceSelector, podSelector and ipBlock.
- The Kubernetes API server does not perform validation of a network policy specification. It is possible to create a network policy that is invalid. NCP will reject such a network policy. If you update the network policy to make it valid, NCP will still not process the network policy. You must delete the network policy and recreate one with a valid specification.

- Certain versions of Kubernetes has a subPath-related issue (see <https://github.com/kubernetes/kubernetes/issues/61076>). If the OpenShift version does not contain a fix for this issue, the creation of the NCP pod will fail with the error `CreateContainerConfigError: failed to prepare subPath for volumeMount`. You can work around this problem by removing the use of subPath from the NCP yaml. Specifically, remove the line containing `subPath: ncp.ini` and replace the configuration for volumes with the following:

```
volumes:
  - name: config-volume
    # ConfigMap nsx-ncp-config is expected to supply ncp.ini
    configMap:
      name: nsx-ncp-config
      items:
        - key: ncp.ini
          path: ncp.ini
```

A side effect of this change is that the entire `/etc/nsx-ujo` directory becomes read-only. As a result, connecting with NSX-T using certificate and private key will not work because NCP will not be able to create a temporary file under `/etc/nsx-ujo` to move both certificate and private key into a single file.

- If you are running or upgrading to OpenShift 3.10 cluster, note the following:
  - You must specify configuration of Node groups specific to OpenShift 3.10 cluster. Node config map configuration must be provided in inventory hosts file.
  - All hosts defined in the `[nodes]` group in the inventory hosts file must be assigned to a node group name.
  - Upgrading OpenShift cluster from an Ansible playbook might cause network loss. Make sure to add the patch (<https://github.com/openshift/openshift-ansible/pull/8016/files#diff-2386e21861da3f95091dbb27d72ca366>) on the openshift-ansible repository to remove the stop/uninstallation of Open vSwitch packages.
- Starting with OpenShift 3.10, kube-proxy was moved from the openshift-node service to a DaemonSet. It is no longer started by default. Perform the following steps to start kube-proxy manually (assuming that the openshift-ansible repo has been cloned):
  - Go to the openshift-ansible directory, under `[defaults]` set the following:

```
library = roles/lib_utils/library/
```

- Create a `create_proxy.yaml` file in the playbooks directory with the following entries:

```
- import_playbook: byo/openshift_facts.yml
- hosts: masters
  run_once: True
  roles:
    - kube_proxy_and_dns
```

- Run the playbook:

```
ansible-playbook -i hosts playbooks/create_proxy.yaml
```

You will see error messages indicating the failure of some operations. These messages can be ignored. You can verify the result by running the command `oc get po --all-namespaces`.

# Installing NCP in a Bare-Metal Environment

# 4

The steps to install NSX-T Container Plug-in (NCP) in a bare-metal environment are similar to the steps to install NCP in a non-bare-metal environment. The steps that are different are described in this section.

This chapter includes the following topics:

- [Install NSX-T Data Center CNI Plug-in](#)
- [Configure NSX-T Data Center Networking for OpenShift Nodes](#)
- [Install NSX Node Agent](#)
- [Configmap for ncp.ini in nsx-node-agent-ds.yml](#)
- [Install NSX-T Container Plug-in](#)
- [Configmap for ncp.ini in ncp-rc.yml](#)

## Install NSX-T Data Center CNI Plug-in

NSX-T Data Center CNI plug-in must be installed on the OpenShift nodes.

### Procedure

- 1 Download the installation file appropriate to your Linux distribution.

The filename is `nsx-cni-1.0.0.0.0.xxxxxxx-1.x86_64.rpm`, where `xxxxxxx` is the build number.

- 2 Install the rpm file downloaded in step 1.

The plug-in is installed in `/opt/cni/bin`. The CNI configuration file `10.net.conf` is copied to `/etc/cni/net.d`. The rpm will also install the configuration file `/etc/cni/net.d/99-loopback.conf` for the loopback plug-in.

## Configure NSX-T Data Center Networking for OpenShift Nodes

This section describes how to configure NSX-T Data Center networking for OpenShift master and compute nodes.

Each node must be registered with the NSX Manager as OS type RHEL Container. The node's management interface can be used to join the OpenShift cluster, and can be on the NSX-T Data Center fabric or not. The other interfaces provide networking for the pods, and must be on the NSX-T Data Center fabric.

The corresponding transport node must have the following tags:

```
{'nsp/node_name': '<node_name>'}
{'nsp/cluster': '<cluster_name>'}
```

You can identify the transport node for an OpenShift node by navigating to **Fabric > Nodes** from the NSX Manager GUI.

If the OpenShift node name changes, you must update the tag `nsp/node_name` and restart NCP. You can use the following command to get the node names:

```
oc get nodes
```

If you add a node to a cluster while NCP is running, you must add the tags to the transport node before you run the `oc cluster add` command. Otherwise, the new node will not have network connectivity. If the tags are incorrect or missing, you can take the following steps to resolve the issue:

- Apply the correct tags to the transport node.
- Restart NCP.

## Install NSX Node Agent

The NSX node agent is a DaemonSet where each pod runs two containers. One container runs the NSX node agent, whose main responsibility is to manage container network interfaces. It interacts with the CNI plugin and the Kubernetes API server. The other container runs NSX kube-proxy, whose only responsibility is to implement Kubernetes service abstraction by translating cluster IPs into pod IPs. It implements the same functionality as the upstream kube-proxy.

### Procedure

- 1 Download the NCP Docker image.

The filename is `nsx-ncp-xxxxxxx.tar`, where `xxxxxxx` is the build number.

- 2 Download the NSX node agent DaemonSet yaml template.

The filename is `nsx-node-agent-ds.yml`. You can edit this file or use it as an example for your own template file.

- 3 Load the NCP Docker image to your image registry.

```
docker load -i <tar file>
```

- 4 Edit `nsx-node-agent-ds.yml`.

Change the image name to the one that was loaded.



Make the following changes:

```
[coe]
node_type = 'BAREMETAL'
...
[nsx_node_agent]
ovs_bridge = 'nsx-managed'
```

Uncomment the following lines:

```
securityContext:
  capabilities:
    add:
      - NET_ADMIN
      - SYS_ADMIN
      - SYS_PTRACE
      - DAC_READ_SEARCH
      # For BMC usecase
      - DAC_OVERRIDE
volumeMounts:
...
# mount nestdb-sock for baremetal node
- name: nestdb-sock
  mountPath: /var/run/vmware/nestdb/nestdb-server.sock
volumes:
...
# volume for baremetal node
- name: nestdb-sock
  hostPath:
    path: /var/run/vmware/nestdb/nestdb-server.sock
    type: Socket
```

---

**Note** In the yaml file, you must specify that the ConfigMap generated for `ncp.ini` must be mounted as a `ReadOnly` volume. The downloaded yaml file already has this specification, which should not be changed.

---

- 5 Create the NSX node agent DaemonSet with the following command.

```
oc apply -f nsx-node-agent-ds.yml
```

## Configmap for ncp.ini in nsx-node-agent-ds.yml

The sample yaml file `nsx-node-agent-ds.yml` contains a ConfigMap for the configuration file `ncp.ini` for the NSX node agent. This ConfigMap section contains parameters that you can specify to customize your node agent installation.

The sample `nsx-node-agent-ds.yml` that you download has the following `ncp.ini` information:

```
# ConfigMap for ncp.ini
apiVersion: v1
kind: ConfigMap
metadata:
  name: nsx-node-agent-config
  labels:
    version: v1
data:
  ncp.ini: |
    [DEFAULT]

    # Set to True to enable logging to stderr
    #use_stderr = True
    # Set to True to send logs to the syslog daemon
    #use_syslog = False
    # Enabler debug-level logging for the root logger. If set to True, the
    # root logger debug level will be DEBUG, otherwise it will be INFO.
    #debug = True

    # The log file path must be set to something like '/var/log/nsx-ujo/'. By
    # default, logging to file is disabled.
    #log_dir = None

    # Name of log file to send logging output to. If log_dir is set but log_file is
    # not, the binary name will be used, i.e., ncp.log, nsx_node_agent.log and
    # nsx_kube_proxy.log.
    #log_file = None

    # max MB for each compressed file. Defaults to 100 MB
    #log_rotation_file_max_mb = 100

    # Total number of compressed backup files to store. Defaults to 5.
    #log_rotation_backup_count = 5
    [coe]
    #
    # Common options for Container Orchestrators
    #

    # Container orchestrator adaptor to plug in
    # Options: kubernetes (default), openshift, pcf.
    #adaptor = kubernetes

    # Specify cluster for adaptor. It is a prefix of NSX resources name to
    # distinguish multiple clusters who are using the same NSX.
    # This is also used as the tag of IP blocks for cluster to allocate
    # IP addresses. Different clusters should have different IP blocks.
    #cluster = k8scluster

    # Log level for the NCP operations. If set, overrides the level specified
    # for the root logger. Possible values are NOTSET, DEBUG, INFO, WARNING,
    # ERROR, CRITICAL
    #loglevel=None
```

```

# Log level for the NSX API client operations. If set, overrides the level
# specified for the root logger. Possible values are NOTSET, DEBUG, INFO,
# WARNING, ERROR, CRITICAL
nsxlib_loglevel=INFO

# Once enabled, all projects in this cluster will be mapped to a NAT
# topology in NSX backend
#enable_snat = True

# The type of container node. Possible values are HOSTVM, BAREMETAL.
node_type = BAREMETAL

[ha]
#
# NCP High Availability configuration options
#

# Time duration in seconds of mastership timeout. NCP instance will
# remain master for this duration after elected. Note that the heartbeat
# period plus the update timeout must be less than this period. This
# is done to ensure that the master instance will either confirm
# liveness or fail before the timeout.
#master_timeout = 9

# Time in seconds between heartbeats for elected leader. Once an NCP
# instance is elected master, it will periodically confirm liveness based
# on this value.
#heartbeat_period = 3

# Timeout duration in seconds for update to election resource. If the
# update request does not complete before the timeout it will be
# aborted. Used for master heartbeats to ensure that the update finishes
# or is aborted before the master timeout occurs.
#update_timeout = 3

[k8s]
#
# From kubernetes
#

# IP address of the Kubernetes API Server. If not set, will try to
# read and use the Kubernetes Service IP from environment variable
# KUBERNETES_SERVICE_HOST.
#apiserver_host_ip = <ip_address>

# Port of the Kubernetes API Server.
# Set to 6443 for https. If not set, will try to
# read and use the Kubernetes Service port from environment
# variable KUBERNETES_SERVICE_PORT.
#apiserver_host_port = <port>

# Specify a CA bundle file to use in verifying the Kubernetes API server
# certificate. (string value)
#ca_file = <None>
ca_file = /var/run/secrets/kubernetes.io/serviceaccount/ca.crt

```

```

# Full path of the Token file to use for authenticating with the k8s API server.
#client_token_file = <None>
client_token_file = /var/run/secrets/kubernetes.io/serviceaccount/token

# Full path of the client certificate file to use for authenticating
# with the k8s API server. It must be specified together with
# "client_private_key_file"
#client_cert_file = <None>

# Full path of the client certificate file to use for authenticating
# with the k8s API server. It must be specified together with
# "client_cert_file"
#client_private_key_file = <None>

# Log level for the kubernetes adaptor. If set, overrides the level specified
# for the root logger. Possible values are NOTSET, DEBUG, INFO, WARNING,
# ERROR, CRITICAL
#loglevel=None

[nsx_node_agent]
#
# Configuration for nsx_node_agent
#

# Needs to mount node /proc to container if nsx_node_agent runs in a container.
# By default node /proc will be mounted to /host/proc, the prefix is /host.
# It should be the same setting with mounted path in the daemonset yaml file.
# Set the path to '' if nsx_node_agent is running as a process in minion node.
#proc_mount_path_prefix = /host

# The OVS bridge to configure container interface.
#ovs_bridge = br-int

[nsx_kube_proxy]
#
# Configuration for nsx_kube_proxy
#

# The OVS uplink OpenFlow port where to apply the NAT rules to.
# If not specified, the port that gets assigned ofport=1 is used.
#ovs_uplink_port = <None>

```

## Install NSX-T Container Plug-in

NSX-T Container Plug-in (NCP) is delivered as a Docker image. NCP should run on a node for infrastructure services. Running NCP on the master node is not recommended.

### Procedure

- 1 Download the NCP Docker image.

The filename is `nsx-ncp-xxxxxxx.tar`, where `xxxxxxx` is the build number.

**2** Download the NCP ReplicationController yaml template.

The filename is `ncp-rc.yml`. You can edit this file or use it as an example for your own template file.

**3** Load the NCP Docker image to your image registry.

```
docker load -i <tar file>
```

**4** Edit `ncp-rc.yml`.

Set the node type to bare metal.

```
[coe]
node_type = 'BAREMETAL'
```

Change the image name to the one that was loaded.

Specify the `nsx_api_managers` parameter. This release supports a single Kubernetes node cluster and a single NSX Manager instance. For example:

```
nsx_api_managers = 192.168.1.180
```

(Optional) Specify the parameter `ca_file` in the `[nsx_v3]` section. The value should be a CA bundle file to use in verifying the NSX Manager server certificate. If not set, the system root CAs will be used.

Specify the parameters `nsx_api_cert_file` and `nsx_api_private_key_file` for authentication with NSX-T Data Center.

`nsx_api_cert_file` is the full path to a client certificate file in PEM format. The contents of this file should look like the following:

```
-----BEGIN CERTIFICATE-----
<certificate_data_base64_encoded>
-----END CERTIFICATE-----
```

`nsx_api_private_key_file` is the full path to a client private key file in PEM format. The contents of this file should look like the following:

```
-----BEGIN PRIVATE KEY-----
<private_key_data_base64_encoded>
-----END PRIVATE KEY-----
```

Specify the parameter `ingress_mode = nat` if the Ingress controller is configured to run in NAT mode.

By default, subnet prefix 24 is used for all subnets allocated from the IP blocks for the pod logical switches. To use a different subnet size, update the `subnet_prefix` option in the `[nsx_v3]` section.

---

**Note** In the yaml file, you must specify that the ConfigMap generated for `ncp.ini` be mounted as a ReadOnly volume. The downloaded yaml file already has this specification, which should not be changed.

---

## 5 Create NCP ReplicationController.

```
kubectl create -f ncp-rc.yml
```

**Note** NCP opens persistent HTTP connections to the Kubernetes API server to watch for life cycle events of Kubernetes resources. If an API server failure or a network failure causes NCP's TCP connections to become stale, you must restart NCP so that it can re-establish connections to the API server. Otherwise, NCP will miss the new events.

During a rolling update of the NCP ReplicationController, do not reboot the container host. If the host is rebooted for any reason, you might see two NCP pods running after the reboot. In that case, do the following:

- Delete one of the NCP pods. It does not matter which one. For example,

```
oc delete pods <NCP pod name> -n nsx-system
```

- Delete the namespace nsx-system. For example,

```
oc delete -f ncp-rc.yml -n nsx-system
```

## Configmap for ncp.ini in ncp-rc.yml

The sample YAML file `ncp-rc.yml` contains a ConfigMap for the configuration file `ncp.ini`. This ConfigMap section contains parameters that you must specify before you install NCP, as described in the previous section.

The sample `ncp-rc.yml` that you download has the following `ncp.ini` information:

```
# ConfigMap for ncp.ini
apiVersion: v1
kind: ConfigMap
metadata:
  name: nsx-ncp-config
  labels:
    version: v1
data:
  ncp.ini: |
    [DEFAULT]

    # Set to True to enable logging to stderr
    #use_stderr = True
    # Set to True to send logs to the syslog daemon
    #use_syslog = False
    # Enabler debug-level logging for the root logger. If set to True, the
    # root logger debug level will be DEBUG, otherwise it will be INFO.
    #debug = True

    # The log file path must be set to something like '/var/log/nsx-ujo/'. By
```

```

# default, logging to file is disabled.
#log_dir = None

# Name of log file to send logging output to. If log_dir is set but log_file is
# not, the binary name will be used, i.e., ncp.log, nsx_node_agent.log and
# nsx_kube_proxy.log.
#log_file = None

# max MB for each compressed file. Defaults to 100 MB
#log_rotation_file_max_mb = 100

# Total number of compressed backup files to store. Defaults to 5.
#log_rotation_backup_count = 5
[coe]
#
# Common options for Container Orchestrators
#

# Container orchestrator adaptor to plug in
# Options: kubernetes (default), openshift, pcf.
#adaptor = kubernetes

# Specify cluster for adaptor. It is a prefix of NSX resources name to
# distinguish multiple clusters who are using the same NSX.
# This is also used as the tag of IP blocks for cluster to allocate
# IP addresses. Different clusters should have different IP blocks.
#cluster = k8scluster

# Log level for the NCP operations. If set, overrides the level specified
# for the root logger. Possible values are NOTSET, DEBUG, INFO, WARNING,
# ERROR, CRITICAL
#loglevel=None

# Log level for the NSX API client operations. If set, overrides the level
# specified for the root logger. Possible values are NOTSET, DEBUG, INFO,
# WARNING, ERROR, CRITICAL
nsxlib_loglevel=INFO

# Once enabled, all projects in this cluster will be mapped to a NAT
# topology in NSX backend
#enable_snat = True

# The type of container node. Possible values are HOSTVM, BAREMETAL.
node_type = BAREMETAL

[ha]
#
# NCP High Availability configuration options
#

# Time duration in seconds of mastership timeout. NCP instance will
# remain master for this duration after elected. Note that the heartbeat
# period plus the update timeout must be less than this period. This
# is done to ensure that the master instance will either confirm
# liveness or fail before the timeout.

```

```

#master_timeout = 9

# Time in seconds between heartbeats for elected leader. Once an NCP
# instance is elected master, it will periodically confirm liveness based
# on this value.
#heartbeat_period = 3

# Timeout duration in seconds for update to election resource. If the
# update request does not complete before the timeout it will be
# aborted. Used for master heartbeats to ensure that the update finishes
# or is aborted before the master timeout occurs.
#update_timeout = 3

[k8s]
#
# From kubernetes
#

# IP address of the Kubernetes API Server. If not set, will try to
# read and use the Kubernetes Service IP from environment variable
# KUBERNETES_SERVICE_HOST.
#apiserver_host_ip = <ip_address>

# Port of the Kubernetes API Server.
# Set to 6443 for https. If not set, will try to
# read and use the Kubernetes Service port from environment
# variable KUBERNETES_SERVICE_PORT.
#apiserver_host_port = <port>

# Specify a CA bundle file to use in verifying the Kubernetes API server
# certificate. (string value)
#ca_file = <None>
ca_file = /var/run/secrets/kubernetes.io/serviceaccount/ca.crt

# Full path of the Token file to use for authenticating with the k8s API server.
#client_token_file = <None>
client_token_file = /var/run/secrets/kubernetes.io/serviceaccount/token

# Full path of the client certificate file to use for authenticating
# with the k8s API server. It must be specified together with
# "client_private_key_file"
#client_cert_file = <None>

# Full path of the client certificate file to use for authenticating
# with the k8s API server. It must be specified together with
# "client_cert_file"
#client_private_key_file = <None>

# Log level for the kubernetes adaptor. If set, overrides the level specified
# for the root logger. Possible values are NOTSET, DEBUG, INFO, WARNING,
# ERROR, CRITICAL
#loglevel=None

# Specify how ingress controllers are expected to be deployed. Possible values:
# hostnetwork or nat. NSX will create NAT rules only in the second case.

```



```

#ingress_mode = hostnetwork

[nsx_v3]
#
# From nsx
#

# IP address of one or more NSX managers separated by commas. The IP address
# should be of the form (list value):
# <ip_address1>[:<port1>],<ip_address2>[:<port2>],...
# HTTPS will be used for communication with NSX. If port is not provided,
# port 443 will be used.
#nsx_api_managers = <ip_address>

# If true, the NSX Manager server certificate is not verified. If false the CA
# bundle specified via "ca_file" will be used or if unset the default system
# root CAs will be used. (boolean value)
#insecure = False

# Specify one or a list of CA bundle files to use in verifying the NSX Manager
# server certificate. This option is ignored if "insecure" is set to True. If
# "insecure" is set to False and ca_file is unset, the system root CAs will be
# used to verify the server certificate. (list value)
#ca_file = <None>

# Path to NSX client certificate file. If specified, the nsx_api_user and
# nsx_api_password options will be ignored. This option must be specified
# along with "nsx_api_private_key_file" option.
#nsx_api_cert_file = <None>

# Path to NSX client private key file. If specified, the nsx_api_user and
# nsx_api_password options will be ignored. This option must be specified
# along with "nsx_api_cert_file" option.
#nsx_api_private_key_file = <None>

# The time in seconds before aborting a HTTP connection to a NSX manager.
# (integer value)
#http_timeout = 10

# The time in seconds before aborting a HTTP read response from a NSX manager.
# (integer value)
#http_read_timeout = 180

# Maximum number of times to retry a HTTP connection. (integer value)
#http_retries = 3

# Maximum concurrent connections to each NSX manager. (integer value)
#concurrent_connections = 10

# The amount of time in seconds to wait before ensuring connectivity to the NSX
# manager if no manager connection has been used. (integer value)
#conn_idle_timeout = 10

# Number of times a HTTP redirect should be followed. (integer value)
#redirects = 2

```

```

# Maximum number of times to retry API requests upon stale revision errors.
# (integer value)
#retries = 10

# Subnet prefix of IP block. IP block will be retrieved from NSX API and
# recognised by tag 'cluster'.
# Prefix should be less than 31, as two addresses(the first and last addresses)
# need to be network address and broadcast address.
# The prefix is fixed after the first subnet is created. It can be changed only
# if there is no subnets in IP block.
#subnet_prefix = 24

# Indicates whether distributed firewall DENY rules are logged.
#log_dropped_traffic = False

# Option to use native loadbalancer support.
#use_native_loadbalancer = False

# Used when ingress class annotation is missing
# if set to true, the ingress will be handled by nsx lbs
# otherwise will be handled by 3rd party ingress controller (e.g. nginx)
#default_ingress_class_nsx = True

# Path to the default certificate file for HTTPS load balancing
#lb_default_cert_path = <None>

# Path to the private key file for default certificate for HTTPS load balancing
#lb_priv_key_path = <None>

# Option to set load balancing algorithm in load balancer pool object.
# Available choices are
# ROUND_ROBIN/LEAST_CONNECTION/IP_HASH/WEIGHTED_ROUND_ROBIN
#pool_algorithm = 'ROUND_ROBIN'

# Option to set load balancer service size. Available choices are
# SMALL/MEDIUM/LARGE.
# MEDIUM Edge VM (4 vCPU, 8GB) only supports SMALL LB.
# LARGE Edge VM (8 vCPU, 16GB) only supports MEDIUM and SMALL LB.
# Bare Metal Edge (IvyBridge, 2 socket, 128GB) supports LARGE, MEDIUM and
# SMALL LB
#service_size = 'SMALL'

# Choice of persistence type for ingress traffic through L7 Loadbalancer.
# Accepted values:
# 'cookie'
# 'source_ip'
#l7_persistence = <None>

# Choice of persistence type for ingress traffic through L4 Loadbalancer.
# Accepted values:
# 'source_ip'
#l4_persistence = <None>

# Name or UUID of the tier0 router that project tier1 routers connect to

```

```
#tier0_router = <None>

# Name or UUID of the NSX overlay transport zone that will be used for creating
# logical switches for container networking. It must refer to an existing
# transport zone on NSX and every hypervisor that hosts the Kubernetes
# node VMs must join this transport zone
#overlay_tz = <None>

# Name or UUID of the NSX lb service that can be attached by virtual servers
#lb_service = <None>

# Name or UUID of the container ip blocks that will be used for creating
# subnets. If name, it must be unique
#container_ip_blocks = <None>

# Name or UUID of the container ip blocks that will be used for creating
# subnets for no-SNAT projects. If specified, no-SNAT projects will use these
# ip blocks ONLY. Otherwise they will use container_ip_blocks
#no_snat_ip_blocks = <None>

# Name or UUID of the external ip pools that will be used for allocating IP
# addresses which will be used for translating container IPs via SNAT rules
#external_ip_pools = <None>

# Firewall sections for this cluster will be created below this mark section
#top_firewall_section_marker = <None>

# Firewall sections for this cluster will be created above this mark section
#bottom_firewall_section_marker = <None>
```

# Load Balancing

The NSX-T Data Center load balancer is integrated with OpenShift and acts as the OpenShift Router..

NCP watches OpenShift route and endpoint events and configures load balancing rules on the load balancer based on the route specification. As a result, the NSX-T Data Center load balancer will forward incoming layer 7 traffic to the appropriate backend pods based on the rules.

## Configuring Load Balancing

Configuring load balancing involves configuring a Kubernetes LoadBalancer service or an OpenShift route. You also need to configure the NCP replication controller. The LoadBalancer service is for layer 4 traffic and the OpenShift route is for layer 7 traffic.

When you configure a Kubernetes LoadBalancer service, it is allocated an IP address from the external IP block that you configure. The load balancer is exposed on this IP address and the service port. You can specify the name or ID of an IP pool using the `loadBalancerIP` spec in the LoadBalancer definition. The Loadbalancer service's IP will be allocated from this IP pool. If the `loadBalancerIP` spec is empty, the IP will be allocated from the external IP block that you configure.

Starting with NCP 2.3.1, the IP pool specified by `loadBalancerIP` must have the tag `{"ncp/owner": cluster:<cluster>}`.

To use the NSX-T Data Center load balancer, you must configure load balancing in NCP. In the `ncp_rc.yml` file, do the following:

- 1 Set `use_native_loadbalancer = True`.
- 2 Set `pool_algorithm` to `WEIGHTED_ROUND_ROBIN`.
- 3 Set `lb_default_cert_path` and `lb_priv_key_path` to be the full path names of the CA-signed certificate file and the private key file, respectively. See below for a sample script to generate a CA-signed certificate. In addition, mount the default certificate and key into the NCP pod. See below for instructions.

- 4 (Optional) Specify a persistence setting with the parameters `l4_persistence` and `l7_persistence`. The available option for layer 4 persistence is source IP. The available options for layer 7 persistence are cookie and source IP. The default is `<None>`. For example,

```
# Choice of persistence type for ingress traffic through L7 Loadbalancer.
# Accepted values:
# 'cookie'
# 'source_ip'
l7_persistence = cookie

# Choice of persistence type for ingress traffic through L4 Loadbalancer.
# Accepted values:
# 'source_ip'
l4_persistence = source_ip
```

- 5 (Optional) Set `service_size` = SMALL, MEDIUM, or LARGE. The default is SMALL.
- 6 If you are running OpenShift 3.11, you must perform the following configuration so that OpenShift will not assign an IP to the LoadBalancer service.
- Set `ingressIPNetworkCIDR` to `0.0.0.0/32` under `networkConfig` in the `/etc/origin/master/master-config.yaml` file.
  - Restart the API server and controllers with the following commands:

```
master-restart api
master-restart controllers
```

**Note** If you configure both a layer 4 and a layer 7 load balancer, you can set either `l4_persistence` or `l7_persistence`, or both to `source_ip`, but you cannot set `l4_persistence` to `source_ip` and `l7_persistence` to `cookie`. If by mistake you set `l4_persistence` to `source_ip` and `l7_persistence` to `cookie`, the LoadBalancer service will not work. To resolve the issue, you must delete the Ingress resource and the LoadBalancer service, change the persistence settings, restart NCP, and recreate the Ingress resource and the LoadBalancer service.

## Layer 7 Load Balancer Example

The following YAML file configures two replication controllers (`tea-rc` and `coffee-rc`), two services (`tea-svc` and `coffee-svc`), and two routes (`cafe-route-multi` and `cafe-route`) to provide layer 7 load balancing.

```
# RC
apiVersion: v1
kind: ReplicationController
metadata:
  name: tea-rc
spec:
  replicas: 2
  template:
    metadata:
      labels:
        app: tea
```

```

    spec:
      containers:
      - name: tea
        image: nginxdemos/hello
        imagePullPolicy: IfNotPresent
        ports:
        - containerPort: 80
---
apiVersion: v1
kind: ReplicationController
metadata:
  name: coffee-rc
spec:
  replicas: 2
  template:
    metadata:
      labels:
        app: coffee
    spec:
      containers:
      - name: coffee
        image: nginxdemos/hello
        imagePullPolicy: IfNotPresent
        ports:
        - containerPort: 80
---
# Services
apiVersion: v1
kind: Service
metadata:
  name: tea-svc
  labels:
    app: tea
spec:
  ports:
  - port: 80
    targetPort: 80
    protocol: TCP
    name: http
  selector:
    app: tea
---
apiVersion: v1
kind: Service
metadata:
  name: coffee-svc
  labels:
    app: coffee
spec:
  ports:
  - port: 80
    targetPort: 80
    protocol: TCP
    name: http
  selector:

```

```

    app: coffee
---
# Routes
apiVersion: v1
kind: Route
metadata:
  name: cafe-route-multi
spec:
  host: www.cafe.com
  path: /drinks
  to:
    kind: Service
    name: tea-svc
    weight: 1
  alternateBackends:
  - kind: Service
    name: coffee-svc
    weight: 2
---
apiVersion: v1
kind: Route
metadata:
  name: cafe-route
spec:
  host: www.cafe.com
  path: /tea-svc
  to:
    kind: Service
    name: tea-svc
    weight: 1

```

## Additional Notes

- Only Edge termination is supported for HTTPS traffic.
- Wildcard subdomain is supported. For example, if wildcardPolicy is set to **Subdomain**, and the host name is set to **wildcard.example.com**, any request to **\*.example.com** will be serviced.
- If NCP throws an error during the processing of a Route event due to misconfiguration, you need to correct the Route YAML file, delete and recreate the Route resource.
- NCP does not enforce hostname ownership by namespaces.
- One Loadbalancer service is supported per Kubernetes cluster.
- NSX-T Data Center will create a layer 4 load balancer virtual server and pool for each LoadBalancer service port. Both TCP and UDP are supported.
- The NSX-T Data Center load balancer comes in different sizes. For information about configuring an NSX-T Data Center load balancer, see the *NSX-T Administration Guide*.

The small NSX-T Data Center load balancer supports the following:

- 10 NSX-T virtual servers.

- 10 NSX-T pools.
- 30 NSX-T pool members.
- 8 ports for LoadBalancer services.
- A total of 10 ports defined by the LoadBalancer services and Route resources.
- A total of 30 endpoints referenced by the LoadBalancer services and Route resources.

The medium NSX-T Data Center load balancer supports the following:

- 100 NSX-T virtual servers.
- 100 NSX-T pools.
- 300 NSX-T pool members.
- 98 ports for LoadBalancer services.
- A total of 100 ports defined by the LoadBalancer services and Route resources.
- A total of 300 endpoints referenced by the LoadBalancer services and Route resources.

The large NSX-T Data Center load balancer supports the following:

- 1000 NSX-T virtual servers.
- 1000 NSX-T pools.
- 3000 NSX-T pool members.
- 998 ports for LoadBalancer services.
- A total of 1000 ports defined by the LoadBalancer services and Route resources.
- A total of 3000 endpoints referenced by the LoadBalancer services and Route resources.

After the load balancer is created, the load balancer size cannot be changed by updating the configuration file. It can be changed through the UI or API.

- Starting with NCP 2.3.1, automatic scaling of the layer 4 load balancer is supported. If a Kubernetes LoadBalancer service is created or modified so that it requires additional virtual servers and the existing layer 4 load balancer does not have the capacity, a new layer 4 load balancer will be created. NCP will also delete a layer 4 load balancer that no longer has virtual servers attached. This feature is enabled by default. You can disable it by setting `l4_lb_auto_scaling` to **false** in the NCP ConfigMap. This feature requires NSX-T Data Center 2.3 or later releases.



## Sample Script to Generate a CA-Signed Certificate

The script below generates a CA-signed certificate and a private key stored in the files <filename>.crt and <filename>.key, respectively. The `genrsa` command generates a CA key. The CA key should be encrypted. You can specify an encryption method with the command such as `aes256`.

```
#!/bin/bash
host="www.example.com"
filename=server

openssl genrsa -out ca.key 4096
openssl req -key ca.key -new -x509 -days 365 -sha256 -extensions v3_ca -out ca.crt -subj
"/C=US/ST=CA/L=Palo Alto/O=OS3/OU=Eng/CN=${host}"
openssl req -out ${filename}.csr -new -newkey rsa:2048 -nodes -keyout ${filename}.key -subj
"/C=US/ST=CA/L=Palo Alto/O=OS3/OU=Eng/CN=${host}"
openssl x509 -req -days 360 -in ${filename}.csr -CA ca.crt -CAkey ca.key -CAcreateserial -out $
{filename}.crt -sha256
```

## Mount the Default Certificate and Key into the NCP Pod

After the certificate and private key have been generated, place them in the directory `/etc/nsx-ujo` on the host VM. Assuming the certificate and key files are named `lb-default.crt` and `lb-default.key`, respectively, edit `ncp-rc.yaml` so that these files on the host are mounted into the pod. For example,

```
spec:
  ...
  containers:
  - name: nsx-ncp
    ...
    volumeMounts:
    ...
    - name: lb-default-cert
      # Mount path must match nsx_v3 option "lb_default_cert_path"
      mountPath: /etc/nsx-ujo/lb-default.crt
    - name: lb-priv-key
      # Mount path must match nsx_v3 option "lb_priv_key_path"
      mountPath: /etc/nsx-ujo/lb-default.key
  volumes:
  ...
  - name: lb-default-cert
    hostPath:
      path: /etc/nsx-ujo/lb-default.crt
  - name: lb-priv-key
    hostPath:
      path: /etc/nsx-ujo/lb-default.key
```

# Administering NSX-T Container Plug-in

# 6

You can administer NSX-T Container Plug-in from the NSX Manager GUI or from the command-line interface (CLI).

---

**Note** If a container host VM is running on ESXi 6.5 and the VM is migrated through vMotion to another ESXi 6.5 host, containers running on the container host will lose connectivity to containers running on other container hosts. You can resolve the problem by disconnecting and connecting the vNIC of the container host. This issue does not occur with ESXi 6.5 Update 1 or later.

Hyperbus reserves VLAN ID 4094 on the hypervisor for PVLAN configuration and this ID cannot be changed. To avoid any VLAN conflict, do not configure VLAN logical switches or VTEP vmknics with the same VLAN ID.

---

This chapter includes the following topics:

- [Manage IP Blocks from the NSX Manager GUI](#)
- [View IP Block Subnets from the NSX Manager GUI](#)
- [CIF-Attached Logical Ports](#)
- [CLI Commands](#)
- [Error Codes](#)

## Manage IP Blocks from the NSX Manager GUI

You can add, delete, edit, view details of, and manage the tags for an IP block from the NSX Manager GUI.

### Procedure

- 1 From a browser, log in to the NSX Manager at `https://<nsx-manager-IP-address-or-domain-name>`.
- 2 Navigate to **Networking > IPAM**.

A list of the existing IP blocks is displayed.

### 3 Perform any of the following actions.

Option	Action
Add an IP block	Click <b>ADD</b> .
Delete one or more IP blocks	Select one or more IP blocks and click <b>DELETE</b> .
Edit an IP block	Select an IP block and click <b>EDIT</b> .
View details about an IP block	Click the IP block name. Click the <b>Overview</b> tab to see general information. Click the <b>Subnets</b> tab to see this IP block's subnets.
Manage tags for an IP block	Select an IP block and click <b>ACTIONS &gt; Manage Tags</b> .

You cannot delete an IP block that has subnets allocated.

## View IP Block Subnets from the NSX Manager GUI

You can view the subnets for an IP block from the NSX Manager GUI. Adding or deleting IP block subnets after NCP is installed and running is not recommended.

### Procedure

- 1 From a browser, log in to the NSX Manager at `https://<nsx-manager-IP-address-or-domain-name>`.
- 2 Navigate to **Networking > IPAM**.  
A list of the existing IP blocks is displayed.
- 3 Click an IP block name
- 4 Click the **Subnets** tab.

## CIF-Attached Logical Ports

CIFs (container interfaces) are network interfaces on containers that are connected to logical ports on a switch. These ports are called CIF-attached logical ports.

You can manage CIF-attached logical ports from the NSX Manager GUI.

## Managing CIF-Attached Logical Ports

Navigate to **Networking > Switching > Ports** to see all logical ports, including CIF-attached logical ports. Click the attachment link of a CIF-attached logical port to see the attachment information. Click the logical port link to open a window pane with four tabs: Overview, Monitor, Manage, and Related. Clicking **Related > Logical Ports** shows the related logical port on an uplink switch. For more information about switch ports, see the *NSX-T Administration Guide*.

## Network Monitoring Tools

The following tools support CIF-attached logical ports. For more information about these tools, see the *NSX-T Administration Guide*.

- Traceflow
- Port Connection
- IPFIX
- Remote port mirroring using GRE encapsulation of a logical switch port that connects to a container is supported. For more information, see "Understanding Port Mirroring Switching Profile" in the *NSX-T Administration Guide*. However, port mirroring of the CIF to VIF port is not supported via the manager UI.

## CLI Commands

To run CLI commands, log in to the NSX-T Container Plug-in container, open a terminal and run the `nsxcli` command.

You can also get the CLI prompt by running the following command on a node:

```
kubectl exec -it <pod name> nsxcli
```

**Table 6-1. CLI Commands for the NCP Container**

Type	Command
Status	get ncp-master status
Status	get ncp-nsx status
Status	get ncp-watcher <watcher-name>
Status	get ncp-watchers
Status	get ncp-k8s-api-server status
Status	check projects
Status	check project <project-name>
Cache	get project-cache <project-name>
Cache	get project-caches
Cache	get namespace-cache <namespace-name>
Cache	get namespace-caches
Cache	get pod-cache <pod-name>
Cache	get pod-caches
Cache	get ingress-caches
Cache	get ingress-cache <ingress-name>
Cache	get ingress-controllers

**Table 6-1. CLI Commands for the NCP Container (Continued)**

Type	Command
Cache	get ingress-controller <ingress-controller-name>
Cache	get network-policy-caches
Cache	get network-policy-cache <pod-name>
Support	get ncp-log file <filename>
Support	get ncp-log-level
Support	set ncp-log-level <log-level>
Support	get support-bundle file <filename>
Support	get node-agent-log file <filename>
Support	get node-agent-log file <filename> <node-name>

**Table 6-2. CLI Commands for the NSX Node Agent Container**

Type	Command
Status	get node-agent-hyperbus status
Cache	get container-cache <container-name>
Cache	get container-caches

**Table 6-3. CLI Commands for the NSX Kube Proxy Container**

Type	Command
Status	get ncp-k8s-api-server status
Status	get kube-proxy-watcher <watcher-name>
Status	get kube-proxy-watchers
Status	dump ovs-flows

## Status Commands for the NCP Container

- Show the status of the NCP master

```
get ncp-master status
```

Example:

```
kubenode> get ncp-master status
This instance is not the NCP master
Current NCP Master id is a4h83eh1-b8dd-4e74-c71c-cbb7cc9c4c1c
Last master update at Wed Oct 25 22:46:40 2017
```

- Show the connection status between NCP and NSX Manager

```
get ncp-nsx status
```

Example:

```
kubecall> get ncp-nsx status
NSX Manager status: Healthy
```

- Show the watcher status for ingress, namespace, pod, and service

```
get ncp-watcher <watcher-name>
get ncp-watchers
```

Example 1:

```
kubecall> get ncp-watcher pod
Average event processing time: 1174 msec (in past 3600-sec window)
Current watcher started time: Mar 02 2017 10:47:35 PST
Number of events processed: 1 (in past 3600-sec window)
Total events processed by current watcher: 1
Total events processed since watcher thread created: 1
Total watcher recycle count: 0
Watcher thread created time: Mar 02 2017 10:47:35 PST
Watcher thread status: Up
```

Example 2:

```
kubecall> get ncp-watchers
pod:
Average event processing time: 1145 msec (in past 3600-sec window)
Current watcher started time: Mar 02 2017 10:51:37 PST
Number of events processed: 1 (in past 3600-sec window)
Total events processed by current watcher: 1
Total events processed since watcher thread created: 1
Total watcher recycle count: 0
Watcher thread created time: Mar 02 2017 10:51:37 PST
Watcher thread status: Up

namespace:
Average event processing time: 68 msec (in past 3600-sec window)
Current watcher started time: Mar 02 2017 10:51:37 PST
Number of events processed: 2 (in past 3600-sec window)
Total events processed by current watcher: 2
Total events processed since watcher thread created: 2
Total watcher recycle count: 0
Watcher thread created time: Mar 02 2017 10:51:37 PST
Watcher thread status: Up

ingress:
Average event processing time: 0 msec (in past 3600-sec window)
Current watcher started time: Mar 02 2017 10:51:37 PST
Number of events processed: 0 (in past 3600-sec window)
Total events processed by current watcher: 0
Total events processed since watcher thread created: 0
Total watcher recycle count: 0
Watcher thread created time: Mar 02 2017 10:51:37 PST
```

```
Watcher thread status: Up
```

```
service:
```

```
Average event processing time: 3 msec (in past 3600-sec window)
Current watcher started time: Mar 02 2017 10:51:37 PST
Number of events processed: 1 (in past 3600-sec window)
Total events processed by current watcher: 1
Total events processed since watcher thread created: 1
Total watcher recycle count: 0
Watcher thread created time: Mar 02 2017 10:51:37 PST
Watcher thread status: Up
```

- Show the connection status between NCP and Kubernetes API server

```
get ncp-k8s-api-server status
```

Example:

```
kubecall> get ncp-k8s-api-server status
Kubernetes ApiServer status: Healthy
```

- Check all projects or a specific one

```
check projects
check project <project-name>
```

Example:

```
kubecall> check projects
default:
  Tier-1 link port for router 1b90a61f-0f2c-4768-9eb6-ea8954b4f327 is missing
  Switch 40a6829d-c3aa-4e17-ae8a-7f7910fdf2c6 is missing

ns1:
  Router 8accc9cd-9883-45f6-81b3-0d1fb2583180 is missing

kubecall> check project default
  Tier-1 link port for router 1b90a61f-0f2c-4768-9eb6-ea8954b4f327 is missing
  Switch 40a6829d-c3aa-4e17-ae8a-7f7910fdf2c6 is missing
```

## Cache Commands for the NCP Container

- Get the internal cache for projects or namespaces

```
get project-cache <project-name>
get project-caches
get namespace-cache <namespace-name>
get namespace-caches
```

## Example:

```
kubenode> get project-caches
default:
  logical-router: 8accc9cd-9883-45f6-81b3-0d1fb2583180
  logical-switch:
    id: 9d7da647-27b6-47cf-9cdb-6e4f4d5a356d
    ip_pool_id: 519ff57f-061f-4009-8d92-3e6526e7c17e
    subnet: 10.0.0.0/24
    subnet_id: f75fd64c-c7b0-4b42-9681-fc656ae5e435

kube-system:
  logical-router: 5032b299-acad-448e-a521-19d272a08c46
  logical-switch:
    id: 85233651-602d-445d-ab10-1c84096cc22a
    ip_pool_id: ab1c5b09-7004-4206-ac56-85d9d94bffa2
    subnet: 10.0.1.0/24
    subnet_id: 73e450af-b4b8-4a61-a6e3-c7ddd15ce751

testns:
  ext_pool_id: 346a0f36-7b5a-4ecc-ad32-338dcb92316f
  labels:
    ns: myns
    project: myproject
  logical-router: 4dc8f8a9-69b4-4ff7-8fb7-d2625dc77efa
  logical-switch:
    id: 6111a99a-6e06-4faa-a131-649f10f7c815
    ip_pool_id: 51ca058d-c3dc-41fd-8f2d-e69006ab1b3d
    subnet: 50.0.2.0/24
    subnet_id: 34f79811-bd29-4048-a67d-67ceac97eb98
  project_nsgroup: 9606afee-6348-4780-9dbe-91abfd23e475
  snat_ip: 4.4.0.3

kubenode> get project-cache default
logical-router: 8accc9cd-9883-45f6-81b3-0d1fb2583180
logical-switch:
  id: 9d7da647-27b6-47cf-9cdb-6e4f4d5a356d
  ip_pool_id: 519ff57f-061f-4009-8d92-3e6526e7c17e
  subnet: 10.0.0.0/24
  subnet_id: f75fd64c-c7b0-4b42-9681-fc656ae5e435

kubenode> get namespace-caches
default:
  logical-router: 8accc9cd-9883-45f6-81b3-0d1fb2583180
  logical-switch:
    id: 9d7da647-27b6-47cf-9cdb-6e4f4d5a356d
    ip_pool_id: 519ff57f-061f-4009-8d92-3e6526e7c17e
    subnet: 10.0.0.0/24
    subnet_id: f75fd64c-c7b0-4b42-9681-fc656ae5e435

kube-system:
  logical-router: 5032b299-acad-448e-a521-19d272a08c46
  logical-switch:
    id: 85233651-602d-445d-ab10-1c84096cc22a
    ip_pool_id: ab1c5b09-7004-4206-ac56-85d9d94bffa2
```



```

        subnet: 10.0.1.0/24
        subnet_id: 73e450af-b4b8-4a61-a6e3-c7ddd15ce751

testns:
  ext_pool_id: 346a0f36-7b5a-4ecc-ad32-338dcb92316f
  labels:
    ns: myns
    project: myproject
  logical-router: 4dc8f8a9-69b4-4ff7-8fb7-d2625dc77efa
  logical-switch:
    id: 6111a99a-6e06-4faa-a131-649f10f7c815
    ip_pool_id: 51ca058d-c3dc-41fd-8f2d-e69006ab1b3d
    subnet: 50.0.2.0/24
    subnet_id: 34f79811-bd29-4048-a67d-67ceac97eb98
  project_nsgroup: 9606afee-6348-4780-9dbe-91abfd23e475
  snat_ip: 4.4.0.3

kubenode> get namespace-cache default
logical-router: 8accc9cd-9883-45f6-81b3-0d1fb2583180
logical-switch:
  id: 9d7da647-27b6-47cf-9cdb-6e4f4d5a356d
  ip_pool_id: 519ff57f-061f-4009-8d92-3e6526e7c17e
  subnet: 10.0.0.0/24
  subnet_id: f75fd64c-c7b0-4b42-9681-fc656ae5e435

```

#### ■ Get the internal cache for pods

```

get pod-cache <pod-name>
get pod-caches

```

Example:

```

kubenode> get pod-caches
nsx.default.nginx-rc-ug2lv:
  cif_id: 2af9f734-37b1-4072-ba88-abbf935bf3d4
  gateway_ip: 10.0.0.1
  host_vif: d6210773-5c07-4817-98db-451bd1f01937
  id: 1c8b5c52-3795-11e8-ab42-005056b198fb
  ingress_controller: False
  ip: 10.0.0.2/24
  labels:
    app: nginx
  mac: 02:50:56:00:08:00
  port_id: d52c833a-f531-4bdf-bfa2-e8a084a8d41b
  vlan: 1

nsx.testns.web-pod-1:
  cif_id: ce134f21-6be5-43fe-afbf-aaca8c06b5cf
  gateway_ip: 50.0.2.1
  host_vif: d6210773-5c07-4817-98db-451bd1f01937
  id: 3180b521-270e-11e8-ab42-005056b198fb
  ingress_controller: False
  ip: 50.0.2.3/24
  labels:

```

```

    app: nginx-new
    role: db
    tier: cache
    mac: 02:50:56:00:20:02
    port_id: 81bc2b8e-d902-4cad-9fc1-aabdc32ecaf8
    vlan: 3

kubenode> get pod-cache nsx.default.nginx-rc-uj2lv
  cif_id: 2af9f734-37b1-4072-ba88-abbf935bf3d4
  gateway_ip: 10.0.0.1
  host_vif: d6210773-5c07-4817-98db-451bd1f01937
  id: 1c8b5c52-3795-11e8-ab42-005056b198fb
  ingress_controller: False
  ip: 10.0.0.2/24
  labels:
    app: nginx
  mac: 02:50:56:00:08:00
  port_id: d52c833a-f531-4bdf-bfa2-e8a084a8d41b
  vlan: 1

```

#### ■ Get network policy caches or a specific one

```

get network-policy caches
get network-policy-cache <network-policy-name>

```

Example:

```

kubenode> get network-policy-caches
nsx.testns.allow-tcp-80:
  dest_labels: None
  dest_pods:
    50.0.2.3
  match_expressions:
    key: tier
    operator: In
    values:
      cache
  name: allow-tcp-80
  np_dest_ip_set_ids:
    22f82d76-004f-4d12-9504-ce1cb9c8aa00
  np_except_ip_set_ids:
  np_ip_set_ids:
    14f7f825-f1a0-408f-bbd9-bb2f75d44666
  np_isol_section_id: c8d93597-9066-42e3-991c-c550c46b2270
  np_section_id: 04693136-7925-44f2-8616-d809d02cd2a9
  ns_name: testns
  src_egress_rules: None
  src_egress_rules_hash: 97d170e1550eee4afc0af065b78cda302a97674c
  src_pods:
    50.0.2.0/24
  src_rules:
    from:
      namespaceSelector:
      matchExpressions:

```

```

        key: tier
        operator: DoesNotExist
      matchLabels:
        ns: myns
    ports:
      port: 80
      protocol: TCP
    src_rules_hash: e4ea7b8d91c1e722670a59f971f8fcc1a5ac51f1

kubenode> get network-policy-cache nsx.testns.allow-tcp-80
dest_labels: None
dest_pods:
  50.0.2.3
match_expressions:
  key: tier
  operator: In
  values:
    cache
name: allow-tcp-80
np_dest_ip_set_ids:
  22f82d76-004f-4d12-9504-ce1cb9c8aa00
np_except_ip_set_ids:
np_ip_set_ids:
  14f7f825-f1a0-408f-bbd9-bb2f75d44666
np_isol_section_id: c8d93597-9066-42e3-991c-c550c46b2270
np_section_id: 04693136-7925-44f2-8616-d809d02cd2a9
ns_name: testns
src_egress_rules: None
src_egress_rules_hash: 97d170e1550eee4afc0af065b78cda302a97674c
src_pods:
  50.0.2.0/24
src_rules:
  from:
    namespaceSelector:
      matchExpressions:
        key: tier
        operator: DoesNotExist
      matchLabels:
        ns: myns
    ports:
      port: 80
      protocol: TCP
  src_rules_hash: e4ea7b8d91c1e722670a59f971f8fcc1a5ac51f1

```

## Support Commands for the NCP Container

- Save the NCP support bundle in the filestore

The support bundle consists of the log files for all the containers in pods with the label **tier:nsx-networking**. The bundle file is in the tgz format and saved in the CLI default filestore directory `/var/vmware/nsx/file-store`. You can use the CLI file-store command to copy the bundle file to a remote site.

```
get support-bundle file <filename>
```

Example:

```
kubenode>get support-bundle file foo
Bundle file foo created in tgz format
kubenode>copy file foo url scp://nicira@10.0.0.1:/tmp
```

- Save the NCP logs in the filestore

The log file is saved in the tgz format in the CLI default filestore directory `/var/vmware/nsx/file-store`. You can use the CLI file-store command to copy the bundle file to a remote site.

```
get ncp-log file <filename>
```

Example:

```
kubenode>get ncp-log file foo
Log file foo created in tgz format
```

- Save the node agent logs in the filestore

Save the node agent logs from one node or all the nodes. The logs are saved in the tgz format in the CLI default filestore directory `/var/vmware/nsx/file-store`. You can use the CLI file-store command to copy the bundle file to a remote site.

```
get node-agent-log file <filename>
get node-agent-log file <filename> <node-name>
```

Example:

```
kubenode>get node-agent-log file foo
Log file foo created in tgz format
```

- Get and set the log level

The available log levels are NOTSET, DEBUG, INFO, WARNING, ERROR, and CRITICAL.

```
get ncp-log-level
set ncp-log-level <log level>
```

Example:

```
kubenode>get ncp-log-level
NCP log level is INFO

kubenode>set ncp-log-level DEBUG
NCP log level is changed to DEBUG
```

## Status Commands for the NSX Node Agent Container

- Show the connection status between the node agent and HyperBus on this node.

```
get node-agent-hyperbus status
```

Example:

```
kubenode> get node-agent-hyperbus status
HyperBus status: Healthy
```

## Cache Commands for the NSX Node Agent Container

- Get the internal cache for NSX node agent containers.

```
get container-cache <container-name>
get container-caches
```

Example 1:

```
kubenode> get container-cache cif104
ip: 192.168.0.14/32
mac: 50:01:01:01:01:14
gateway_ip: 169.254.1.254/16
vlan_id: 104
```

Example 2:

```
kubenode> get container-caches
cif104:
ip: 192.168.0.14/32
mac: 50:01:01:01:01:14
gateway_ip: 169.254.1.254/16
vlan_id: 104
```

## Status Commands for the NSX Kube-Proxy Container

- Show the connection status between Kube Proxy and Kubernetes API Server

```
get ncp-k8s-api-server status
```

Example:

```
kubecall> get kube-proxy-k8s-api-server status
Kubernetes ApiServer status: Healthy
```

- Show the Kube Proxy watcher status

```
get kube-proxy-watcher <watcher-name>
get kube-proxy-watchers
```

Example 1:

```
kubecall> get kube-proxy-watcher endpoint
Average event processing time: 15 msec (in past 3600-sec window)
Current watcher started time: May 01 2017 15:06:24 PDT
Number of events processed: 90 (in past 3600-sec window)
Total events processed by current watcher: 90
Total events processed since watcher thread created: 90
Total watcher recycle count: 0
Watcher thread created time: May 01 2017 15:06:24 PDT
Watcher thread status: Up
```

Example 2:

```
kubecall> get kube-proxy-watchers
endpoint:
Average event processing time: 15 msec (in past 3600-sec window)
Current watcher started time: May 01 2017 15:06:24 PDT
Number of events processed: 90 (in past 3600-sec window)
Total events processed by current watcher: 90
Total events processed since watcher thread created: 90
Total watcher recycle count: 0
Watcher thread created time: May 01 2017 15:06:24 PDT
Watcher thread status: Up

service:
Average event processing time: 8 msec (in past 3600-sec window)
Current watcher started time: May 01 2017 15:06:24 PDT
Number of events processed: 2 (in past 3600-sec window)
Total events processed by current watcher: 2
Total events processed since watcher thread created: 2
Total watcher recycle count: 0
Watcher thread created time: May 01 2017 15:06:24 PDT
Watcher thread status: Up
```

- Dump OVS flows on a node

```
dump ovs-flows
```

Example:

```
kubenode> dump ovs-flows
NXST_FLOW reply (xid=0x4):
  cookie=0x0, duration=8.876s, table=0, n_packets=0, n_bytes=0, idle_age=8, priority=100,ip
actions=ct(table=1)
  cookie=0x0, duration=8.898s, table=0, n_packets=0, n_bytes=0, idle_age=8, priority=0
actions=NORMAL
  cookie=0x0, duration=8.759s, table=1, n_packets=0, n_bytes=0, idle_age=8,
priority=100,tcp,nw_dst=10.96.0.1,tp_dst=443 actions=mod_tp_dst:443
  cookie=0x0, duration=8.719s, table=1, n_packets=0, n_bytes=0, idle_age=8,
priority=100,ip,nw_dst=10.96.0.10 actions=drop
  cookie=0x0, duration=8.819s, table=1, n_packets=0, n_bytes=0, idle_age=8,
priority=90,ip,in_port=1 actions=ct(table=2,nat)
  cookie=0x0, duration=8.799s, table=1, n_packets=0, n_bytes=0, idle_age=8, priority=80,ip
actions=NORMAL
  cookie=0x0, duration=8.856s, table=2, n_packets=0, n_bytes=0, idle_age=8, actions=NORMAL
```

## Error Codes

This section lists error codes produced by the various components.

### NCP Error Codes

Error Code	Description
NCP00001	Invalid configuration
NCP00002	Initialization failed
NCP00003	Invalid state
NCP00004	Invalid adapter
NCP00005	Certificate not found
NCP00006	Token not found
NCP00007	Invalid NSX configuration
NCP00008	Invalid NSX tag
NCP00009	NSX connection failed
NCP00010	Node tag not found
NCP00011	Invalid node logical switch port
NCP00012	Parent VIF update failed
NCP00013	VLAN exhausted
NCP00014	VLAN release failed
NCP00015	IP pool exhausted
NCP00016	IP release failed
NCP00017	IP block exhausted
NCP00018	IP subnet creation failed

Error Code	Description
NCP00019	IP subnet deletion failed
NCP00020	IP pool creation failed
NCP00021	IP pool deletion failed
NCP00022	Logical router creation failed
NCP00023	Logical router update failed
NCP00024	Logical router deletion failed
NCP00025	Logical switch creation failed

Error Code	Description
NCP00026	Logical switch update failed
NCP00027	Logical switch deletion failed
NCP00028	Logical router port creation failed
NCP00029	Logical router port deletion failed
NCP00030	Logical switch port creation failed
NCP00031	Logical switch port update failed
NCP00032	Logical switch port deletion failed
NCP00033	Network policy not found
NCP00034	Firewall creation failed
NCP00035	Firewall read failed
NCP00036	Firewall update failed
NCP00037	Firewall deletion failed
NCP00038	Multiple firewall found
NCP00039	NSGroup creation failed
NCP00040	NSGroup deletion failed
NCP00041	IP set creation failed
NCP00042	IP set update failed
NCP00043	IP set deletion failed
NCP00044	SNAT rule creation failed
NCP00045	SNAT rule deletion failed
NCP00046	Adapter API connection failed
NCP00047	Adapter watcher exception
NCP00048	Load balancer service deletion failed
NCP00049	Load balancer virtual server creation failed
NCP00050	Load balancer virtual server update failed



Error Code	Description
NCP00051	Load balancer virtual server deletion failed
NCP00052	Load balancer pool creation failed
NCP00053	Load balancer pool update failed
NCP00054	Load balancer pool deletion failed
NCP00055	Load balancer rule creation failed
NCP00056	Load balancer rule update failed
NCP00057	Load balancer rule deletion failed
NCP00058	Load balancer pool IP release failed
NCP00059	Load balancer virtual server and service association not found
NCP00060	NSGroup update failed
NCP00061	Firewall rules get failed
NCP00062	NSGroup no criteria
NCP00063	Node VM not found
NCP00064	Node VIF not found
NCP00065	Certificate import failed
NCP00066	Certificate un-import failed
NCP00067	SSL binding update failed
NCP00068	SSL profile not found
NCP00069	IP pool not found
NCP00070	T0 edge cluster not found
NCP00071	IP pool update failed
NCP00072	Dispatcher failed
NCP00073	NAT rule deletion failed
NCP00074	Logical router port get failed
NCP00075	NSX configuration validation failed

Error Code	Description
NCP00076	SNAT rule update failed
NCP00077	SNAT rule overlapped
NCP00078	Load balancer endpoints add failed
NCP00079	Load balancer endpoints update failed
NCP00080	Load balancer rule pool creation failed
NCP00081	Load balancer virtual server not found
NCP00082	IP set read failed
NCP00083	SNAT pool get failed

Error Code	Description
NCP00084	Load balancer service creation failed
NCP00085	Load balancer service update failed
NCP00086	Logical router port update failed
NCP00087	Load balancer init failed
NCP00088	IP pool not unique
NCP00089	Layer 7 load balancer cache sync error
NCP00090	Load balancer pool not exist error
NCP00091	Load balancer rule cache init error
NCP00092	SNAT process failed
NCP00093	Load balancer default certificate error
NCP00094	Load balancer endpoint deletion failed
NCP00095	Project not found
NCP00096	Pool access denied
NCP00097	Failed to get a load balancer service
NCP00098	Failed to create a load balancer service
NCP00099	Load balancer pool cache synchronization error

## NSX Node Agent Error Codes

Error Code	Description
NCP01001	OVS uplink not found
NCP01002	Host MAC not found
NCP01003	OVS port creation failed
NCP01004	No pod configuration
NCP01005	Pod configuration failed
NCP01006	Pod un-configuration failed
NCP01007	CNI socket not found
NCP01008	CNI connection failed
NCP01009	CNI version mismatch
NCP01010	CNI message receive failed
NCP01011	CNI message transmit failed
NCP01012	Hyperbus connection failed
NCP01013	Hyperbus version mismatch
NCP01014	Hyperbus message receive failed
NCP01015	Hyperbus message transmit failed

Error Code	Description
NCP01016	GARP send failed
NCP01017	Interface configuration failed

## nsx-kube-proxy Error Codes

Error Code	Description
NCP02001	Proxy invalid gateway port
NCP02002	Proxy command failed
NCP02003	Proxy validate failed

## CLI Error Codes

Error Code	Description
NCP03001	CLI start failed
NCP03002	CLI socket create failed
NCP03003	CLI socket exception
NCP03004	CLI client invalid request
NCP03005	CLI server transmit failed
NCP03006	CLI server receive failed
NCP03007	CLI command execute failed

## Kubernetes Error Codes

Error Code	Description
NCP05001	Kubernetes connection failed
NCP05002	Kubernetes invalid configuration
NCP05003	Kubernetes request failed
NCP05004	Kubernetes key not found
NCP05005	Kubernetes type not found
NCP05006	Kubernetes watcher exception
NCP05007	Kubernetes resource invalid length
NCP05008	Kubernetes resource invalid type
NCP05009	Kubernetes resource handle failed
NCP05010	Kubernetes service handle failed
NCP05011	Kubernetes endpoint handle failed
NCP05012	Kubernetes Ingress handle failed

Error Code	Description
NCP05013	Kubernetes network policy handle failed
NCP05014	Kubernetes node handle failed
NCP05015	Kubernetes namespace handle failed
NCP05016	Kubernetes pod handle failed
NCP05017	Kubernetes secret handle failed
NCP05018	Kubernetes default backend failed
NCP05019	Kubernetes unsupported match expression
NCP05020	Kubernetes status update failed
NCP05021	Kubernetes annotation update failed
NCP05022	Kubernetes namespace cache not found
NCP05023	Kubernetes secret not found
NCP05024	Kubernetes default backend is in use
NCP05025	Kubernetes LoadBalancer service handle failed

## OpenShift Error Codes

Error Code	Description
NCP07001	OC route handle failed
NCP07002	OC route status update failed