



Prepare Cluster Configuration File

Prepare the cluster configuration file by completing the following tasks:

1. Get details of VMware vCenter.
2. Get IP Addresses for deployer and cluster.
3. Add VMware vCenter environment configuration.
4. Add deployer configuration.
5. Add cluster configuration.
6. Add Cisco Smart PHY CIN configuration.
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VMware vCenter Details

To contact the VMware vCenter server, the `deployer` script and the deployer VM require the following details:

- Server name or IP address
- Username and password
- Datacenter and cluster name
- Host server and datastore names

The deployer and the single-node cluster require one host server and the multinode cluster requires three host servers.

IP Addresses for Deployer and Cluster

Deploying the Cisco Smart PHY software offline requires the following IP addresses:

- One management IP address for the deployer
- Management IP addresses for cluster (1 for single-node, 12 for multi-node cluster)
- CIN network IP addresses for Cisco Smart PHY (1 per CIN interfaces per Operations VM)
- One virtual IP address for management network and one for each CIN network (multi-node cluster)

Sample Configuration Files

The `examples` directory contains sample configuration files for automatic deployment:

- `deploy-sample-config.yaml`: Configuration file with only the deployer.
- `aio-smartphy-config.yaml`: Configuration file with the deployer and the single-node Smart PHY cluster.
- `multinode-smartphy-config.yaml`: Configuration file with deployer and multinode Cisco Smart PHY cluster.
- `aio-smartphy-standby-config.yaml`: Configuration file with deployer and single-node Cisco Smart PHY cluster that is used for standby (without CIN config).
- `multinode-smartphy-standby-config.yaml`: Configuration file with deployer and multinode Cisco Smart PHY cluster that is used as a standby (without CIN config).

Cluster Configuration File

Place the configuration file in the staging directory. This configuration file is in the standard YAML language format, with the following three sections:

- Environments
- Deployers
- Clusters (Smart PHY multi-node/single-node)

Each section can contain multiple items. Replace `<...>` with actual values.

Environment Configuration

This section provides details of the VMware vCenter access and network access for creating and provisioning the deployers and cluster virtual machines.

```
environments:  
  <environment name>:
```

```

server: <vCenter name or IP address>
username: <vCenter user name>
datacenter: <vCenter datacenter name>
cluster: <vCenter cluster name>
nics: [ <list of vCenter networks> ]
nameservers: [ <list of DNS servers> ]
search-domains: [ <list of search domains> ]
ntp: [ <list of ntp server names or IP addresses> ]
https-proxy: <HTTP proxy server>
no-proxy: <list of domains not using proxy>

```

Guidelines for configuring the VMware vCenter environment:

- The environment name can have only lowercase letters, digits, and hyphens (-).
- The NIC's list must have only one network, although the NIC configuration allows multiple networks. This network is used as the management network in the deployer or cluster that refers to this environment.
- Configure multiple environments for this vCenter if your vCenter has more than one network that serves as a management network. One for each network. In addition, refer to the corresponding environment in the deployer or cluster based on the management network it uses.
- Make sure the NIC's name-servers and search-domains fields are configured as lists.

Deployer Configuration

Before creating and deploying a deployer VM, define a minimum of one environment.

```

deployers:
  <deployer name>:
    environment: <environment of vCenter hosting the deployer>
    address: <deployer VM IP address in CIDR format>
    gateway: <gateway IP address>
    username: <user name for deployer>
    # SSH private-key-file with path relative to the staging directory
    # If the line is missing, ssh private key will be auto-generated and saved inside
    .sec/
    private-key-file: <path and filename for ssh private key>
    host: <ESXi host IP address>
    # datastore-folder parameter is optional, it accepts subfolder structure too. If you
    don't specify the folder, cluster and deployer are created under root folder of VM datastore.

    datastore-folder: "my-folder/cluster"
    datastore: <vCenter datastore name for host>
    # ingress-hostname only supports '.' and alphanumeric characters
    ingress-hostname: "deployer.example.com"
    # Use docker-subnet-override to override default docker-subnet address in deployer
    VM. This is an optional parameter. If you do not specify it, 172.17.0.0/16 subnet range
    will be assigned by default. Use this option if the default docker IP subnet (172.17.0.0/16)
    of the deployer VM may overlap with IP networks in your environment.
    docker-subnet-override:
      # pool name of docker bridge address pool, like pool1, pool2 etc..
      - pool-name: pool1
      # docker bridge subnet range in CIDR format.
      base: 172.XX.X.X/16
      # subnet range is 8-24.
      size: 24

```

Guidelines for configuring the deployer VM:

- The name of the deployer VM can have only lowercase letters, digits, and hyphens (-).

- The deployer supports FQDN. Use the field `ingress-hostname` to configure FQDN.
- If you specify `ingress-hostname` (for example `deployer.example.com`), add the FQDN entries to DNS. Use the following FQDNs:

- `charts.deployer.example.com`
- `docker.deployer.example.com`
- `deployer.example.com`
- `files-offline.smi-deployer.deployer.example.com`
- `cli.smi-deployer.deployer.example.com`
- `restconf.smi-deployer.example.com`

- The `private-key-file` field, when present, must refer to the SSH private key file. This file must be in the staging directory and must not be accessible (read/write/execute) to other users.

If the `private-key-file` line is missing, the `deployer` script generates an SSH private key for the deployer and places it in the `.sec` subdirectory under the staging directory. The filename is `<deployer-name>_auto.pem`.

- To avoid a resource contention, do not run the deployer VM on the same ESXi hosts running any of the Cisco Smart PHY cluster's 12 VMs.

Cluster Configuration

Before creating and deploying a cluster, configure one environment and one deployer. A cluster has an environment field to reference to its corresponding environment.

```
clusters:
<SMI cluster name>
  type: "opshub"
  # optional cluster `size` field. Support `small` or `normal`.Default value is `small`
  if not specified.
  size: small
  environment: <environment of vCenter hosting the SMI cluster>
  gateway: <gateway IP address>
  username: <user name for the SMI cluster>
  # SSH private-key-file with path relative to the staging directory
  # If the line is missing, ssh private key will be auto-generated and saved inside .sec/
  private-key-file: <path and filename for ssh private key>
  # The following two fields are for multi-node cluster only
  primary-vip: <virtual IP address for the management network in CIDR format>
  vrouter-id: <VRRP ID for the management network>
  # ingress-hostname only supports '.' and alphanumeric characters
  ingress-hostname: "smartphy.example.com"
  pod-subnet: <IP address range for kubernetes pod in CIDR format "192.168.120.0/24">
  #pod-subnet is an optional field. If you do not specify the IP address, "192.168.0.0/16"
  will be assigned by default.
  service-subnet: <IP address range for kubernetes service in CIDR format "10.96.120.0/24">

  # service-subnet is an optional field. If you do not specify the IP address, "10.96.0.0/12"
  will be assigned by default.
  docker-bridge-subnet: ["IP address range for docker bridge in CIDR format
'10.96.120.0/24'"]
```

```

# docker-bridge-subnet is an optional field. If you do not specify the IP address,
"172.17.0.0/16" will be assigned by default.
# For Multi-Node cluster only
nodes:
  - host: <ESXi host 1 IP address>
    addresses: [ <CONTROL-PLANE 1 IP>, <ETCD 1 IP>, <INTRA 1 IP>, <OPS 1 IP> ]
    datastore: <vCenter datastore for host 1>
    # datastore-folder parameter is optional, it accepts subfolder structure too. If you
    don't specify the folder, cluster and deployer are created under root folder of VM datastore.

    datastore-folder: "my-folder/cluster"
  - host: <ESXi host 2 IP address>
    addresses: [ <CONTROL-PLANE 2 IP>, <ETCD 2 IP>, <INTRA 2 IP>, <OPS 2 IP> ]
    datastore: <vCenter datastore for host 2>
    # datastore-folder parameter is optional, it accepts subfolder structure too. If you
    don't specify the folder, cluster and deployer are created under root folder of VM datastore.

    datastore-folder: "my-folder/cluster"
  - host: <ESXi host 3 IP address>
    addresses: [ <CONTROL-PLANE 3 IP>, <ETCD 3 IP>, <INTRA 3 IP>, <OPS 3 IP> ]
    datastore: <vCenter datastore for host 3>
    # datastore-folder parameter is optional, it accepts subfolder structure too. If you
    don't specify the folder, cluster and deployer are created under root folder of VM datastore.

    datastore-folder: "my-folder/cluster"
apps:
  - smartphy:
    nodes:
      - host: <ESXi host 1 IP address>
        nics: <vCenter network for CIN>
        ops:
          interfaces:
            - addresses: [ <OPS 1 IP> ]
              vip: [ <LIST of virtual IP for CIN network in CIDR format> ]
              vrouter-id: <VRRP ID for CIN network>
              routes:
                - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }
                - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }
      - host: <ESXi host 2 IP address>
        nics: <vCenter network for CIN>
        ops:
          interfaces:
            - addresses: [ <OPS 2 IP> ]
              vip: [ <LIST of virtual IP for CIN network in CIDR format> ]
              vrouter-id: <VRRP ID for CIN network>
              routes:
                - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }
                - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }
      - host: <ESXi host 3 IP address>
        nics: <vCenter network for CIN>
        ops:
          interfaces:
            - addresses: [ <OPS 3 IP> ]
              vip: [ <LIST of virtual IP for CIN network in CIDR format> ]
              vrouter-id: <VRRP ID for CIN network>
              routes:
                - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }
                - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }

# For Single-Node cluster only

clusters:
  "cicd-smi-ai0":
    type: "opshub"

```

```

environment: "cicd-vcenter"
username: "build"
# private-key-file must exist in the path of staging/install directory.
# file path is relative to the staging/install directory.
private-key-file: "cmts.pem"
# pod-subnet is an optional field. If you do not specify the IP address, "192.168.0.0/16"
will be assigned by default.
pod-subnet: "192.168.120.0/24"
# service-subnet is an optional field. If you do not specify the IP address, "10.96.0.0/12"
will be assigned by default.
service-subnet: "10.96.120.0/24"
# docker-bridge-subnet is an optional field. If you do not specify the IP address,
"172.17.0.0/16" will be assigned by default.
docker-bridge-subnet: ["172.17.120.0/24"]
gateway: "172.22.80.1"
ingress-hostname: smartphy.example.com
nodes:
- host: <ESXi host IP address>
  addresses: [ <AIO VM IP address> ]
  datastore: <vCenter datastore for host>
  # datastore-folder parameter is optional, it accepts subfolder structure too. If you
  don't specify the folder, cluster and deployer are created under root folder of VM datastore.

  datastore-folder: "my-folder/cluster"
apps:
- smartphy:
  nodes:
  - host: <ESXi host IP address>
    nics: [<vCenter network for CIN>]
    control-plane:
      interfaces:
      - addresses: [ <LIST of IP addresses for CIN network in CIDR format> ]
        routes:
        - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }
        - { dest: [ <LIST of destination subnets> ], nhop: <next hop IP> }

```

Command	Description
<cluster name>	Cluster name.
type	Use <code>opshub</code> for Cisco Smart PHY cluster.
size	Small or normal. When the size is not specified, the default value is small.
environment	Reference to vCenter environment.
gateway	Gateway for the cluster nodes.
username	Username of the cluster.
private-key-file	SSH private-key-file with the path relative to the staging directory. If the line is missing, the SSH private key will be auto-generated and saved inside <code>.sec/</code> .
primary-vip	Primary virtual IP address in CIDR format (multinode only).
vrouter-id	VRRP ID for management network (multinode only).

Command	Description
ingress-hostname	<p>Fully Qualified Domain Name (FQDN) assigned to the cluster. Only alphanumeric characters and period (.) are allowed.</p> <p>Your authoritative DNS server must be configured to resolve the specified FQDN and the following subdomain:</p> <ul style="list-style-type: none"> • <code>opscenter.<fqdn></code> <p>Alternatively, if your authoritative DNS server supports wildcards, you must configure the DNS to resolve the specified FQDN and a wildcard record covering the subdomains listed here.</p> <p>If you do not specify an FQDN:</p> <ul style="list-style-type: none"> • The cluster IP address is used to generate an FQDN leveraging <code>nip.io</code> as the domain and top-level domain (TLD). For example, if the IP address of the cluster is <code>10.0.0.2</code>, the generated FQDN is <code>10.0.0.2.nip.io</code>. The subdomains listed here are also leveraged. • Your DNS servers must allow the resolution of the <code>nip.io</code> domain. If resolution of <code>nip.io</code> is blocked, you cannot access the cluster.
host	ESXi IP address where VMs are hosted.
service-subnet	Service subnet range to configure k8s and calico in CIDR format. The default value is <code>10.96.0.0/12</code> .
pod-subnet	Pod subnet to configure k8s and calico in CIDR format. The default value is <code>192.168.0.0/16</code> .
docker-bridge-subnet	IP address range for docker bridge in CIDR format. It is an optional field. If you do not specify the IP address, <code>172.17.0.0/16</code> will be assigned by default.
apps	Application to be installed on top of the platform, in this case <code>smartphy</code> .
addresses	IP addresses assigned to control-plane, etcd, infra and docsis or operations nodes respectively.
CIN Configuration	
vip	Virtual IP address in CIDR format.
vrouter-id	VRRP ID for CIN.
addresses	CIN IP addresses in CIDR format.
nics	vCenter NICs for CIN.
For Single-Node cluster	
host	ESXi IP address where VM is hosted.
control-plane	Cisco Smart PHY CIN configuration.

Guidelines for configuring a cluster:

- The name of the cluster can have only lowercase letters, digits, and hyphens (-).
- The `private-key-file` field, when present, should refer to the SSH private key file. This file must be in the staging directory and must not be accessible (read/write/execute) to other users.
If the `private-key-file` line is missing, the `deployer` script generates an SSH private key for the cluster and places it in the `.sec` subdirectory under the staging directory. The filename is `<cluster-name>_auto.pem`.
- Configure the virtual IP address of the Smart PHY cluster and VRRP ID (`vrouter-id` at cluster level) for the management network for multinode clusters. The management network supports only IPv4. The `vrouter-id` can take values 1–254.
- If multiple clusters share the same management subnet, the VRRP ID for each cluster must be unique in the management subnet.



Note If the cluster ingress hostname is `smartphy.example.com`, you can access opscenter CLI and RESTCONF endpoints as follows:

- Use `opscenter.smartphy.example.com/cee-data/restconf` to access cee-data opscenter RESTCONF endpoint.
- Use `opscenter.smartphy.example.com/cee-data/cli` to access cee-data opscenter CLI.
- Use `opscenter.smartphy.example.com/opshub-data/restconf` to access opshub-data opscenter RESTCONF endpoint.
- Use `opscenter.smartphy.example.com/opshub-data/cli` to access opshub-data opscenter CLI.
- Use `opscenter.smartphy.example.com/smartphy-data/restconf` to access smartphy-data opscenter RESTCONF endpoint.
- Use `opscenter.smartphy.example.com/smartphy-data/cli` to access smartphy-data opscenter CLI.

Configure TLS Certificate

When Cisco Operations Hub cluster is deployed, a self-signed certificate is configured by default. You can replace the self-signed certificate with a CA signed certificate through the Deployer CLI. Use the following commands as example to configure a CA signed TLS certificate.

```
product opshub# config terminal
Entering configuration mode terminal
product example deployer(config)# clusters {k8s-cluster-name}
product example deployer(config-clusters-*****)# secrets tls opshub-data cert-api-ingress
?
Possible completions:
  certificate  Path to PEM encoded public key certificate.
  private-key  Private key associated with given certificate.
  <cr>
product example deployer(config-clusters-*****)# secrets tls nginx-ingress
default-ssl-certificate ?
Possible completions:
  certificate  Path to PEM encoded public key certificate.
```



```
private-key Private key associated with given certificate.
<cr>
product example deployer(config-clusters-*****)#commit
product example deployer(config-clusters-*****)#exit

product example deployer(config-clusters-*****)# cluster <cluster-name> actions sync run
force-vm-redeploy false
```

Cisco Smart PHY CIN Configuration

Configure Converged Interconnect Network (CIN) for the Cisco Smart PHY cluster. One or more CIN networks can be present. Configure CIN under each node.

Guidelines for configuring CIN:

- CIN should contain the network names (NICs) and the IP addresses (addresses).
- The routing table (routes) is optional.
- The virtual IP addresses (vip) and the VRRP ID (vrouter-id) fields are used only in multinode clusters. They are configured on the first node.
- The virtual IP addresses are mandatory. You can configure up to one IPv4 and one IPv6 addresses per CIN network.
- If multiple Smart PHY clusters share a CIN subnet, the VRRP ID should be unique for each cluster.
- For multinode cluster, all nodes must have the same number of CIN interfaces. If the NICs or route fields are missing for the second or third nodes, the corresponding value from the first node is used.
- You can also set up a Smart PHY cluster as backup cluster. For backup clusters, do not include any CIN configuration. The configuration should not have operations and interfaces under the nodes.

