Virtual Infrastructure Manager

- Virtual Infrastructure Manager, on page 1
- **Adding vCenter Visualization**, on page 4
- Kubernetes Cluster, on page 6
- OpenStack Cluster, on page 9
- Annexure, on page 11

Virtual Infrastructure Manager

UI Path: **Virtual Management** > **Virtual Infrastructure Manager**

Note Ensure that you have enabled Network visualization of Virtual Machines feature for Cisco Nexus Dashboard Fabric Controller.

1. Choose **Settings** > **Feature Management**, choose the following check boxes:
   - Kubernetes Visualizer
   - VMM Visualizer
   - Openstack Visualizer
2. Click **Apply**.

The following table describes the fields that appear on Virtual Infrastructure Manager window:

Field	Description
Server	Specifies the Server IP Address.
Type	Specifies the type of instance that can be one of the following: • vCenter • Kubernetes Cluster • OpenStack Cluster

Field	Description
Managed	Specifies the status of the cluster either Managed or Unmanaged.
Status	Specifies the status of the added cluster.
User	Specifies the user created the cluster.
LastUpdated Time	Specifies the last updated time for the cluster.

Note Click **Refresh** icon to refresh the Virtual Infrastructure Manager table.

The following table describes the action items, in the Actions menu drop-down list, that appear on Virtual Infrastructure Manager window:

Action Item	Description
Add Instance	From the **Actions** drop-down list, choose **Add Instance**. For more instructions, see Adding an Instance. **Note** Ensure that you have configured same IP address on Routes. Refer to Configuring Routes IP Address.
Edit Instance	Choose an instance to edit. From the **Actions** drop-down list, choose **Edit Instance**. Make the necessary changes and click **Save**. Click **Cancel** to discard the changes.
Delete Instance(s)	Choose one or more required instance to delete. From the **Actions** drop-down list, choose **Delete Instance(s)**. Click **Confirm** to delete the instance. Click **Cancel** to discard the delete.
Rediscover Instance(s)	Choose one or more required instance to rediscover. From the **Actions** drop-down list, choose **Rediscover Instance(s)**. A confirmation message appears.

For more information:

Support for Cisco UCS B-Series Blade Servers

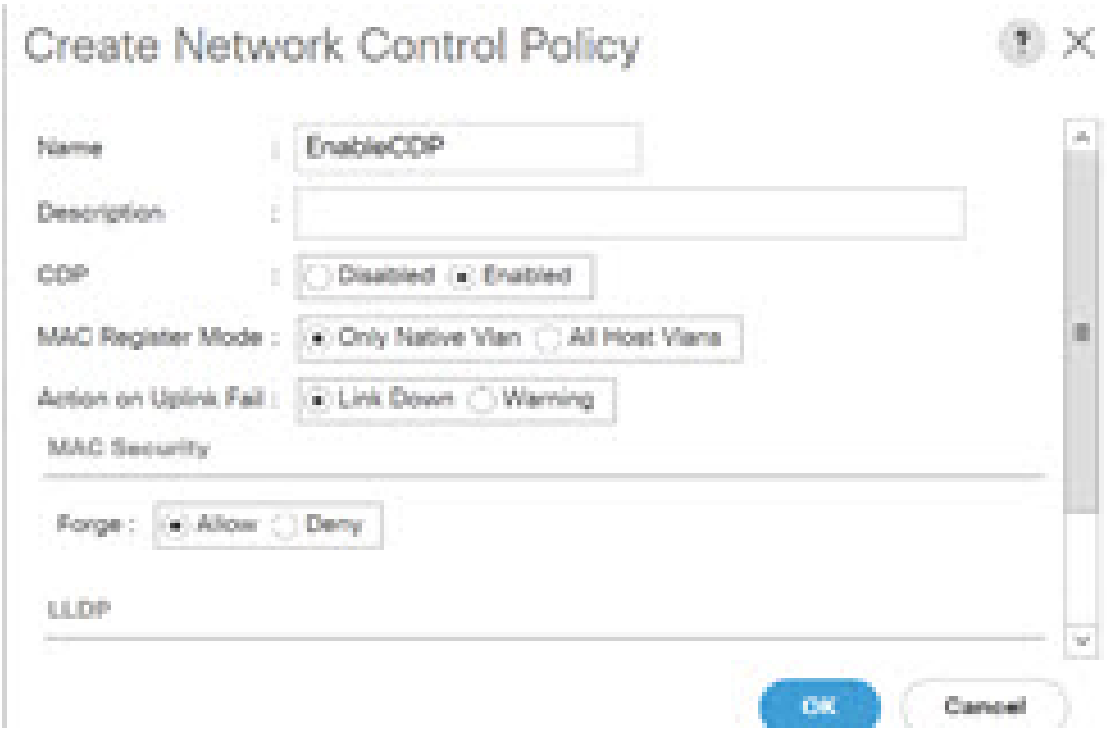
NDFC supports hosts running on UCS type B (chassis UCS) that are behind the Fabric interconnect. You must enable CDP of the vNIC on Cisco UCSM to use this feature.

Note By default, CDP is disabled on Cisco UCSM.

Let us consider two VMMs, VMM-A and VMM-B, for reference. After the discovery of Cisco UCS UCS B-Series Blade Servers, the Topology displays the blue colored VMM-A and VMM-B are fabric interconnect nodes. A sample topology is as shown in the figure below.

To enable CDP on UCSM, you must create a new Network Control policy using the following steps:

1. On the USCM, choose **LAN** and expand the policies.
2. Right-click on the **Network Control Policies** to create a new policy.
3. In the Name field, enter the policy name as **EnableCDP**.
4. Choose **enabled** option for CDP.



5. Click **OK** to create the policy.

To apply the new policy to the ESX NICs, perform the following steps:

- If you are using updated vNIC templates, choose each vNIC template for your ESXi vNICs, and apply the EnableCDP policy from the Network Control Policy drop-down list.
- If you are not using any vNIC templates, use the updated Service Profile Template. Apply EnableCDP policy on each of the service profile template.
- If you are using one-off Service Profiles (i.e., if each server using its own service profile), then you must go to every Service Profile and enable EnableCDP policy on every vNIC.

For more information about Cisco UCSM, refer to Cisco UCSM Network Management Guide.

Configuring Routes IP Address

Before you add IP address to vCenter, you must configure same IP address on Cisco Nexus Dashboard.

To configure Routes on Cisco Nexus Dashboard, perform the following steps:

Procedure

Step 1 Choose **Infrastructure** > **Cluster Configuration**.

Step 2 On **General** tab, in **Routes** card, click **Edit** icon.

The **Routes** window appears.

Step 3 To configure IP addresses, click **Add Management Network Routes**, enter required IP addresses, and click **check** icon.

Step 4 Click **Save**.

The route configuration is governed by following two scenarios:

a. For vCenter, which is an application server is typically reachable over mgmt network.

b. The ESXi servers that are managed by vCenters and the baremetal servers hosting the K8s instances and/or OpenStack instances would be connected to the fabric network directly. Hence, they will be reachable over data networks.

Adding vCenter Visualization

You can perform various actions in the **Actions** menu drop-down list, that appear on **Virtual Management > Virtual Infrastructure Manager.**

Procedure

Step 1 Choose **Actions** > **Add Instance**.

The **Add Instance** window appears.

Step 2 Choose **vCenter** from Select Type drop-down list.

Enter required IP address or Domain name and password in the respective fields.

Step 3 Click **Add**.

You can view added vCenter cluster in the **Virtual Infrastructure Manager** window.

Step 4 To edit an instance**,** choose required vCenter, choose **Actions > Edit Instance** and click **Save** changes.

You can update password for the selected vCenter cluster and change the admin status to Managed or Unmanaged and vice-versa.

Note
For the vCenter cluster in Unmanaged status, you cannot view the topology and vCenter cluster details on dashboard.

Step 5 To delete one or more vCenter cluster, choose the required vCenter, choose **Actions** > **Delete Instance(s)** and click **Confirm** changes.

Note
All the data will be deleted if you delete the Cluster. The Cluster will be removed from the Topology view also.

Step 6 To rediscover one or more vCenter cluster, choose the required vCenter, choose **Actions > Rediscover Instance(s)**.

A confirmation message appears.

Kubernetes Cluster

Note Ensure that you have enabled Network Visualization of K8s clusters feature for Cisco Nexus Dashboard Fabric Controller .

Choose **Settings** > **Feature Management** choose check box **Kubernetes Visualizer** and click **Apply**.

You can view the added Kubernetes Visualizer details on dashboard. Navigate **Dashboard** > **Kubernetes Pods**

To enable LLDP on NDFC, choose **Settings** > **Server** > **Settings** > **Discovery**. Choose check box **enable / disable neighbor link discovery using LLDP**.

Note LLDP is applicable for Bare-metal Kubernetes clusters only.

- Ensure that the LLDP feature is enabled on all fabric switches for which the cluster node is connected. (Switches may be spine or leaf switches).
- On the Kubernetes cluster, ensure that LLDP and SNMP services are enabled on all Bare-metal nodes.
- If the Cisco UCS is using an Intel NIC, LLDP neighborship fails to establish due to FW-LLDP.

  Workaround – For selected devices based on the Intel® Ethernet Controller (for example, 800 and 700 Series), disable the LLDP agent that runs in the firmware. Use the following command to disable LLDP:

  echo 'lldp stop' > /sys/kernel/debug/i40e/<bus.dev.fn>/command

  To find the bus.dev.fn for a given interface, run the following command and select the ID associated with the interface. The ID is highlighted in the below sample output.

```
[ucs1-lnx1]# dmesg | grep enp6s0 [ 12.609679] IPv6: ADDRCONF(NETDEV_UP): enp6s0: link
is not ready [ 12.612287] enic 0000:06:00.0 enp6s0: Link UP [ 12.612646] IPv6:
ADDRCONF(NETDEV_UP): enp6s0: link is not ready [ 12.612665] IPv6: ADDRCONF(NETDEV_CHANGE):
enp6s0: link becomes ready[ucs1-lnx1]#
```

Note LLDP feature is enabled on those fabric switches, to which the bare-metal cluster nodes are connected. They can also be connected to the border gateway switches.

If the Fabric, to which the Kubernetes cluster is connected to, is discovered after the Cluster was discovered, you must rediscover the cluster to display the topology correctly.

If the Bare-metal-based Kubernetes cluster is discovered after configuring LLDP, you must rediscover the Baremetal cluster to display the topology correctly.

To find the bus.dev.fn for a given interface, run the following command and select the ID associated with the interface. The ID is highlighted in the below sample output.

Note When discovering or visualizing VM-based Kubernetes cluster, it must first onboard the vCenter cluster which is managing the VMs hosting the Kubernetes cluster being discovered. Without this, Kubernetes cluster discovery would result in failure.

Configuring Routes IP Address

Before you add IP address to Kubernetes cluster, you must configure same IP address on Cisco Nexus Dashboard.

To configure Routes on Cisco Nexus Dashboard, perform the following steps:

Procedure

Step 1 Choose **Infrastructure** > **Cluster Configuration**.

Step 2 On **General** tab, in **Routes** card, click **Edit** icon.

The **Routes** window appears.

Step 3 To configure IP addresses, click **Add Management Network Routes**, enter required IP addresses, and click **check** icon.

Step 4 Click **Save**.

Adding Kubernetes Cluster

You can perform various actions in the **Actions** menu drop-down list, that appear on **Virtual Management** > **Virtual Infrastructure Manager**.

Note Ensure that you have configured same IP address on Routes. Refer to Configuring Routes IP Address.

Procedure

Step 1 Choose **Actions** > **Add Instance**

The **Add Instance** window appears.

Step 2 Choose **Kubernetes Cluster** from Select Type drop-down list.

Step 3 Enter **Cluster IP address**, **Username** in appropriate fields.

Step 4 Click **Fetch CSR** to obtain a Certificate Signing Request (CSR) from the Kubernetes Visualizer application.

Note
This option is disabled until you enter a valid Cluster IP address and username.

Use the **Fetch CSR** only if you haven't obtained the SSL certificate. If you already have a valid certificate, you need not fetch the CSR.

Click **Download CSR**. The certificate details are saved in the **<username>.csr** in your directory. Paste the contents of the CSR to a file **kubereader.csr**, where kubereader is the username of the API Client to connect to Kubernetes.

The CSR file name must adhere to naming convention <<*username*>>*.csr*.

Note
As the certificates are generated on the Kubernetes cluster, you need Kubernetes admin privileges to generate certificates.

Refer to Annexure, on page 11 to generate the certificate **genk8clientcert.sh**.

Step 5 Login to the Kubernetes cluster controller node.

You need admin privileges to generate the certificates.

Step 6 Copy the genk8clientcert.sh and kubereader.csr from the NDFC server location to the Kubernetes Cluster controller node.

Perform a "vnc cut and paste" operation to ensure that all the characters are copied correctly.

Step 7 Generate the CSR for the user name, by using the **genk8sclientcert.sh** script.

(k8s-root)# **./genk8sclientcert.sh kubereader 10.x.x.x**where,

- kubereader is the username of the API Client to connect to Kubernetes. (as defined in Step 3).
- 10.x.x.x is the IP address of the NDFC server.

There are two new certificates generated in the same location:

- k8s_cluster_ca.crt
- *username_dcnm-IP.crt*

  For example: kubereader_10.x.x.x.crt (where, kubereader is the username, and 10.x.x.x is the NDFC IP address)

```
dcnm(root)# cat k8s_cluster_ca.crt
```

Step 8 Use the cat command to extract the certificate from these 2 files.

```
dcnm(root)# cat kubereader_10.x.x.x.crt
dcnm(root)# cat k8s_cluster_ca.crt
```

Provide these two certificates to the user, who is adding the Kubernetes cluster on Cisco NDFC.

Step 9 Copy the content in the kubereader_10.x.x.x.crt to **Client Certificate** field.

Note
Perform a "vnc cut and paste" operation to ensure that all the characters are copied correctly.

Step 10 Copy the content in the k8s_cluster_ca.crt to **Cluster Certificate** field.

Note
Perform a "vnc cut and paste" operation to ensure that all the characters are copied correctly.

Step 11 Click **Add**.

You can view added Kubernetes cluster in the **Virtual Infrastructure Manager** window.

Note
You can view details of the added Kubernetes cluster details on the dashboard and topology window. Navigate **Dashboard** > **Kubernetes Pods** and topology window.

Step 12 To edit Kubernetes cluster, choose required cluster, choose **Actions** > **Edit Instance**, click Edit to modify the values appropriately. You can update the Cluster and the Client certificates. You can also update the Managed status of the Kubernetes cluster. If you choose to update the Managed status, certificates are not required.

Note
For the kubernetes cluster in Unmanaged status, you cannot view the topology and Kubernetes cluster details on dashboard.

Step 13 Click **Save** to save the changes or click **Cancel** to discard changes.

Step 14 To delete one or more Kubernetes Cluster, choose the required cluster, choose **Actions** > **Delete Instance(s)** to delete the cluster.

Note
All the data will be deleted if you delete the Cluster. The Cluster will be removed from the Topology view also.

Step 15 Click **Confirm** to delete the cluster.

Step 16 To rediscover one or more Kubernetes cluster, choose required Kubernetes cluster, choose **Actions** > **Rediscover Instance(s)**.

A confirmation message appears.

OpenStack Cluster

Note

- Ensure that you have enabled Network Visualization of Openstack Clusters feature for Cisco Nexus Dashboard Fabric Controller. Choose **Settings > Feature Management** choose check box **Openstack Visualizer** and click **Apply**.
- Ensure that the vCenter cluster or Kubernetes cluster feature must be enabled to add an openstack cluster.

- To enable LLDP on NDFC, choose Web UI, choose **Settings > Server Settings > Discovery.** Choose check box **enable / disable neighbor link discovery using LLDP**.
- On the OpenStack cluster, ensure that the LLDP service is enabled on all the bare-metal nodes. LLDP feature is enabled on those fabric switches, to which the bare-metal cluster nodes are connected. They can also be connected to the border gateway switches.

- For selected devices based on the Intel® Ethernet Controller (for example, 800 and 700 Series), disable the Link Layer Discovery Protocol (LLDP) agent that runs in the firmware. Use the following command to achieve the same:

```
# echo 'lldp stop'>/sys/kernel/debug/i40e/bus.dev.fn/command
```

- To find *bus.dev.fn* for a given interface, run the following command and select the ID associated with the interface. The ID is highlighted in the below output.

```
# dmesg | grep eth0
[ 8.269557] enic 0000:6a:00.0 eno5: renamed from eth0
[ 8.436639] i40e 0000:18:00.0 eth0: NIC Link is Up, 40 Gbps Full Duplex, Flow Control:
 None
[ 10.968240] i40e 0000:18:00.0 ens1f0: renamed from eth0
[ 11.498491] ixgbe 0000:01:00.1 eno2: renamed from eth0
```

Configuring Routes IP Address

Before you add IP address to Openstack Visualizer, you must configure same IP address on Cisco Nexus Dashboard.

To configure Routes on Cisco Nexus Dashboard, perform the following steps:

Procedure

Step 1 Choose **Infrastructure** > **Cluster Configuration**.

Step 2 On **General** tab, in **Routes** card, click **Edit** icon.

The **Routes** window appears.

Step 3 To configure IP addresses, click **Add Management Network Routes**, enter required IP addresses, and click **check** icon.

Step 4 Click **Save**.

Configuring AMQP Endpoints on OpenStack Cluster

- RabbitMQ notification (oslo.messaging) bus configuration should be completed on the OpenStack cluster.

  Make the following configuration changes in the OpenStack Nova service. Replace the parameter values as shown. The Nova configuration file is located at the path:

  ```
  /etc/nova/nova.conf
  ```

  ```
  [notifications]
  notify_on_state_change=vm_and_task_state
  default_level=INFO
  notification_format=both

  [oslo_messaging_notifications]
  driver = messagingv2
  transport_url=rabbit://guest:guest@X.X.X.X:5672/
  topics=notifications
  retry=-1
  ```

Note

- **transport_url** is the address of the RabbitMQ endpoint hosted on the server having IP X.X.X.X at port 5672. Replace it with the appropriate server IP address.
- **guest:guest** is the username and password to connect to the endpoint.

  Also, open port 5672 by setting the appropriate 'iptables' rule so that the monitoring application client can connect to the port and read the notification data.

- OpenStack plugin receives and handles the real-time change notifications from the OpenStack cluster and updates the topology description information. The real-time change notifications are related to the change of state of VM (for example, adding, deleting, or updating a VM) and change of state of network (for example, shutting down of a link between VM and the virtual switch).
- Powering on of a cluster node reflects in the topology view. The corresponding node is added to the cluster view. Similarly, powering down of a cluster node reflects in the topology view. The corresponding node is removed from the cluster view.
- Adding or deleting a node (controller, compute, or storage) in the OpenStack cluster is reflected automatically in NDFC in the Topology cluster view.

Annexure

The following message is displayed, after the certificates are generated successfully:

```
#!/usr/bin/bash
#############################################################
# Title: Script to provision the client CSR and generat the #
#        the client SSL certificate.                        #
#############################################################

# Create CSR resource template.
function create_csr_resource() {
    K8SUSER=$1
    DCNM=$2
    FILE=${K8SUSER}_${DCNM}_csr_res.yaml
    echo "
apiVersion: certificates.k8s.io/v1
kind: CertificateSigningRequest
metadata:
  name: ${K8SUSER}_${DCNM}csr
spec:
  groups:
  - system:authenticated
  request: ${BASE64_CSR}
  signerName: kubernetes.io/kube-apiserver-client
  usages:
  - digital signature
  - key encipherment
  - client auth" > $FILE
}

# Create CLUSTER ROLE resource template
```

```
function create_cluster_role() {
    K8SUSER=$1
    DCNM=$2
    FILE=${K8SUSER}_${DCNM}_cluster_role_res.yaml
    echo "
kind: ClusterRole
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: clustrole_${K8SUSER}_${DCNM}
rules:
- apiGroups: [\"\"]
  resources: ["nodes", "namespaces", "pods", "services"]
  verbs: ["get", "list", "watch"]" > $FILE
}

# Create CLUSTER ROLE BINDING template
function create_cluster_role_binding() {
    K8SUSER=$1
    DCNM=$2
    FILE=${K8SUSER}_${DCNM}_cluster_rolebinding_res.yaml
    echo "
kind: ClusterRoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: clustrolebind_${K8SUSER}_${DCNM}
roleRef:
  kind: ClusterRole
  name: clustrole_${K8SUSER}_${DCNM}
  apiGroup: rbac.authorization.k8s.io
subjects:
- kind: User
  name: ${K8SUSER}
  apiGroup: rbac.authorization.k8s.io" > $FILE
}

function valid_ip() {
    local  ip=$1
    local  stat=1

    if [[ $ip =~ ^[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}$ ]]; then
        OIFS=$IFS
        IFS='.'
        ip=($ip)
        IFS=$OIFS
        [[ ${ip[0]} -le 255 && ${ip[1]} -le 255 \
            && ${ip[2]} -le 255 && ${ip[3]} -le 255 ]]
        stat=$?
    fi
    return $stat
}

# Start of the script
if [ "$#" -ne 2 ]; then
    echo "Please provide the username and IP of the DCNM"
    echo
    exit 1
else

    # Check if user have required K8s privileges
    LINUX_USER=$(whoami)
    K8S_CONF_PATH=""
    echo
   echo "Hello ${LINUX_USER}! I am going to help you generate K8s cluster CA and K8s client
 certificate."
```

```
if [ ${LINUX_USER} == "root" ] ; then
    # You are root
    if [ ! -d "/root/.kube" ] ; then
        echo
        echo "Directory /root/.kube does not exists."
        echo "User ${LINUX_USER} does not have required K8s privileges"
        echo "Please make sure you are logged into K8s cluster's master node"
        echo
        exit 1
    else
        K8S_CONF_PATH=/${LINUX_USER}/.kube/config
    fi
else
    # You are not root
    if [ ! -d "/home/${LINUX_USER}/.kube" ] ; then
        echo
        echo "Directory /home/${LINUX_USER}/.kube does not exists."
        echo "User ${LINUX_USER} does not have required K8s privileges"
        echo "Please make sure you are logged into K8s cluster's master node"
        echo
        exit 1
    else
        K8S_CONF_PATH=/home/${LINUX_USER}/.kube/config
    fi
fi

# Check if K8s config file exist
if [ ! -f ${K8S_CONF_PATH} ]; then
    echo
    echo "${K8S_CONF_PATH} file does not exist"
    echo "K8s CA certificate can not be exported"
    echo "Please make sure you are logged into K8s cluster's master node"
    echo
    exit 1
fi

K8SUSER=$1
DCNM=$2
K8S_CA_CRT="k8s_cluster_ca.crt"

# Validate the IP address
if valid_ip $DCNM; then
    echo -e
else
    echo "${2} is not a valid IP address"
    echo
    exit 1
fi

# Validate the CSR file format
if [ ${K8SUSER: -4} == ".csr" ]; then
    K8SUSER=${K8SUSER%.csr}
fi

if [ ! -f "./${K8SUSER}.csr" ]; then
    echo
    echo "./${K8SUSER}.csr does not exist"
    echo "CSR file is required for creation of client certificate"
    echo
    exit 1
fi

echo "Generating certificate for ${K8SUSER} for DCNM ${DCNM}"
```

```
    echo

    # Encoding the .csr file in base64
    export BASE64_CSR=$(cat ./${K8SUSER}.csr | tr -d '\n')

    # Create the CSR resource in K8s cluster
    create_csr_resource $K8SUSER $DCNM

    # Delete if the CSR resource already exist. We need a fresh one.
    kubectl delete csr ${K8SUSER}_${DCNM}csr &> /dev/null
    status=$?
    if test $status -eq 0
    then
        echo "./${K8SUSER}_${DCNM}csr CSR resource already exist, removing it"
    else
        echo "./${K8SUSER}_${DCNM}csr CSR resource does not exist, creating it"
    fi

    # Create the CertificateSigninRequest resource
    kubectl apply -f ${K8SUSER}_${DCNM}_csr_res.yaml

    # Check the status of the newly created CSR
    kubectl get csr

    # Approve this CSR
    echo "Approving the CSR"
    kubectl certificate approve ${K8SUSER}_${DCNM}csr

    # Check the status of the newly created CSR
    kubectl get csr

    # Create role resource definition
    kubectl delete clusterrole clustrole_${K8SUSER}_${DCNM} &> /dev/null
    create_cluster_role $K8SUSER $DCNM
    kubectl apply -f ${K8SUSER}_${DCNM}_cluster_role_res.yaml

    # Create role binding definition
    kubectl delete clusterrolebinding clustrolebind_${K8SUSER}_${DCNM} &> /dev/null
    create_cluster_role_binding $K8SUSER $DCNM
    kubectl apply -f ${K8SUSER}_${DCNM}_cluster_rolebinding_res.yaml

    # Extract the client certificate
    echo "Extracting the user SSL certificate"
    kubectl get csr ${K8SUSER}_${DCNM}csr -o jsonpath='{.status.certificate}' >
${K8SUSER}_${DCNM}.crt
    echo "" >> ${K8SUSER}_${DCNM}.crt

    # Export the K8s cluster CA cert
    if [ -f ${K8S_CONF_PATH} ]; then
        echo "Exporting K8s CA certificate"
        cat ${K8S_CONF_PATH} | grep certificate-authority-data | awk -F ' ' '{print $2}' >
 ${K8S_CA_CRT}
    fi
    echo
    echo "----------------------------------------------------------------"
    echo "Notes: "
    echo "1. The K8s CA certificate is copied into ${K8S_CA_CRT} file."
    echo "      This to be copied into \"Cluster CA\" field."
    echo "2. The client certificate is copied into ${K8SUSER}_${DCNM}.crt file."
    echo "      This to be copied into \"Client Certificate\" field."
    echo "----------------------------------------------------------------"
    echo
fi
```