Cisco Crosswork Installation Requirements

This chapter contains the following topics:

Cisco Crosswork Infrastructure Requirements

This section explains the requirements for installing the Cisco Crosswork.

The Crosswork cluster for 4.1 release consists of at least three VMs or nodes operating in a hybrid configuration. This is the minimum configuration necessary to support the applications in a typical network. Additional VMs or nodes in a worker configuration can be added later to scale your deployment, as needed, to match the requirements of your network or as other applications are introduced.

In addition to the Crosswork cluster VMs, at least one VM is needed to deploy Crosswork Data Gateway. This configuration can be scaled by adding additional resources if it is determined that either your use case requires more resources or to support Crosswork Data Gateway high availability (HA), or both.

The data center resources need to run NSO are addressed in the NSO installation Guide and are not addressed in this document.

Data Center Requirements

Cisco Crosswork can be deployed in either a vCenter managed data center or onto Cisco CSP. To aid in the deployment, Cisco has developed a cluster installation tool. This tool works in both environments. However, there are limitations to the tool which are detailed later in this section.

Note

- The machine where you run the installer must have network connectivity to the data center (vCenter or CSP) where you plan to install the cluster. If this mandatory requirement cannot be met, you must manually install the cluster. For more information on manual installation, see Install Cisco Crosswork Manually.
- Cisco Crosswork cluster VMs (Hybrid nodes and Worker nodes) must be hosted on hardware with Hyper Threading disabled.
- Ensure that the host resources are not oversubscribed (in terms of CPU or memory).

- VMware Data Center Requirements, on page 2
- CSP Data Center Requirements, on page 3

VMware Data Center Requirements

This section explains the data center requirements to install Cisco Crosswork on VMware vCenter.

Note The following requirements are mandatory if you are planning to install Cisco Crosswork using the cluster installer. If your vCenter data center does not meet these requirements, then the VMs have to be deployed individually, and connectivity has to be established manually between the VMs.

- Hypervisor and vCenter supported:
  - VMware vSphere 6.7 or above.
  - VMware vCenter Server 7.0 and ESXi 7.0.
  - VMware vCenter Server 6.7 (Update 3g or later) and ESXi 6.7 (Update 1).
- All the physical host machines must be organized within the same VMware Data Center, and while it is possible to deploy all the cluster nodes on a single physical host (provided it meets the requirements), it is recommended that the nodes be distributed across multiple physical hosts.
- The networks required for the Crosswork Management and Data networks need to be built and configured in the data centers, and must allow low latency L2 communication.
- To allow use of VRRP, DVS Port group needs to be set as follows:

Property	Value
Promiscuous mode	Reject
MAC address changes	Reject
Forged transmits	Accept

To edit the settings in vCenter, navigate to the **Host** > **Configure** > **Networking** > **Virtual Switches**, and select the virtual switch. In the virtual switch, select **Edit** > **Security** and confirm the settings as suggested. Repeat the process for each virtual switch used in the cluster.

- Ensure the user account you use for accessing vCenter has the following privileges:
  - VM (Provisioning): Clone VM on the VM you are cloning.
  - VM (Provisioning): Customize on the VM or VM folder if you are customizing the guest operating system.
  - VM (Provisioning): Read customization specifications on the root vCenter server if you are customizing the guest operating system.
  - VM (Inventory): Create from the existing VM on the data center or VM folder.
  - VM (Configuration): Add new disk on the data center or VM folder.
  - Resource: Assign VM to resource pool on the destination host, cluster, or resource pool.
  - Datastore: Allocate space on the destination datastore or datastore folder.
  - Network: Assign network to which the VM will be assigned.
  - Profile-driven storage (Query): This permission setting needs to be allowed at the root of the DC tree level.
- We also recommend you to enable vCenter storage control.

CSP Data Center Requirements

This section explains the data center requirements to install Cisco Crosswork on Cisco Cloud Services Platform (CSP).

- Cisco CSP, Release 2.8.0.276
- Allowed hardware list:

UCSC-C220-M4S, UCSC-C240-M4SX
N1K-1110-X, N1K-1110-S
CSP-2100, CSP-2100-UCSD, CSP-2100-X1, CSP-2100-X2
CSP-5200, CSP-5216, CSP-5228
CSP-5400, CSP-5436, CSP-5444, CSP-5456

- CSP host or cluster is setup and installed with a minimum of 2 physical ethernet interfaces - one ethernet connected to the Management network, and the other to the Data network.

VM Host Requirements

This section explains the VM host requirements.

Table 1: VM Host Requirements

Requirement	Description
CPU/Memory/Storage Profiles (per VM)	The data center host platform has to accommodate 3 VMs of the following minimum configuration: **VMware vCenter:** • Small (*for lab deployments only*): 8 vCPUs | 48 GB RAM Memory| 1 TB disk space | (Optional) 2 GB RAM disk • Large: 12 vCPUs | 96 GB RAM Memory | 1 TB disk space **Cisco CSP:** • Small (*for lab deployments only*): 8 CPU cores | 48 GB RAM Memory| 1 TB disk space | (Optional) 2 GB RAM disk • Large: 12 CPU cores | 96 GB RAM Memory | 1 TB disk space **Note** For assistance in adjusting VM Memory and CPU configuration post installation, contact your Cisco Customer Experience team. Things to note: • Storage requirements vary based on factors such as the number of devices being supported and the type of deployment selected. However, 1 TB disk space should work for most deployments. • Due to their performance, solid state drives (SSD) are preferred over traditional hard disk drives (HDD). • If you are using HDD, the minimum speed should be over 10,000 RPM. • The VM data store(s) need to have disk access latency of < 10 ms. • Upgrade of the cluster temporarily requires double the total disk space used by the cluster.
Additional Storage	10 GB (approximately) of storage is required for the Crosswork OVA (in **vCenter**), OR the Crosswork QCOW2 image on each CSP node (in **CSP**).
Network Connections	For production deployments, we recommend that you use dual interfaces, one for the Management network and one for the Data network. For optimal performance, the Management and Data networks should use links configured at a minimum of 10 Gbps.

Requirement	Description
IP Addresses	2 IP subnets, one for the Management network and one for Data network, with each allowing a minimum of 4 assignable IP addresses (IPv4 or IPv6). A Virtual IP (VIP) address is used to access the cluster, and then 3 IP addresses for each VM in the cluster. If your deployment requires worker nodes, you will need a Management and Data IP address for each worker node. • The IP addresses must be able to reach the gateway address for the network where Cisco Crosswork Data Gateway will be installed, or the installation will fail. • When deploying a IPv6 cluster, the installer needs to run on an IPv6 enabled container/VM. • At this time, your IP allocation is permanent and cannot be changed without re-deployment. For more information, contact your Cisco Customer Experience team.
NTP Servers	The IPv4 or IPv6 addresses or host names of the NTP servers you plan to use. If you want to enter multiple NTP servers, separate them with spaces. These should be the same NTP servers you use to synchronize the Crosswork application VM clock, devices, clients, and servers across your network. • Ensure that the NTP servers are reachable on the network before attempting installation. The installation will fail if the servers cannot be reached. • The ESXi hosts that will run the Crosswork application and Crosswork Data Gateway VM must have NTP configured, or the initial handshake may fail with "certificate not valid" errors.
DNS Servers	The IPv4 or IPv6 addresses of the DNS servers you plan to use. These should be the same DNS servers you use to resolve host names across your network. • Ensure that the DNS servers are reachable on the network before attempting installation. The installation will fail if the servers cannot be reached.
DNS Search Domain	The search domain you want to use with the DNS servers, for example, cisco.com. You can have only one search domain.

Important Notes

- Cisco Crosswork Infrastructure and applications are built to run as a distributed collection of containers managed by Kubernetes. The number of containers varies as applications are added or deleted.
- Dual stack configuration is not supported in Crosswork Platform Infrastructure. Therefore, **all** addresses for the environment must be either IPv4 or IPv6.

Port Requirements

As a general policy, ports that are not needed should be disabled. To view a list of all the open listening ports once all the applications are installed and active, log in as a Linux CLI admin user on any Crosswork cluster VM, and run the **netstat -aln** command.

The following ports are needed by Cisco Crosswork to operate correctly.

Table 2: External Ports

Port	Protocol	Usage
22	TCP	Remote SSH traffic
111	TCP/UDP	GlusterFS (port mapper)
179	TCP	Calico BGP (Kubernetes)
500	UDP	IPSec
2379/2380	TCP	Kubernetes etcd
4500	UDP	IPSec
6443	TCP	kube-apiserver (Kubernetes)
9100	TCP	Kubernetes metamonitoring
10250	TCP	kubelet (Kubernetes)
24007	TCP	GlusterFS
30603	TCP	User interface (NGINX server listens for secure connections on port 443)
30604	TCP	Used for Classic Zero Touch Provisioning (Classic ZTP) on the NGINX server.
30606	TCP	Docker Registry
30607	TCP	Crosswork Data Gateway vitals collection
30608	TCP	Data Gateway gRPC channel with Data Gateway VMs
30609	TCP	Used by the Expression Orchestrator (Crosswork Service Health)
30610	TCP	Used by the Metric Scheduler (Crosswork Service Health)
30617	TCP	Used for Secure Zero Touch Provisioning (Secure ZTP) on the ZTP server.
30620	TCP	Used to receive plug and play HTTP traffic on the ZTP server.

Port	Protocol	Usage
30621	TCP	For FTP (available on data interface only). The additional ports used for file transfer are 31121 (TCP), 31122 (TCP), and 31123 (TCP). This port is available only when the supported application is installed on Cisco Crosswork and the FTP settings are enabled.
30622	TCP	For SFTP (available on data interface only) This port is available only when the supported application is installed on Cisco Crosswork and the SFTP settings are enabled.
30649	TCP	To set up and monitor Crosswork Data Gateway collection status.
30650	TCP	astack gRPC channel with astack-client running on Data Gateway VMs
30993, 30994, 30995	TCP	Crosswork Data Gateway sending the collected data to Crosswork Kafka destination.
49152:49170	TCP	GlusterFS

Table 3: Destination Ports

Port	Protocol	Usage
7	TCP/UDP	Discover endpoints using ICMP
22	TCP	Initiate SSH connections with managed devices
53	TCP/UDP	Connect to DNS
123	UDP	Network Time Protocol (NTP)
830	TCP	Initiate NETCONF
2022	TCP	Used for communication between Crosswork and Cisco NSO (for NETCONF).
8080	TCP	REST API to SR-PCE
8888	TCP	Used for communication between Crosswork and Cisco NSO (for HTTPS).
20243	TCP	Used by the DLM Function Pack for communication between DLM and Cisco NSO
20244	TCP	Used to internally manage the DLM Function Pack listener during a Reload Packages scenario on Cisco NSO

Supported Web Browsers

After installing the Cisco Crosswork cluster, you require one of the following web browsers to log into the Cisco Crosswork UI:

Table 4: Supported Web Browsers

Browser	Version
Google Chrome (recommended)	75 or later
Mozilla Firefox	70 or later

The recommended display resolution: 1600 x 900 pixels or higher (minimum: 1366 x 768).

In addition to using a supported browser, all client desktops accessing geographical maps in the Crosswork applications must be able to reach the mapbox.com site. Customers not wishing to have Cisco Crosswork access an external site can choose to install the map files locally. For more information, see the *Set Up Maps* chapter in the *Cisco Crosswork Infrastructure 4.1 and Applications Administration Guide*.

Cisco Crosswork Data Gateway Requirements

You can deploy Crosswork Data Gateway on both VMware and Cisco Cloud Services Platform (Cisco CSP). This section provides information about the general guidelines and minimum requirements for installing Crosswork Data Gateway on both platforms.

- Crosswork Data Gateway VM Requirements
- Crosswork Data Gateway Ports Requirements

Cisco Crosswork Data Gateway VM Requirements

Cisco Crosswork Data Gateway provides two On-Premise deployment options:

1. **Standard**: Choose this option to install Crosswork Data Gateway to be used with all Crosswork applications, except Crosswork Health Insights, and Crosswork Service Health (Automated Assurance).
2. **Extended**: Choose this option to install Crosswork Data Gateway for use with Crosswork applications that need micro services to be deployed on the Crosswork Data Gateway - Crosswork Health Insights and Crosswork Service Health (Automated Assurance).

The table below lists the deployment profiles that must be used for installing Crosswork Data Gateway in each Crosswork product:

Note Extended Crosswork Data Gateways are compatible with applications that can otherwise use Standard Crosswork Data Gateways. If any of the deployed applications require Extended Crosswork Data Gateways, then the Crosswork Data Gateways of other applications should also be configured as Extended Crosswork Data Gateways only.

Table 5: Mandatory deployment type for Crosswork Data Gateway

Cisco Crosswork Product	Crosswork Data Gateway Deployment
Crosswork Network Controller (combination of Crosswork Active Topology & Crosswork Optimization Engine)	Standard
Crosswork Optimization Engine	Standard
Crosswork Change Automation	Extended
Crosswork Health Insights	Extended
Crosswork Zero Touch Provisioning	Standard
Crosswork Service Health (Automated Assurance)	Extended

The VM resource requirements for Crosswork Data Gateway differ between Standard and Extended deployments. As a result, Crosswork Data Gateway must be re-installed when moving from Standard to Extended configuration.

Requirements for both types of deployments are listed below.

Note The requirements are same for both VMware and Cisco CSP, unless stated otherwise.

Table 6: Cisco Crosswork Data Gateway VM Requirements

Requirement	Description
Data Center	VMware • VMware vSphere 6.7 or above. • VMware vCenter Server 7.0, ESXi 7.0 or later installed on hosts. • VMware vCenter Server 6.7 (Update 3g or later), ESXi 6.7 Update 1 installed on hosts. Cisco CSP • Cisco CSP 2.8.0.276 or later Allowed_hardware_list = ['UCSC-C220-M4S', 'UCSC-C240-M4SX', 'N1K-1110-X', 'N1K-1110-S','CSP-2100', 'CSP-2100-UCSD', 'CSP-2100-X1', 'CSP-2100-X2','CSP-5200', 'CSP-5216', 'CSP-5228','CSP-5400', 'CSP-5436', 'CSP-5444', 'CSP-5456'] **Note** CSP host or cluster is setup and installed with a minimum of 2 physical ethernet interfaces. If you plan to install Crosswork Data Gateway on Cisco CSP, plan also for a third ethernet interface.

Requirement	Description
Memory	• Standard: 32 GB • Extended: 96 GB
Disk space	• Standard: 55 GB (Minimum) • Extended: 550 GB (Minimum)
vCPU	• Standard: 8 • Extended: 16

<table>
<tr><th>Requirement</th><th>Description</th></tr>
<tr><td>Interfaces</td><td>
Minimum: 1
Maximum: 3
Cisco Crosswork Data Gateway can be deployed with either 1, 2, or 3 interfaces as per the combinations below:
Note If you use one interface on your Crosswork cluster, you must use only one interface on the Crosswork Data Gateway. If you use two interfaces on your Crosswork Cluster, then you can use two or three interfaces on the Crosswork Data Gateway as per your network requirements.
<table>
<tr><th>No. of NICs</th><th>vNIC0</th><th>vNIC1</th><th>vNIC2</th></tr>
<tr><td>1</td><td>• Management Traffic
• Control/Data Traffic
• Device Access Traffic</td><td>—</td><td>—</td></tr>
<tr><td>2</td><td>• Management Traffic</td><td>• Control/Data Traffic
• Device Access Traffic</td><td>—</td></tr>
<tr><td>3</td><td>• Management Traffic</td><td>• Control/Data Traffic</td><td>• Device Access Traffic</td></tr>
</table>
• Management traffic: for accessing the UIs and command line and passing Control/Data information between servers (for example, a Crosswork application to Crosswork Data Gateway or NSO).
• Control/Data traffic: for data and configuration transfer between Cisco Crosswork Data Gateway and Crosswork applications and other external data destinations.
• Device access traffic: for device management (NSO or a Crosswork application to the devices as a result of KPI configuration or playbook execution) and telemetry data being forwarded to the Cisco Crosswork Data Gateway.
Note Due to security policies, traffic from subnets of a vNIC received on other vNICs is dropped. For example, in a 3 vNIC model setup, all device traffic (incoming and outgoing) must be routed through vNIC2. Crosswork Data Gateway drops device traffic received over vNIC0 and vNIC1 will be dropped.
</td></tr>
</table>

Requirement	Description
IP Addresses	1, 2, or 3 IPv4/IPv6 addresses based on the number of interfaces you choose to use. **Note** Crosswork does not support dual stack configurations. Therefore, ALL addresses for the environment must be either IPv4 or IPv6. During installation, you will need to provide IP address for Management Traffic and Control/Data Traffic only. IP address for Device Access Traffic is assigned during Crosswork Data Gateway pool creation as explained in the Section: *Create a Crosswork Data Gateway Pool* in the *Cisco Crosswork Infrastructure 4.1 and Applications Administration Guide*.
NTP Servers	The IPv4/IPv6 addresses or host names of the NTP servers you plan to use. If you want to enter multiple NTP servers, separate them with spaces. These should be the same NTP servers you use to synchronize devices, clients, and servers across your network. Confirm that the NTP IP address or host name is reachable on the network or installation will fail. Also, the ESXi hosts that will run the Crosswork application and Cisco Crosswork Data Gateway VM must have NTP configured, or the initial handshake may fail with "certificate not valid" errors.
DNS Servers	The IPv4 or IPv6 addresses of the DNS servers you plan to use. These should be the same DNS servers you use to resolve host names across your network. Confirm that the DNS servers are reachable on the network before attempting installation. The installation will fail if the servers cannot be reached.
DNS Search Domain	The search domain you want to use with the DNS servers, for example, cisco.com. You can have only one search domain.

Crosswork Data Gateway Ports Requirements

The following tables show the minimum set of ports required for Crosswork Data Gateway to operate correctly.

Note SCP port can be tuned.

Inbound: Crosswork Data Gateway listens on the specified ports.

Outbound: Crosswork Data Gateway connects to external destination IP on the specified ports.

Table 7: Ports to be Opened for Management Traffic

Port	Protocol	Used for...	Direction
22	TCP	SSH server	Inbound
22	TCP	SCP client	Outbound
123	UDP	NTP Client	Outbound
53	UDP	DNS Client	Outbound

Port	Protocol	Used for...	Direction
30607	TCP	Crosswork Controller	Outbound

Table 8: Ports to be Opened for Device Access Traffic

Port	Protocol	Used for...	Direction
161	UDP	SNMP Collector	Outbound
1062	UDP	SNMP Trap Collector **Note** This is the default port. You customize this from the Interactive Console of the VM.	Inbound
9010	TCP	MDT Collector	Inbound
22	TCP	CLI Collector	Outbound
6514	TLS	Syslog Collector **Note** These are the default ports. You customize these values from the Interactive Console of the VM.	Inbound
9898	TCP		
9514	UDP		
Site Specific Default ports differ from XR, XE to vendor. Check platform-specific documentation.	TCP	gNMI Collector	Outbound

Table 9: Ports to be Opened for Control/Data Traffic

Port	Protocol	Used for...	Direction
30649	TCP	Crosswork Controller	Outbound
30993 30994 30995	TCP	Crosswork Kafka	Outbound

Port	Protocol	Used for...	Direction
Site Specific	Site Specific	Kafka and gRPC Destination	Outbound

Cisco NSO and NED Requirements

The requirements in the following table are applicable if you plan to use Cisco Network Services Orchestrator.

Table 10: Supported Cisco NSO and NED versions

Software/Driver	Version
Cisco Network Services Orchestrator (Cisco NSO)	5.5.2.12 You must install the necessary function packs based on the Crosswork applications that are being deployed. For more information, see Installation Dependencies for Cisco Crosswork Products, on page 14
Cisco Network Element Driver (NED)	**Cisco IOS XR:** • CLI: 7.33.12 • NETCONF: 6.6.3, 7.3, 7.315, 7.4.1 **Cisco IOS:** • CLI: 6.74.8

Installation Dependencies for Cisco Crosswork Products

This sections explains the installation and configuration dependencies for each Crosswork product.

Mandatory Function Packs

Depending on the Cisco Crosswork application or solution that you are using, there are mandatory Function Packs (FP) that must be installed to make the product functional. The table below provides references to each FP installation procedure:

Table 11: List of mandatory Function Packs

Crosswork Product	Required Function Pack
Crosswork Network Controller (combination of Crosswork Active Topology & Crosswork Optimization Engine)	• Cisco NSO Transport-SDN Function Pack Bundle Installation Guide 3.0 • Cisco NSO Transport-SDN Function Pack Bundle User Guide 3.0 • Cisco NSO DLM Service Pack Installation Guide 4.1.0 • Cisco Crosswork Telemetry Traffic Collector Function Pack Installation Guide 4.1.0-209
Crosswork Health Insights Crosswork Change Automation	• Cisco NSO DLM Service Pack Installation Guide 4.1.0 • Cisco Crosswork Telemetry Traffic Collector Function Pack Installation Guide 4.1.0-209 • Cisco Crosswork Change Automation NSO Function Pack Installation Guide 4.1.0
Crosswork Optimization Engine	• Cisco NSO DLM Service Pack Installation Guide 4.1.0 • Cisco Crosswork Telemetry Traffic Collector Function Pack Installation Guide 4.1.0-209

Providers Required

Cisco Crosswork applications rely on external services such as Cisco Network Services Orchestrator (NSO) or SR-PCE for various tasks like configuration changes, segment routing path computation, and so on. In order to manage the access and reuse of information between Crosswork applications, providers (such as NSO or SR-PCE) need to be configured for each external service. The provider family determines the type of service that provider supplies to Cisco Crosswork, and the parameters unique to that service, which must be configured.

Depending on what Crosswork application or solution is used, you must configure certain provider families with specific parameters, as explained in the table below:

Table 12: List of Mandatory Provider Configurations

Cisco Crosswork Product	Cisco NSO Provider	Cisco SR-PCE Provider
Crosswork Network Controller (combination of Crosswork Active Topology & Crosswork Optimization Engine)	Mandatory Required protocols are HTTPS and NETCONF. Set **Property Key** as *forward* and **Property Value** as *true*.	Mandatory Required protocol is HTTP.
Crosswork Optimization Engine	Optional	Mandatory Required protocol is HTTP.

Cisco Crosswork Product	Cisco NSO Provider	Cisco SR-PCE Provider
Crosswork Change Automation	Mandatory Required protocol is NETCONF. Set **Property Key** as *forward* and **Property Value** as *true*.	Optional
Crosswork Health Insights		
Crosswork Zero Touch Provisioning	Optional	Optional

Network Topology Models

The following figures show the different topology models, and the corresponding network components and connections needed to install and use Cisco Crosswork.

Figure 1: Cisco Crosswork - 1 NIC Network Topology

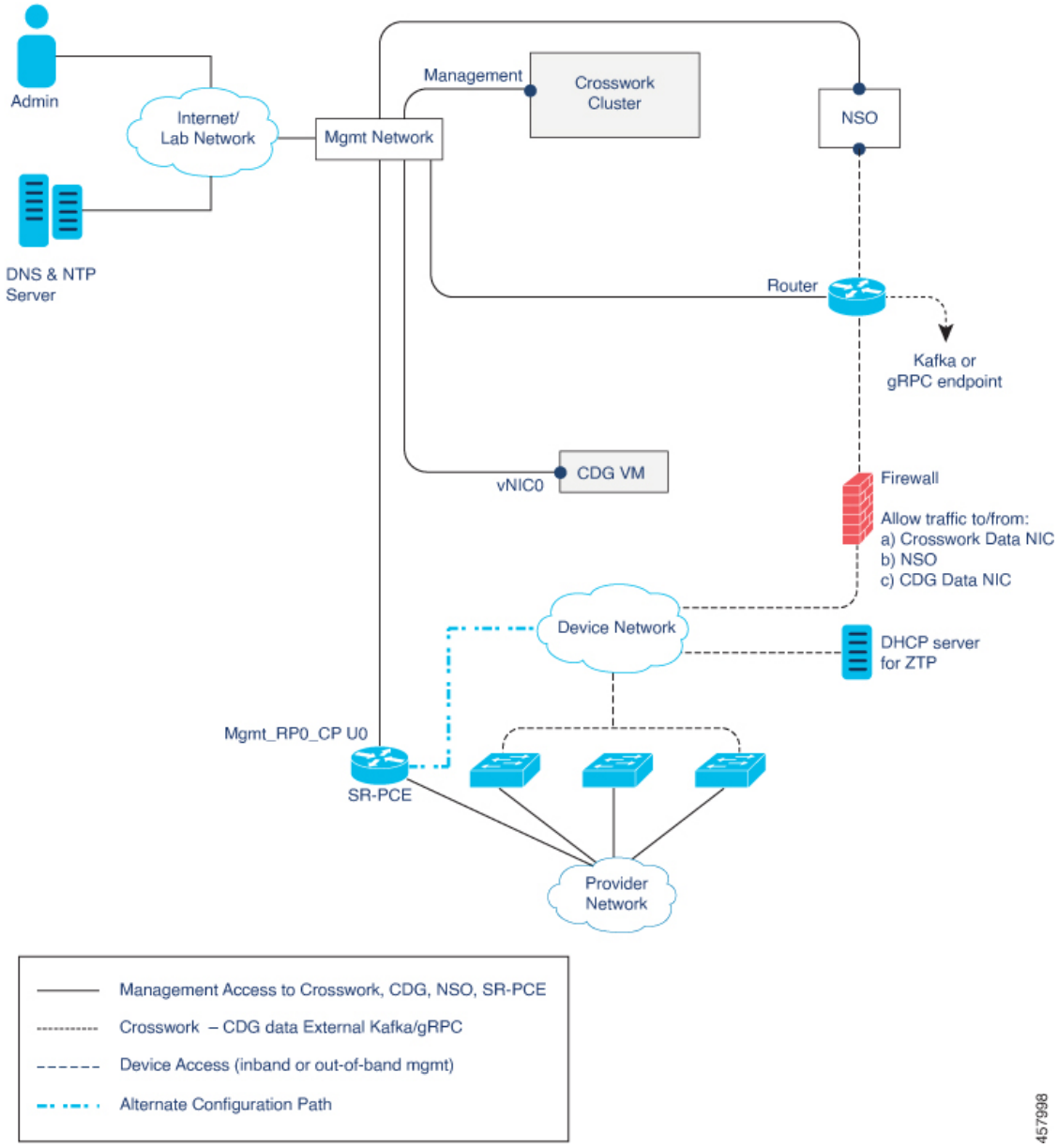


Figure 2: Cisco Crosswork - 2 NIC Network Topology

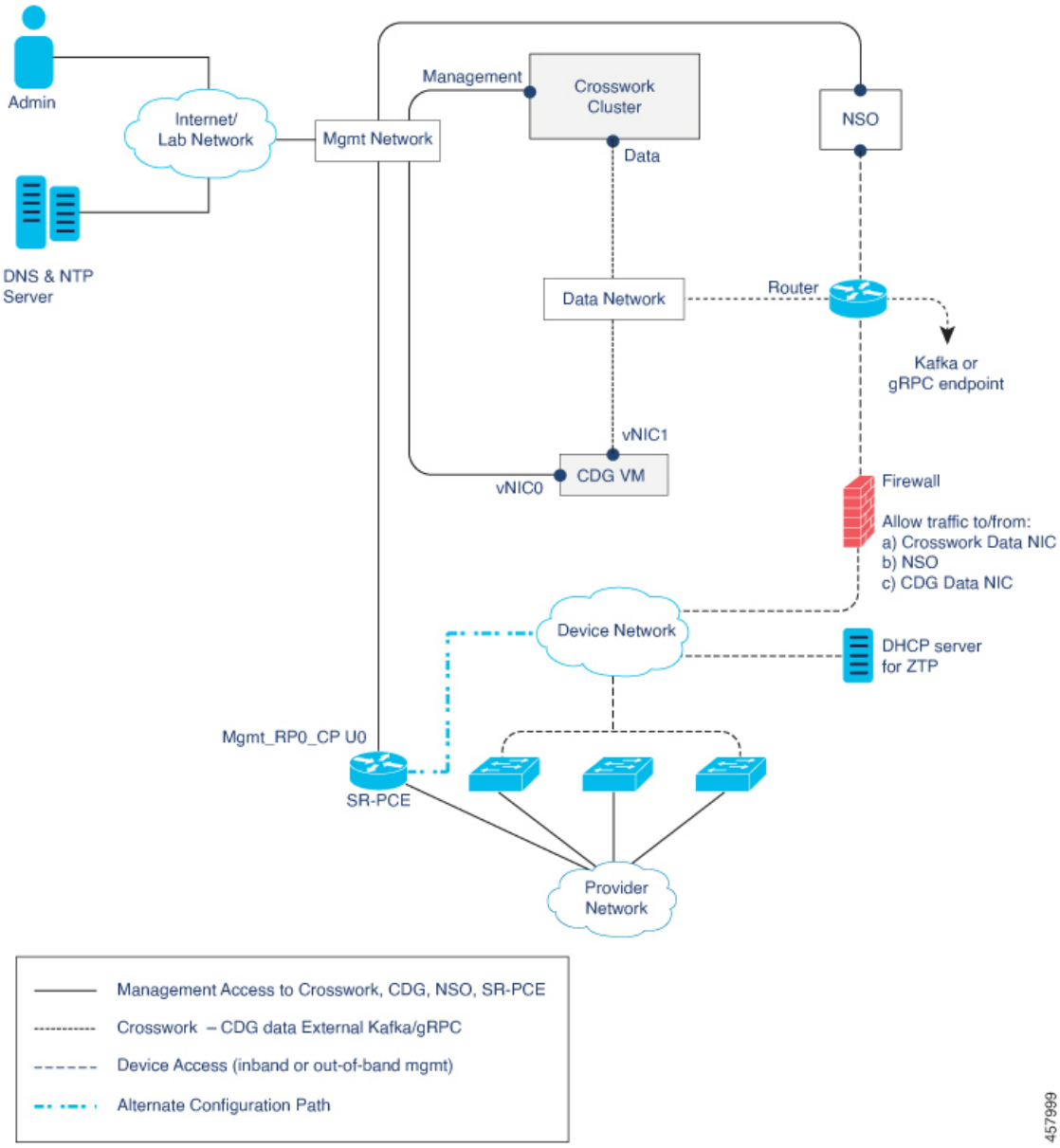
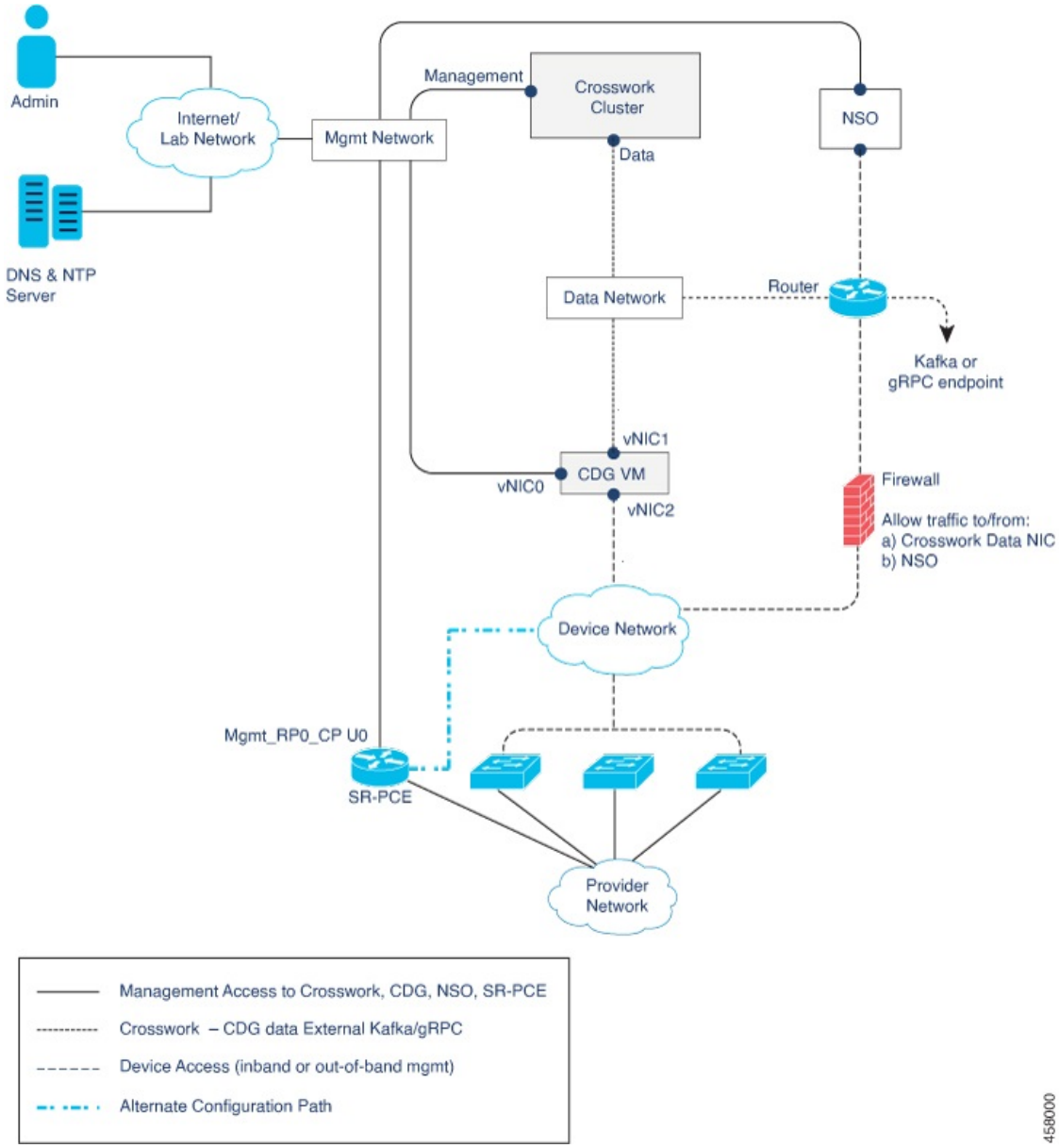


Figure 3: Cisco Crosswork - 3 NIC Network Topology



There are three types of traffic flowing between the network components, as explained below:

Table 13: Types of Network Traffic

Traffic	Description
Management	For accessing the UI and command line, and passing Data information between servers (for example, Cisco Crosswork to Crosswork Data Gateway or NSO)
Data	Data and configuration transfer between Crosswork Data Gateway and Cisco Crosswork, and other data destinations (external Kafka/gRPC).

Traffic	Description
Device Access	Device configuration and management, and telemetry data being forwarded to the Crosswork Data Gateway.

Cisco Crosswork Virtual Machine (VM)

The Cisco Crosswork VM has the following vNIC deployment options:

Table 14: Cisco Crosswork vNIC deployment modes

No. of vNICs	vNIC	Description
1	Management	Management, Data, and Device access passing through a single NIC
2	Management	Management
	Data	Data and Device access

Cisco Crosswork Data Gateway VM

The Cisco Crosswork Data Gateway VM has the following vNIC deployment options:

Note If you use one interface on your Crosswork cluster, you must use only one interface on the Crosswork Data Gateway. If you use two interfaces on your Crosswork Cluster, then you can use two or three interfaces on the Crosswork Data Gateway as per your network requirements.

Table 15: Cisco Crosswork Data Gateway vNIC deployment modes

No. of vNICs	vNIC	Description
1	vNIC0	Management, Data, and Device access passing through a single NIC
2	vNIC0	Management
	vNIC1	Data and Device access
3	vNIC0	Management
	vNIC1	Data
	vNIC2	Device Access

Cisco Network Services Orchestrator (NSO) VM

The NSO VM has the following vNICs:

- Management: Used for Crosswork applications to reach NSO.

- Device Access: Used for NSO to reach devices or NSO Resource Facing Services (RFS).

Note Preference for the number of vNICs can vary from one deployment to another. The number of vNICs can be dependent on the security and traffic isolation needs of the deployment. Crosswork Data Gateway and Crosswork accommodates this variability by introducing a variable number of vNICs.

Routed and Device Networks

Connectivity between the various components should be accomplished via an external routing entity. The figures show various line styles suggesting possible routing domains within the routed network.

- Solid - Management routing domain.
- Dotted - Data/Control routing domain (information transferred between Cisco Crosswork and Cisco Crosswork Data Gateway, and other data destinations (external Kafka or gRPC)).
- Dashes - Device access routing domain (from Cisco Crosswork Data Gateway and NSO).
- Blue dashes - Alternate SR-PCE configuration path

The IP/subnet addressing scheme on each of these domains depends on the type of deployment.

Routing between domains is needed for Crosswork and NSO to reach the devices. However, proper firewall rules need to be in place to allow only select sources (for example, Crosswork and NSO) to reach the devices.

On the device network, devices can be reached in-band or using out-of-band management interfaces, depending on the local security policies of each deployment.

SR-PCE Configuration

The Segment Routing Path Computation Element (SR-PCE) is both a device and a Software-Defined Networking (SDN) controller. Some deployments may want to treat an SR-PCE instance as a device, in which case they would need access via the device network. Some deployments may want to treat an SR-PCE instance as an SDN controller and access it on the Management routing domain. Crosswork supports both models. By default, Crosswork will use **`eth0`** (Management) to access SR-PCE as an SDN controller on the Management domain (shown in the figures). To enable Crosswork access to an SR-PCE instance as a device on the device network (shown as alternate path in the figures): When adding an SR-PCE as a provider, add the **Property Key** and **Property Value** as **`outgoing-interface`** and **`eth1`** (Data) respectively.

ZTP Requirements

If you plan to use Zero Touch Provisioning, the device network needs to be equipped with a DHCP server (not provided with Cisco Crosswork). The devices must also have network connectivity to the Crosswork cluster as they will pull files (software and/or configuration) directly from the Crosswork cluster.