

# Juniper Paragon Automation 2.0.0 Installation and Upgrade Guide

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*Juniper Paragon Automation 2.0.0 Installation and Upgrade Guide*  
2.0.0

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# About This Guide

Use this guide to install Paragon Automation on a VMware ESXi 8.0 server. This guide explains how to:

- Install and upgrade Paragon Automation.
- Repair and replace nodes.
- Back up and restore the configuration.

## RELATED DOCUMENTATION

[Paragon Automation User Guide](#)

[Paragon Automation Release Notes, Release 2.0.0](#)

# 1

CHAPTER

## Introduction

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# Paragon Automation Installation Overview

Juniper® Paragon™ Automation is a WAN automation solution that enables enterprise and service provider networks to meet the challenges posed by an increase in volume, velocity, and types of traffic. Paragon Automation delivers an experience-first and automation-driven network that provides a high-quality experience to network operators.

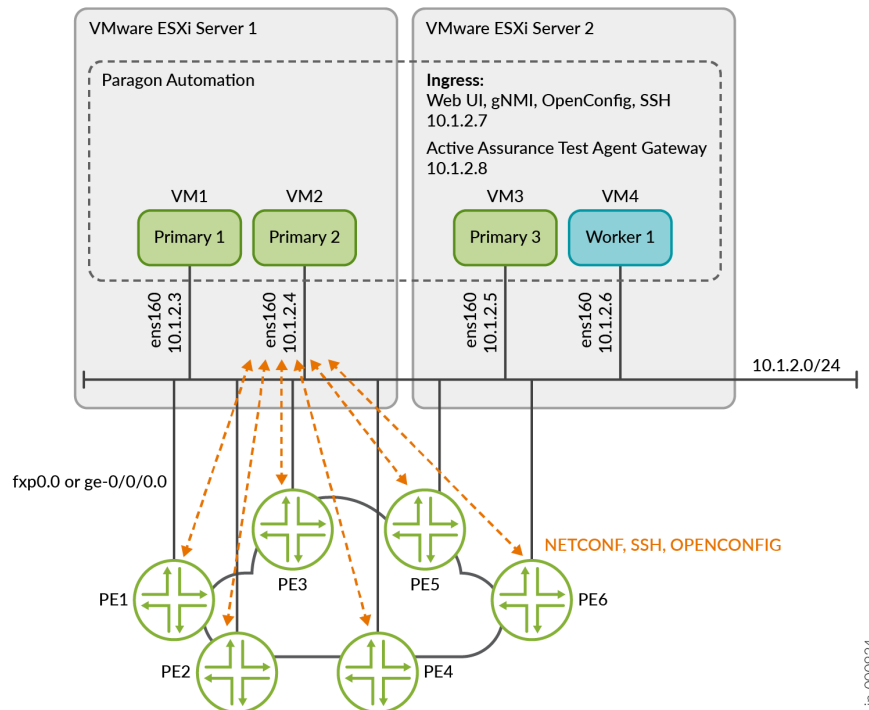
This guide describes how to install Paragon Automation and is intended for system administrators and network operators who install and manage the network infrastructure.

You deploy Paragon Automation as a set of on-premises (customer managed) nodes or virtual machines (VMs) in a Kubernetes cluster. The Kubernetes cluster is a collection of microservices that interact with one another through APIs and that gets created automatically during Paragon Automation installation.

This cluster inter-node communication is implemented using APIs, and SSH, while the communication between Paragon Automation and the managed devices uses SSH, NETCONF, OpenConfig, and gNMI.

[Figure 1 on page 3](#) shows a typical Paragon Automation cluster deployment along with communication protocols. While the illustration shows two servers, you can deploy the cluster on a single server as well.

**Figure 1: Paragon Automation Deployment**



### Paragon Automation Installation

To install Paragon Automation:

1. Download the installation bundle to your local desktop. The installation bundle comprises an OVA file. Use the OVA directly or extract the OVF and .vmdk files to create your VMs.
2. Create and configure the VMs on an ESXi 8 server using the OVA (or OVF) bundles.
3. Deploy a Paragon Automation cluster on the VMs using either the Paragon Shell CLI or the interactive deployment wizard.
4. Log in to the Paragon Automation Web GUI.

An IT or system administrator with permissions to create VMs in the VMware ESXi server and who is involved in tasks related to installation and administration, installs and maintains the Paragon Automation cluster. Paragon Automation can be deployed in an air-gap environment where there is no access to the Internet.

You do not have to create the VMs and then use the OVA or OVF bundles. You will be creating the VMs from the OVA or OVF bundles. In other words, you do not need to bring up the VMs with any particular operating system, install additional components such as Docker, create and configure the interfaces,

configure NTP, and so on, separately. All these tasks are done automatically as part of the VM-creation process from the OVA or OVF bundles.

### Paragon Shell CLI

Paragon Automation provides a custom containerized MGD (cMGD) user shell, called Paragon Shell. A system administrator can use Paragon Shell to deploy and configure the Paragon Automation cluster. The Paragon Shell CLI is installed and available after the VMs are created on the VMware ESXi server using the OVA or OVF bundles. The OVA or OVF bundles are prepackaged with all the packages required to create the node VMs and deploy the Paragon Automation cluster. Paragon Shell is installed on the base OS.

You can use Paragon Shell to:

- Deploy the Paragon Automation cluster
- Upgrade, backup, restore, and edit the cluster configuration
- Create and edit users
- Retrieve cluster information for troubleshooting

The VMs are appliances containing both the Linux base OS as well as all required application code. When you create and log in to the VMs, you are placed in Paragon Shell, by default. When you exit Paragon Shell, you are placed in the Linux root shell.

You can also deploy the cluster from the Linux root shell using a deployment wizard.



**NOTE:** Exercise caution while executing commands from the Linux root shell. Commands executed from the Linux root shell are not supported unless explicitly mentioned in the documentation.

The configuration files used to deploy the cluster are stored in the `/root/epic/config` folder on the VM from which you deployed the cluster.

This guide explains how to:

- Install and upgrade Paragon Automation.
- Repair and replace nodes.
- Back up and restore a configuration.

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# 2

CHAPTER

## System Requirements

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# Paragon Automation System Requirements

## IN THIS SECTION

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Before you install the Paragon Automation software, ensure that your system meets the requirements that we describe in these sections.

To determine the resources required to implement Paragon Automation, you must understand the fundamentals of the Paragon Automation underlying infrastructure.

Paragon Automation is a collection of microservices that interact with one another through APIs and run within containers in a Kubernetes cluster. A Kubernetes cluster is a set of nodes or virtual machines (VMs) running containerized applications.

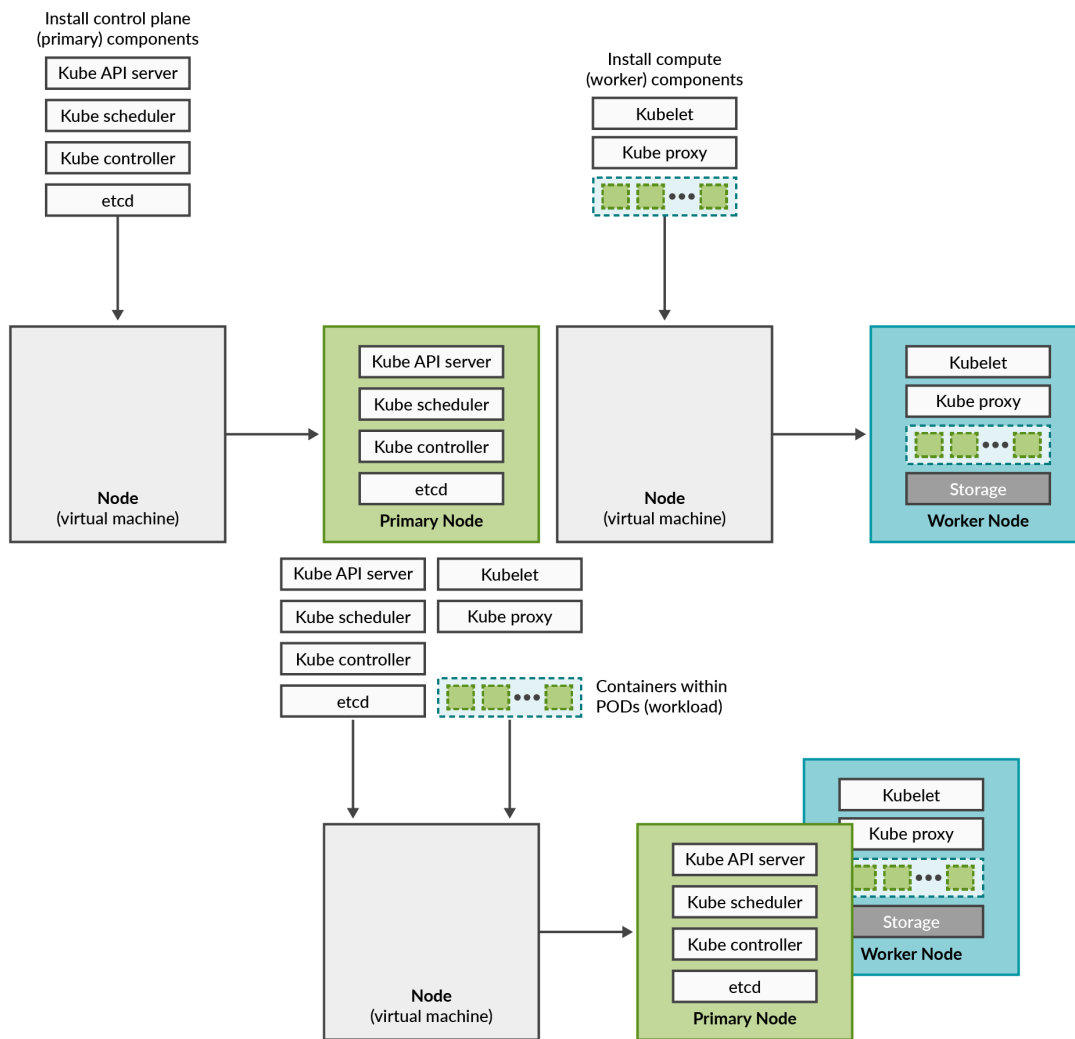
A Kubernetes cluster comprises one or more primary and worker nodes.

- **Control plane (primary) node**—The primary node performs the Kubernetes control-plane functions.
- **Compute (worker) node**—The worker node provides resources to run the pods. Worker nodes do not have control-plane function.

The two types of nodes can be deployed separately or co-located in the same VM. A single node can function as both primary and worker if the components required for both roles are installed in the same node.

In Paragon Automation, by default, the primary nodes also serve as worker nodes.

**Figure 2: Kubernetes Cluster Nodes and Roles**



You need to consider the intended system's capacity (number of devices to be managed, use cases, and so on), the level of availability required, and the expected system's performance, to determine the following cluster parameters:

- Total number of nodes in the cluster
- Amount of resources on each node (CPU, memory, and disk space)
- Number of nodes acting as primary and worker nodes

The amount of resources on each node are described later in this topic.

## Paragon Automation Implementation

Paragon Automation is implemented on top of a Kubernetes cluster, which consists of one or more primary nodes and one or more worker nodes. Paragon Automation is implemented as a multinode cluster. At minimum, three nodes that function as both primary and worker nodes and one node that functions as a worker-only node is required for a functional cluster. The four-node cluster is the recommended and supported implementation.

This implementation not only improves performance but allows for high availability within the cluster:

- **Control plane high availability**—The three nodes that function as both primary and worker nodes, provide the required control plane redundancy. The cluster remains functional when a single node fails. We do not recommend more than three primary nodes.
- **Workload high availability**—For workload high availability and workload performance, you must have more than one worker. In Paragon Automation, the three nodes that function as both primary and worker nodes and the one node that serves as a worker-only node provide workload high availability.
- **Storage high availability**—For storage high availability, all the nodes provide Ceph storage.

## Hardware Requirements

This section describes the minimum hardware resources required on each node VM in the Paragon Automation cluster, for evaluation purposes or for small deployments.

The compute, memory, and disk requirements of the cluster nodes can vary based on the intended capacity of the system. The intended capacity depends on the number of devices to be onboarded and monitored, types of sensors, and frequency of telemetry messages. If you increase the number of devices, you'll need higher CPU and memory capacities.



**NOTE:** To get a scale and size estimate of a production deployment and to discuss detailed dimensioning requirements, contact your Juniper Partner or Juniper Sales Representative. Paragon Automation Release 2.0.0 supports a scale of a maximum of 150 devices.

Each of the four nodes in the cluster must have:

- 16-core vCPU
- 32-GB RAM
- 300-GB SSD



**NOTE:** SSDs are mandatory.

The VMs do not need to be on the same server, but they need to be able to communicate over the same Layer 2 network. You need one or more servers with enough CPU, memory, disk space to accommodate the hardware resources listed in this section.

## Software Requirements

Use VMware ESXi 8.0 to deploy Paragon Automation.

## Network Requirements

The four nodes must be able to communicate with each other through SSH. The nodes must be able to sync to an NTP server. SSH is enabled automatically during the VM creation, and you will be asked to enter the NTP server address during the cluster creation. Ensure that there is no firewall blocking NTP or blocking SSH traffic between the nodes in case they are on different servers.

You need to have the following addresses available for the installation, all in the *same subnet*.

- Four interface IP addresses, one for each of the four nodes
- Internet gateway IP address
- Two virtual IP (VIP) addresses for:
  - Generic ingress IP address shared between GNMI, OC-TERM (SSH connections from devices), and the Web UI—This is a general purpose VIP address that is shared between multiple services and used to access Paragon Automation from outside the cluster.
  - Paragon Active Assurance Test Agent gateway—This VIP address serves HTTP-based traffic to the Paragon Active Assurance Test Agent endpoint.

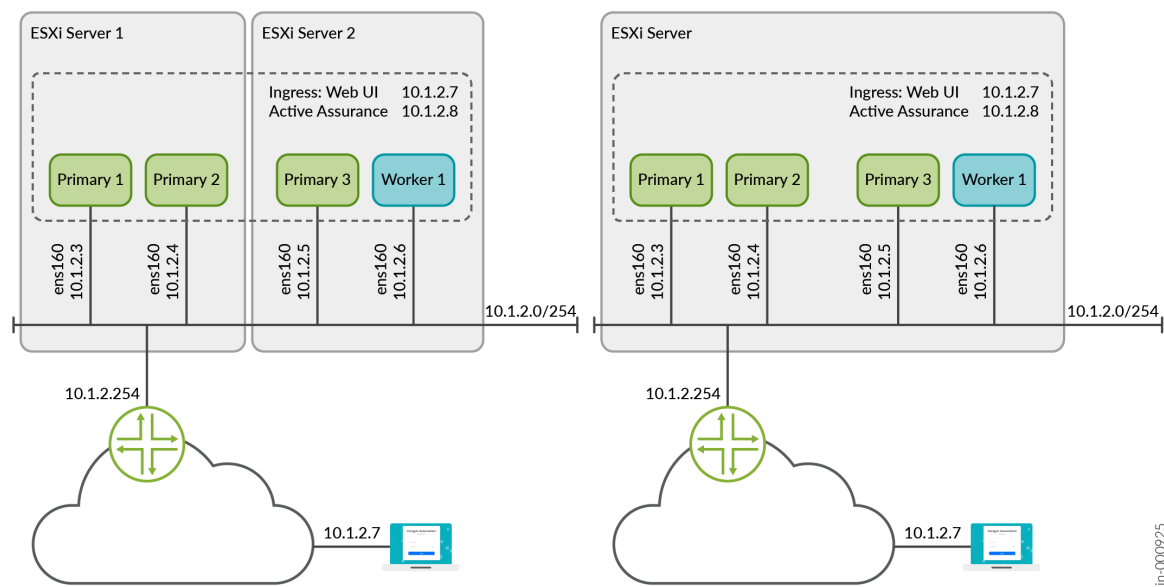
The VIP addresses are added to the outbound SSH configuration that is required for a device to establish a connection with Paragon Automation. The outbound SSH commands for OC-TERM and GNMI both use the VIP addresses.

- (Optional) Hostnames mapped to the VIP addresses—Along with VIP addresses, you can also enable devices to connect to Paragon Automation using hostnames. However, you must ensure that the hostnames and the VIP addresses are correctly mapped in the DNS and your device must be able to

connect to the DNS. If you configure Paragon Automation to use hostnames, the hostnames are added to the outbound SSH configuration instead of the VIP addresses.

Figure 3 on page 11 illustrates the IP and VIP addresses required to install a Paragon Automation cluster. The illustration displays two ways of deploying the cluster, that is, on a single server or two servers.

**Figure 3: IP Addressing Requirements**



You must allow intracluster communication between the nodes. In particular, you must keep the ports listed in Table 1 on page 11 open for communication.

**Table 1: Ports That Firewalls Must Allow for Intracluster Communication**

| Port                 | Usage              | From              | To                | Comments                      |
|----------------------|--------------------|-------------------|-------------------|-------------------------------|
| Infrastructure Ports |                    |                   |                   |                               |
| 22                   | SSH for management | All cluster nodes | All cluster nodes | Require a password or SSH-key |

**Table 1: Ports That Firewalls Must Allow for Intracluster Communication (*Continued*)**

| Port        | Usage                            | From              | To                | Comments                                                   |
|-------------|----------------------------------|-------------------|-------------------|------------------------------------------------------------|
| 2222<br>TCP | Paragon Shell configuration sync | All cluster nodes | All cluster nodes | Require password or SSH-key                                |
| 443<br>TCP  | HTTPS for registry               | All cluster nodes | Primary nodes     | Anonymous read access<br><br>Write access is authenticated |
| 2379<br>TCP | etcd client port                 | Primary nodes     | Primary nodes     | Certificate-based authentication                           |
| 2380<br>TCP | etcd peer port                   | Primary nodes     | Primary nodes     | Certificate-based authentication                           |
| 5473        | Calico CNI with Typha            | All cluster nodes | All cluster nodes | —                                                          |
| 6443        | Kubernetes API                   | All cluster nodes | All cluster nodes | Certificate-based authentication                           |
| 7472<br>TCP | MetallB metric port              | All cluster nodes | All cluster nodes | Anonymous read only, no write access                       |
| 7946<br>UDP | MetallB member election port     | All cluster nodes | All cluster nodes | —                                                          |
| 8443        | HTTPS for registry data sync     | Primary nodes     | Primary nodes     | Anonymous read access<br><br>Write access is authenticated |

**Table 1: Ports That Firewalls Must Allow for Intracluster Communication (*Continued*)**

| Port             | Usage                     | From              | To                | Comments                           |
|------------------|---------------------------|-------------------|-------------------|------------------------------------|
| 9345             | rke2-server               | All cluster nodes | All cluster nodes | Token based authentication         |
| 10250            | kubelet metrics           | All cluster nodes | All cluster nodes | Standard Kubernetes authentication |
| 10260            | RKE2 cloud controller     | All cluster nodes | All cluster nodes | Standard Kubernetes authentication |
| Calico CNI Ports |                           |                   |                   |                                    |
| 4789<br>UDP      | Calico CNI with VXLAN     | All cluster nodes | All cluster nodes | —                                  |
| 5473<br>TCP      | Calico CNI with Typha     | All cluster nodes | All cluster nodes | —                                  |
| 51820<br>UDP     | Calico CNI with Wireguard | All cluster nodes | All cluster nodes | —                                  |

The following ports must be open for communication from outside the cluster.

**Table 2: Ports That Firewalls Must Allow for Communication from Outside the Cluster**

| Port | Usage         | From                           | To                              |
|------|---------------|--------------------------------|---------------------------------|
| 443  | Web GUI + API | External user computer/desktop | Web GUI Ingress VIP address(es) |

Table 2: Ports That Firewalls Must Allow for Communication from Outside the Cluster *(Continued)*

| Port  | Usage                               | From                     | To                                              |
|-------|-------------------------------------|--------------------------|-------------------------------------------------|
| 443   | Paragon Active Assurance Test Agent | External network devices | Paragon Active Assurance Test Agent VIP address |
| 2200  | OC-TERM                             | External network devices | Web GUI Ingress VIP address(es)                 |
| 6800  | Paragon Active Assurance Test Agent | External network devices | Paragon Active Assurance Test Agent VIP address |
| 32767 | gNMI                                | External network devices | Web GUI Ingress VIP address(es)                 |

## Web Browser Requirements

The latest version of Google Chrome, Mozilla Firefox, and Safari.



**NOTE:** We recommend that you use Google Chrome.

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# 3

CHAPTER

## Install

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  - Install User Certificates | 36
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# Install Paragon Automation

## SUMMARY

This topic describes the steps you must perform to install Paragon Automation using an OVA or OVF bundle.

## IN THIS SECTION

- [Prepare the Nodes | 17](#)
- [Deploy the Cluster Using Paragon Shell | 23](#)
- [Deploy the Cluster Using The Deployment Wizard | 32](#)
- [Log in to the Web GUI | 35](#)

You (system administrator) can install Paragon Automation by downloading an OVA bundle. You can use the OVA bundle as a whole or extract OVF and **.vmdk** files from the OVA bundle and use the files to deploy the node virtual machines (VMs) on a VMware ESXi server. Paragon Automation runs on a Kubernetes cluster with at least three primary and worker nodes and one worker-only node. The installation is air-gapped but you need Internet access to download the OVA bundle to your computer.

If you are installing from a remote machine, you can instead create a local desktop installer VM, either on the same server where you want to install Paragon Automation or on a different server. The local desktop installer VM can be a basic Ubuntu desktop VM. This avoids having to download the files into your remote machine, and then running the installation from the remote machine. This is described in the ["Prepare the Nodes" on page 17](#) section.

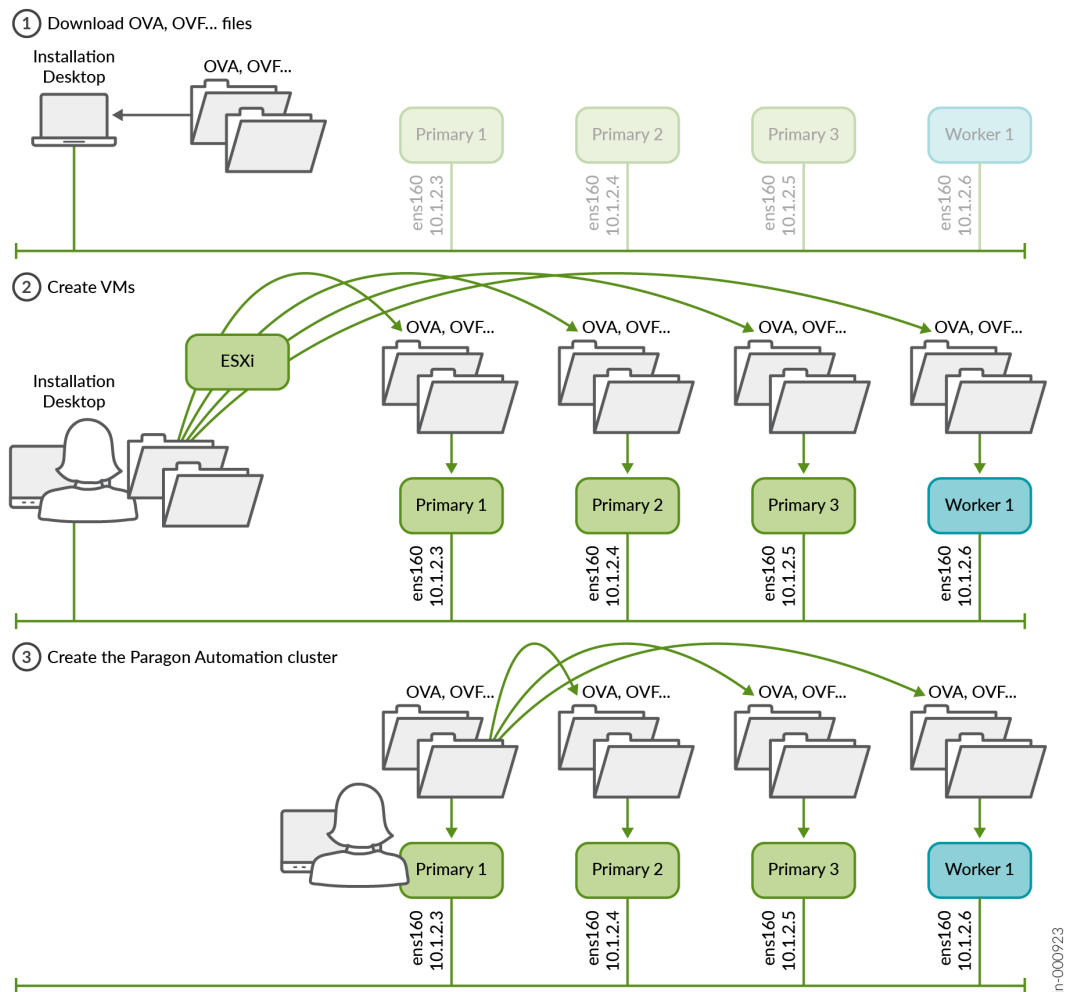
To install Paragon Automation, you must create the node VMs using the downloaded OVA or OVF and **.vmdk** files. The software download files come prepackaged with the base OS and all packages required to create the VMs and deploy your Paragon Automation cluster. The VMs have an Ubuntu 22.04.4 LTS (Jammy Jellyfish) Linux base OS.

Once the VMs are created, you must configure each VM in the same way. When all the VMs are configured and prepared, you deploy the Paragon Automation cluster. You can deploy the cluster in either of the following ways:

- ["Deploy the Cluster Using Paragon Shell" on page 23](#)
- ["Deploy the Cluster Using The Deployment Wizard" on page 32](#)

[Figure 4 on page 17](#) illustrates the Paragon Automation installation process at a high-level.

Figure 4: Installation Process



**NOTE:** You create the VMs directly using the OVA/OVF bundles. You do not need to create the VMs separately with any running software (for example, Ubuntu), or explicitly create interfaces, install Docker separately and so on. These are all automatically created and configured when you create the VMs using the OVA/OVF bundles.

To prepare the VMs, perform the following steps.

## Prepare the Nodes

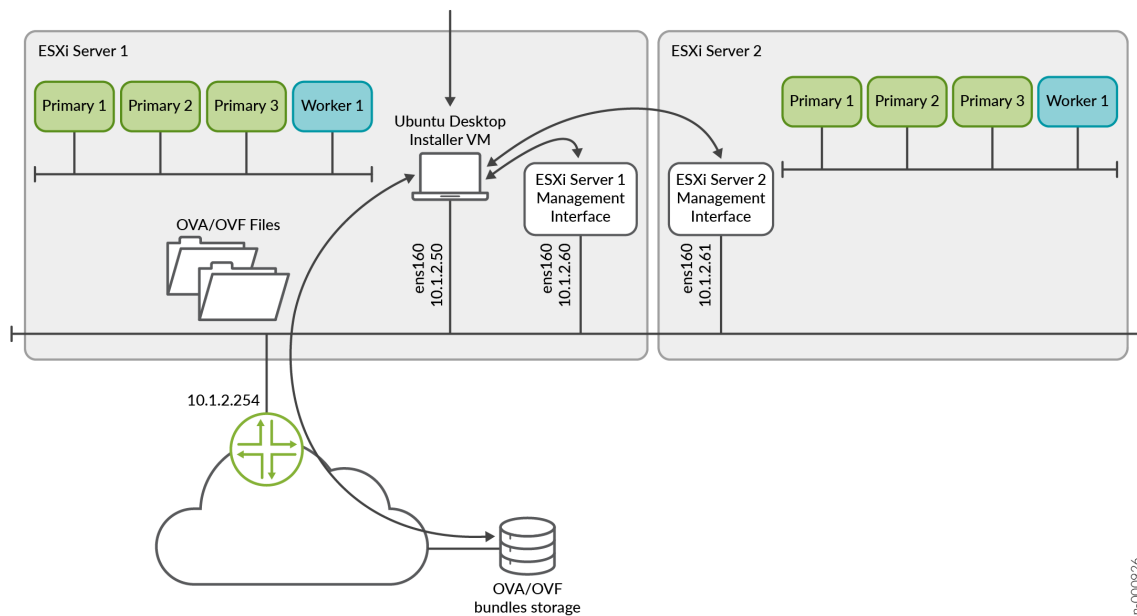
To prepare the nodes you must create and configure the VMs.

1. Download the **Paragon Automation Installation OVA** file from the [Juniper Paragon Automation software download site](#). The OVA is used to create the node VMs and deploy your cluster.

Note that the actual filename will include the release date in it, such as **paragon-2.0.0-0515.ova**.

The file is large in size and it might take considerable time to download it and then create the VMs from your computer. So, we recommend that you create a local installer VM, which can be a basic Ubuntu desktop VM, either on the same server where you want to install Paragon Automation or on a different server. You must be able to download the OVA file to this local installer VM and you must have enough space on the VM to store the file. Configure connectivity to the management IP addresses of the servers as show in [Figure 5 on page 18](#).

**Figure 5: Local Installer VM to download the OVA/OVF files**



2. (Optional) Validate the integrity of the OVA file. If you are using an Ubuntu desktop, use the following command:

```
root@ubuntu:~$ sha512sum paragon-2.0.0-0515.ova
7deda68aae8ba6399aa95d5365a659a8d579c5562811ebe588972cf0c5107337628370d78dcdbd56ab8ea97e73b759
7f3a5ff06e9f501706bd8954b7454b86d2 paragon-2.0.0-0515.ova
```

Verify that the number displayed onscreen is the same as the SHA512 checksum number available on the Juniper Paragon Automation [software download site](#). Click **Checksums** to view the valid SHA512 checksum.

3. After verifying the integrity, create the node VMs. You can use the OVA as a whole to create the VMs.

Alternatively, extract and use the OVF and **.vmdk** files from the OVA to create your VMs. To extract the files, use the following command:

```
tar -xvf paragon-2.0.0-0515.ova
```

If your installation desktop is running Windows, you can download and use the tar utility from <https://gnuwin32.sourceforge.net/packages/gtar.htm> to extract the files.



**NOTE:** If you are using a stand-alone ESXi 8.0 server without vCenter, due to a limitation of the VMware host client, you cannot upload large OVA files to the client. In such cases, you **must** extract and use the OVF, **.vmdk**, and **.nvram** files to create your VMs.

4. From your Web browser, connect and log in to the VMware ESXi 8.0 server where you will install Paragon Automation.

If you are using a local installer VM, use the browser in the VM to connect to the VMware ESXi server.

## 5. Create the node VMs.

Perform the following steps to create the VMs.

- a. Right-click the **Host** icon and select **Create/Register VM**.

The New virtual machine wizard appears.

- b. On the Select creation type page, select **Deploy a virtual machine from an OVF or OVA file**.

Click **Next**.

- c. On the Select OVF and VMDK files page, enter a name for the node VM.

Click to upload or drag and drop the OVA file or the OVF file along with the **.vmdk** files.

Review the list of files to be uploaded and click **Next**.

- d. On the Select storage page, select the appropriate datastore that can accommodate 300-GB SSD for the node VM. Note that SSD is mandatory.

Click **Next**. The extraction of files takes a few minutes.

- e. On the Deployment options page:

- Select the virtual network to which the node VM will be connected.
- Select the **Thick** disk provisioning option.
- Enable the VM to power on automatically.

Click **Next**.

- f. On the Ready to complete page, review the VM settings.

Click **Finish** to create the node VM.



**NOTE:** If you used the OVF and **.vmdk** files to create your VMs and the VM creation failed, retry creating the VMs with the **.nvram** file. On step "5.c" on page 19, upload the **.nvram** file along with the OVF and **.vmdk** files. For standalone ESXi 8.0 servers without vCenter, you must upload the **.nvram** file as well.

- g. Repeat steps "5.a" on page 19 through "5.f" on page 20 for the other three node VMs. Enter appropriate VM names when prompted.
- h. (Optional) Verify the progress of the VM creation in the Recent tasks section at the bottom of the page. When a VM is created, it appears in the VMware Host Client inventory under Virtual Machines.
- i. When all the VMs have been created, verify that they have the correct specifications and are powered on.

## 6. Configure the node VMs

When all the node VMs are created, perform the following steps to configure them.

- a. Connect to the node VM Web console of the first VM. You are logged in as root automatically.
- b. You are prompted to change your password immediately. Enter and re-enter the new password. You are automatically logged out of the VM.



**NOTE:** We recommend that you enter the same password for all the VMs. If you configure different passwords for the VMs, enter the different passwords correctly when requested to:

- ["Generate SSH keys" on page 28](#) for the cluster nodes when deploying the cluster using Paragon Shell.
- ["Enter the passwords" on page 33](#) for the VMs when deploying the cluster using the deployment wizard.

- c. When prompted, log in again as root user with the newly configured password.
- d. Configure the following information when prompted.

**Table 3: VM Configuration Wizard**

| Prompt                                  | Action                                  |
|-----------------------------------------|-----------------------------------------|
| Do you want to set up a Hostname? (y/n) | Enter <b>y</b> to configure a hostname. |

Table 3: VM Configuration Wizard (*Continued*)

| Prompt                                             | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Please specify the Hostname                        | <p>Enter an identifying hostname for the VM. For example: Primary1. The hostname should be under 64 characters and can include alphanumeric and some special characters.</p> <p>If you do not enter a hostname, a default hostname in the format controller -&lt;VM-IP-address-4th-octet&gt; is assigned.</p> <p><b>NOTE:</b> Since you are deploying the cluster from one node, and entering the IP addresses of the other nodes during the cluster configuration process, the roles are assigned automatically. The first three nodes to be configured are the primary and worker nodes and the last node is the worker-only node.</p> <p>The hostnames (and whether or not they match the role of the node), will not affect the operations of the cluster. However, for management purposes, we recommend that you pay attention to how you name the nodes and the order in which you entered their addresses during the cluster creation steps.</p> <p>We do not support changing the hostname after the cluster has been installed.</p> |
| Do you want to set up Static IP (preferred)? (y/n) | Enter <b>y</b> to configure an IP address for the VM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Please specify the IP address in CIDR notation     | <p>Enter the IP address in the CIDR notation. For example, 10.1.2.3/24.</p> <p><b>NOTE:</b> If you enter 10.1.2.3 instead of 10.1.2.3/24 you will get an Invalid IP address error message.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Please specify the Gateway IP                      | Enter the gateway IP address.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Please specify the Primary DNS IP                  | Enter the primary DNS IP address.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**Table 3: VM Configuration Wizard (Continued)**

| Prompt                              | Action                              |
|-------------------------------------|-------------------------------------|
| Please specify the Secondary DNS IP | Enter the secondary DNS IP address. |

- e. When prompted if you are sure to proceed, review the information displayed, type **y** and press Enter.
  - f. You are logged in to Paragon Shell.
  - g. Repeat steps "6.a" on page 20 through "6.f" on page 23 for the other three VMs.
7. (Optional) Before you proceed to deploy the cluster, verify that the NTP server(s) is reachable. On any one of the cluster nodes, type `start shell`. At the `#` prompt, ping the server using the `ping ntp-servers-name-or-address` command. If the ping is unsuccessful, use an alternate NTP server.

You have completed the node preparation steps and are ready to deploy the cluster using either Paragon Shell or the deployment wizard.

## Deploy the Cluster Using Paragon Shell

Perform the following steps to deploy the Paragon Automation cluster using Paragon Shell CLI.

1. Go back to the first node VM (*Primary1*). If you have been logged out, log in again using SSH, as root with the previously configured "password" on page 20. You are placed in Paragon Shell operational mode.

```
*****
WELCOME TO PARAGON SHELL!
You will now be able to execute Paragon CLI commands!
*****
root@eop>
```

2. To configure the cluster, enter the configuration mode in Paragon Shell.

```
root@eop> configure
Entering configuration mode
```

```
[edit]
```

### 3. Configure the following cluster parameters.

```
root@eop# set paragon cluster nodes kubernetes 1 address 10.1.2.3

[edit]
root@eop# set paragon cluster nodes kubernetes 2 address 10.1.2.4

[edit]
root@eop# set paragon cluster nodes kubernetes 3 address 10.1.2.5

[edit]
root@eop# set paragon cluster nodes kubernetes 4 address 10.1.2.6

[edit]
root@eop# set paragon cluster ntp ntp-servers pool.ntp.org

[edit]
root@eop# set paragon cluster common-services ingress ingress-vip 10.1.2.7

[edit]
root@eop# set paragon cluster applications active-assurance test-agent-gateway-vip 10.1.2.8

[edit]
root@eop# set paragon cluster applications web-ui web-admin-user "user-admin@juniper.net"

[edit]
root@eop# set paragon cluster applications web-ui web-admin-password Userpasswd

[edit]
```

Where:

The IP addresses of kubernetes nodes with indexes 1 through 4 must match the ["static IP addresses" on page 22](#) configured on the node VMs. The Kubernetes nodes with indexes 1,2 and 3 are the primary and worker nodes, the node with index 4 is the worker-only node.

ntp-servers is the NTP server to sync to.

web-admin-user and web-admin-password are the e-mail address and password that the first user can use to log in to the Web GUI.

ingress-vip is the VIP address for the generic ingress IP address.

test-agent-gateway-vip is the VIP address for the Paragon Active Assurance Test Agent gateway.

The VIP addresses are added to the outbound SSH configuration that is required for a device to establish a connection with Paragon Automation.

4. (Optional) If you want to configure hostnames for generic ingress and Paragon Active Assurance Test Agent gateway, configure the following:

```
root@eop# set paragon cluster common-services ingress system-hostname ingress-vip-dns-hostname

[edit]
root@eop# set paragon cluster applications active-assurance test-agent-gateway-hostname nginx-ingress-controller-hostname

[edit]
```

Where:

system-hostname is the hostname for the generic ingress virtual IP address.

test-agent-gateway-hostname is the hostname for the Paragon Active Assurance Test Agent gateway virtual IP address.

When you configure hostnames, the hostnames are added to the outbound SSH configuration instead of the VIP addresses.

5. (Optional) Configure the following settings for SMTP-based user management.

```
root@eop# set paragon cluster mail-server smtp-allowed-sender-domains sender-domains

[edit]
root@eop# set paragon cluster mail-server smtp-relayhost relayhost-hostname

[edit]
root@eop# set paragon cluster mail-server smtp-relayhost-username relayhost-username

[edit]
root@eop# set paragon cluster mail-server smtp-relayhost-password relayhost-password

[edit]
root@eop# set paragon cluster mail-server smtp-sender-email sender-e-mail-address
```

```
[edit]
root@eop# set paragon cluster mail-server smtp-sender-name sender-name

[edit]
root@eop# set paragon cluster papi papi-local-user-management False

[edit]
```

Where:

*sender-domains* are the e-mail domains from which Paragon Automation sends e-mails to users.

*relayhost-hostname* is the name of the SMTP server that relays messages.

*relayhost-username* (optional) is the user name to access the SMTP (relay) server.

*relayhost-password* (optional) is the password for the SMTP (relay) server.

*sender-e-mail-address* is the e-mail address that appears as the sender's e-mail address to the e-mail recipient.

*sender-name* is the name that appears as the sender's name in the e-mails sent to users from Paragon Automation.

*papi-local-user-management False* disables local user management.



**NOTE:** SMTP configuration is optional at this point. SMTP settings can be configured after the cluster has been deployed also. For information on how to configure SMTP after cluster deployment, see *Configure SMTP Settings in Paragon Shell*.

6. (Optional) Install custom user certificates. Note, before you install user certificates, you must have copied the custom certificate file and certificate key file to the **/root/epic/config** folder in the Linux root shell of the node from which you are deploying the cluster.

```
root@eop# set paragon cluster common-services ingress user-certificate use-user-certificate
true

[edit]
root@eop# set paragon cluster common-services ingress user-certificate user-certificate-
filename "certificate.cert.pem"

[edit]
```

```
root@eop# set paragon cluster common-services ingress user-certificate user-certificate-key-
filename "certificate.key.pem"

[edit]
```

Where:

*certificate.cert.pem* is the user certificate file name.

*certificate.key.pem* is the user certificate key file name.



**NOTE:** Installing certificates is optional at this point. You can configure Paragon Automation to use custom user certificates after cluster deployment also. For information on how to install user certificates after cluster deployment, see ["Install User Certificates" on page 36](#).

7. Commit the configuration and exit configuration mode.

```
root@eop# commit
commit complete

[edit]
root@eop# exit
Exiting configuration mode

root@eop>
```

8. Generate the configuration files.

```
root@eop> request paragon config
Paragon inventory file saved at /epic/config/inventory
Paragon config file saved at /epic/config/config.yml
```

The **inventory** file contains the IP addresses of the VMs.

The **config.yml** file contains minimum Paragon Automation cluster parameters required to deploy a cluster.

The `request paragon config` command also generates a **config.cmgd** file in the **config** directory. The **config.cmgd** file contains all the set commands that you executed in ["3" on page 24](#). If the

**config.yml** file is inadvertently edited or corrupted, you can redeploy your cluster using the `load set config/config.cmdg` command in the configuration mode.

## 9. Generate ssh keys on the cluster nodes.

When prompted, enter the SSH password for the VMs. Enter the same ["password" on page 20](#) that you configured to log in to the VMs.

```

root@eop> request paragon ssh-key
Setting up public key authentication for ['10.1.2.3','10.1.2.4','10.1.2.5','10.1.2.6']

Please enter SSH username for the node(s):
      root
Please enter SSH password for the node(s):

      password

checking server reachability and ssh connectivity ...
Connectivity ok for 10.1.2.3
Connectivity ok for 10.1.2.4
Connectivity ok for 10.1.2.5
Connectivity ok for 10.1.2.6
SSH key pair generated in 10.1.2.3
SSH key pair generated in 10.1.2.4
SSH key pair generated in 10.1.2.5
SSH key pair generated in 10.1.2.6
copied from 10.1.2.3 to 10.1.2.3
copied from 10.1.2.3 to 10.1.2.4
copied from 10.1.2.3 to 10.1.2.5
copied from 10.1.2.3 to 10.1.2.6
copied from 10.1.2.4 to 10.1.2.3
copied from 10.1.2.4 to 10.1.2.4
copied from 10.1.2.4 to 10.1.2.5
copied from 10.1.2.4 to 10.1.2.6
copied from 10.1.2.5 to 10.1.2.3
copied from 10.1.2.5 to 10.1.2.4
copied from 10.1.2.5 to 10.1.2.5
copied from 10.1.2.5 to 10.1.2.6
copied from 10.1.2.6 to 10.1.2.3
copied from 10.1.2.6 to 10.1.2.4

```

```
copied from 10.1.2.6 to 10.1.2.5
copied from 10.1.2.6 to 10.1.2.6
```



**NOTE:** If you have configured different passwords for the VMs, ensure that you enter corresponding passwords when prompted.

## 10. Deploy the cluster.

```
root@eop> request paragon deploy cluster
Process running with PID: 231xx03
To track progress, run 'monitor start /epic/config/log'
After successful deployment, please exit Paragon-shell and then re-login to the host to
finalize the setup
```

The cluster deployment begins and takes over an hour to complete.

## 11. (Optional) Monitor the progress of the deployment onscreen.

```
root@eop> monitor start /epic/config/log
```

The progress of the deployment is displayed. Deployment is complete when you see an output similar to this onscreen.

<output snipped>

```
PLAY RECAP *****
10.1.2.3      : ok=1648 changed=636 unreachable=0 failed=0 skipped=417
rescued=0    ignored=9
10.1.2.4      : ok=168  changed=79  unreachable=0 failed=0 skipped=115
rescued=0    ignored=0
10.1.2.5      : ok=168  changed=79  unreachable=0 failed=0 skipped=115
rescued=0    ignored=0
10.1.2.6      : ok=168  changed=82  unreachable=0 failed=0 skipped=108
rescued=0    ignored=0

Monday 08 April 2024 19:00:19 +0000 (0:00:06.528)      1:03:24.322 *****
=====
user-registry : Push Docker Images from local registry to paragon registry - 877.85s
kubernetes/addons/rook : Wait for Object-Store ----- 403.53s
```

```

jcloud/airflow2 : Install Helm Chart ----- 183.14s
Install Helm Chart ----- 122.57s
kubernetes/addons/postgres-operator : Make sure postgres is fully up and accepting request
using regular user - 113.31s
delete existing install config-map - if any ----- 91.59s
Save installer config to configmap ----- 82.56s
Install Helm Chart ----- 78.55s
jcloud/papi : Install Helm Chart ----- 68.59s
systemd ----- 64.85s
kubernetes/multi-master-rke2 : start rke2 server on other master ----- 60.60s
kubernetes/multi-master-rke2 : start rke2 server on other master ----- 58.66s
Create Kafka Topics ----- 58.50s
paa/timescaledb : Make sure postgres is fully up and accepting request using regular user
-- 56.30s
kubernetes/multi-master-rke2 : start rke2 server on 1st master ----- 50.92s
kubernetes/addons/metallb : Apply MetalLB configuration ----- 48.86s
Check if kafka container is up ----- 45.22s
jcloud/papi : wait for papi rest api ----- 43.13s
Install Helm Chart ----- 36.27s
user-registry : Push Helm Charts to paragon registry ----- 36.09s
Playbook run took 0 days, 1 hours, 03 minutes, 24 seconds
registry-5749
root@eop>

```

Alternatively, if you did not choose to monitor the progress of the deployment onscreen using the `monitor` command, you can view the contents of the log file using the `file show /epic/config/log` command. The last few lines of the log file must look similar to ["the sample output" on page 29](#). We recommend that you check the log file periodically to monitor the progress of the deployment.

## 12. When deployment is complete, log out of the VM and log in again to Paragon Shell.

Upon successful completion of the deployment, the application cluster is created.

The console output displays the Paragon Shell welcome message and the IP addresses of the four nodes (called Controller-1 through Controller-4), the Paragon Active Assurance Test Agent gateway VIP address, the Web admin user e-mail address, and Web GUI IP address.

```
Welcome to Juniper Paragon Automation OVA
```

```
This VM 10.1.2.3 is part of an EPIC on-prem system.
```

```
=====
```

```

Controller IP   : 10.1.2.3, 10.1.2.4, 10.1.2.5, 10.1.2.6
PAA Virtual IP  : 10.1.2.8
UI              : https://10.1.2.7
Web Admin User  : admin-user@juniper.net

```

```

=====
ova: 20240503_2010
build: eop-release-2.0.0.6928.g6be8b6ce52

```

```

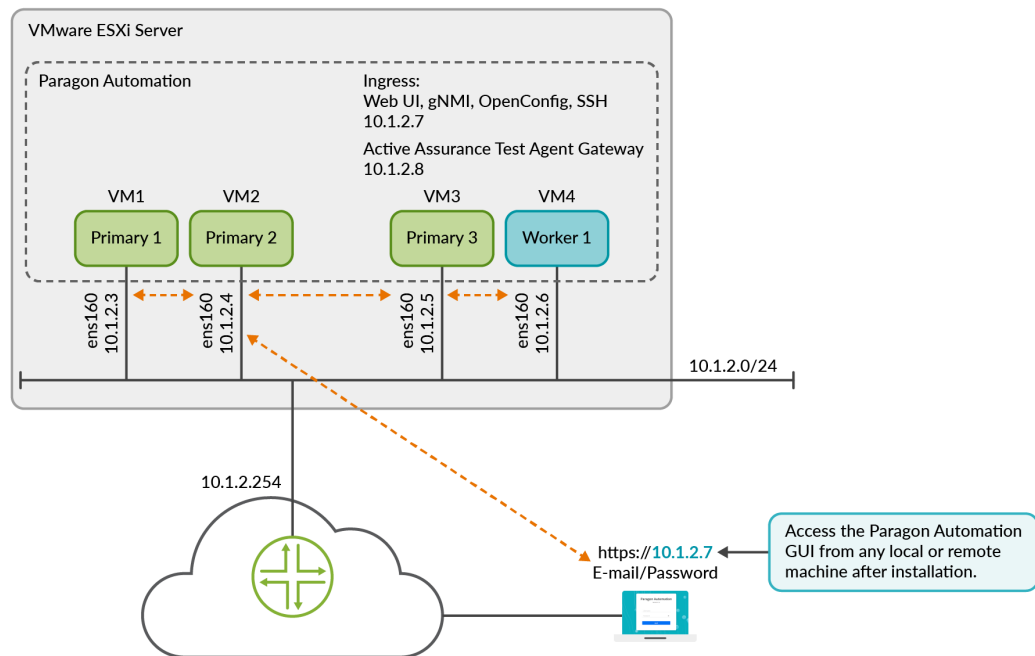
*****
                WELCOME TO PARAGON SHELL!
    You will now be able to execute Paragon CLI commands!
*****
root@Primary1>

```

The CLI command prompt displays your login username and the node hostname that you configured previously. For example, if you entered Primary1 as the hostname of your primary node, the command prompt is root@Primary1 >.

Figure 6 on page 31 illustrates a Paragon Automation cluster post-installation.

**Figure 6: Paragon Automation Cluster**



You can now verify the cluster deployment and log in to the Web GUI. See ["Log in to the Web GUI" on page 35](#).

## Deploy the Cluster Using The Deployment Wizard

If you haven't deployed the cluster using Paragon Shell, perform the following steps to deploy the Paragon Automaton cluster using the interactive deployment wizard from the Linux root shell.

1. Go back to the first node VM (*Primary1*) and log in as root with the previously configured ["password" on page 20](#). You are in the Paragon Shell operational mode.
2. Exit Paragon Shell. Type `exit` to go back to the Linux root shell.
3. When prompted whether you want to create a cluster, type `y` and press Enter.



**NOTE:** You can launch the deployment wizard to create a cluster at any time using the `setup` command.

4. Configure the following information when prompted.

**Table 4: VM Deployment Wizard**

| Prompt                                   | Action                                                                                                                                                                                                                                            |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Please specify the list of available IPs | Enter the VIP addresses as a list in the format, 10.1.2.3, 10.1.2.4, or as a range in the format, 10.1.2.3-10.1.2.4.                                                                                                                              |
| Please specify Controller-2 IP           | Enter the IP addresses of the second, third, and fourth VMs to correspond to Controller-2, Controller-3, and Controller-4 VMs.<br><br>These IP addresses must match the <a href="#">"static IP addresses" on page 22</a> configured on the nodes. |
| Please specify Controller-3 IP           |                                                                                                                                                                                                                                                   |
| Please specify Controller-4 IP           |                                                                                                                                                                                                                                                   |

**Table 4: VM Deployment Wizard (Continued)**

| Prompt                                                                             | Action                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Please specify Web Admin Email                                                     | Enter the e-mail address of the first user to log in to the Paragon Automation Web GUI. This user can be the system administrator or any other designated user. This user has superuser privileges and can create additional users. |
| Please specify Web Admin Password<br><br>Please specify Web Admin Password (again) | Enter a password that the first user can use to log in to the Web GUI.<br><br>Re-enter to confirm the password.                                                                                                                     |
| Please specify NTP server                                                          | Enter the NTP server IP address. Ensure that the NTP server is reachable and no firewall is blocking access to the server from the VM network.                                                                                      |

5. When prompted whether you want to proceed, type **y** and press Enter.
6. When prompted, enter the SSH password for the VMs. Enter the same **"password"** on page 20 that you configured to log in to the VMs.



**NOTE:** If you have configured different passwords for the VMs, ensure that you enter the correct corresponding passwords when prompted.

The cluster deployment begins. The deployment takes over an hour to complete.

7. Upon successful completion of the deployment, the application cluster is created and you are logged in to Paragon Shell.

The console output displays the four Controller IP addresses, the Paragon Active Assurance Test Agent gateway VIP address, the Web GUI VIP address, and the Web admin user e-mail address . The first VIP address in the list of VIP addresses that you entered while configuring the cluster is assigned to the Web GUI and the second VIP address is assigned to the Test Agent gateway.

```
The Application Cluster is created.This VM 10.1.2.3 is part of an EPIC on-prem system.
```

```
=====
```

```
Controller IP      : 10.1.2.3, 10.1.2.4, 10.1.2.5, 10.1.2.6
```

```

PAA Virtual IP   : 10.1.2.8
UI               : https://10.1.2.7
Web Admin User   : user-admin@juniper.net
=====
ova: 20240503_2010
build: eop-release-2.0.0.6928.g6be8b6ce52

*****
                WELCOME TO PARAGON SHELL!
    You will now be able to execute Paragon CLI commands!
*****
root@Primary1>

```

8. Log out of the node VM and log in again to Paragon Shell to see the updated command prompt. The CLI command prompt displays your log in user name and the node hostname that you configured previously. For example, if you entered Primary1 as the hostname of your primary node, the command prompt is root@Primary1 >.
9. (Optional) Configure SMTP-based user management. To configure SMTP, perform the steps described in *Configure SMTP Settings in Paragon Shell*.
10. (Optional) Upload custom user certificates. To configure Paragon Automation to use custom user certificates, perform the steps described in ["Install User Certificates" on page 36](#).
11. (Optional) Configure hostnames for common ingress and Paragon Active Assurance Test Agent gateway using Paragon Shell, perform the following steps:

```

root@Primary1> configure
Entering configuration mode

root@Primary1# set paragon cluster common-services ingress system-hostname ingress-vip-dns-  
hostname

[edit]
root@Primary1# set paragon cluster applications active-assurance test-agent-gateway-  
hostname nginx-ingress-controller-hostname

[edit]
root@Primary1# commit

```

```

commit complete

[edit]
root@Primary1# exit
Exiting configuration mode

root@Primary1> request paragon config
Paragon inventory file saved at /epic/config/inventory
Paragon config file saved at /epic/config/config.yml
root@Primary1> request paragon deploy cluster input "-t apps"
Process running with PID: 23xx022
To track progress, run 'monitor start /epic/config/log'

```

Where:

system-hostname is the hostname for the generic ingress IP address.

test-agent-gateway-hostname is the hostname for the Paragon Active Assurance Test Agent gateway IP address.

You can now verify the cluster deployment and log in to the Web GUI.

[Figure 6 on page 31](#) illustrates a Paragon Automation cluster post-installation.

## Log in to the Web GUI

After the cluster has been deployed, you can verify the deployment (optionally), and log in to the Web GUI using the information you entered during the deployment.

### 1. (Optional) Verify the deployment.

#### a. Verify cluster details.

```

root@Primary1 > show paragon cluster details
Storage and Controller Node IPs: 10.1.2.3, 10.1.2.4, 10.1.2.5, 10.1.2.6

```

#### b. Verify cluster node details.

```

root@Primary1 > show paragon cluster nodes

```

| NAME     | STATUS | ROLES                     | AGE   | VERSION        |
|----------|--------|---------------------------|-------|----------------|
| Primary1 | Ready  | control-plane,etcd,master | 4h12m | v1.28.6+rke2r1 |

|          |       |                           |       |                |
|----------|-------|---------------------------|-------|----------------|
| Primary2 | Ready | control-plane,etcd,master | 4h12m | v1.28.6+rke2r1 |
| Primary3 | Ready | control-plane,etcd,master | 4h11m | v1.28.6+rke2r1 |
| Worker1  | Ready | influxdb-worker,worker    | 4h11m | v1.28.6+rke2r1 |

## 2. Log in to the Web GUI.

- a. Enter **`https://web-ui-ip-address`** in a Web browser to access the Paragon Automation login page. *web-ui-ip-address* is the URL displayed on your console after the cluster deployment is complete.
- b. Enter the Web admin user e-mail and password that you **"configured"** on [page 24](#) previously to log in to Paragon Automation. The Web admin user e-mail is also displayed on your console after the cluster deployment is complete

You are logged in to the Paragon Automation GUI and are directed to the New Account page from where you can create a new Organization. For more information, see *User Activation and Login*.

## SEE ALSO

[Paragon Automation System Requirements | 7](#)

[Upgrade Paragon Automation | 39](#)

*Configure SMTP Settings in Paragon Shell*

*Adopt a Device*

# Install User Certificates

You can configure Paragon Automation to use custom user certificates. When deploying the Paragon Automation cluster using Paragon Shell, you can install the certificates during installation of the cluster. When deploying using the deployment wizard, you must install the user certificates after cluster deployment is complete.

To upload and install custom user certificates, perform the following steps:

1. Log in to the Linux root shell of the node from which you deployed the cluster.
2. Copy the custom user certificate file and key file to the **root/epic/config** directory.
3. Type `cli` to log in to Paragon Shell and type `configure` to enter configuration mode.

4. Configure the following parameters, commit, and exit the configuration mode.

```

root@Primary1# set paragon cluster common-services ingress user-certificate use-user-
certificate true

root@Primary1# set paragon cluster common-services ingress user-certificate user-certificate-
filename "certificate.cert.pem"

root@Primary1# set paragon cluster common-services ingress user-certificate user-certificate-
key-filename "certificate.key.pem"

root@Primary1# commit
commit complete

[edit]
root@Primary1# exit
Exiting configuration mode

root@Primary1>

```

Where:

*certificate.cert.pem* is the user certificate filename.

*certificate.key.pem* is the user certificate key filename.

5. Generate the configuration files.

```

root@Primary1> request paragon config
Paragon inventory file saved at /epic/config/inventory
Paragon config file saved at /epic/config/config.yml

```

6. Deploy the certificates.

```

root@Primary1> request paragon deploy cluster input "-t ingress-controller "
Process running with PID: 23xx022
To track progress, run 'monitor start /epic/config/log'

```

# 4

CHAPTER

## Upgrade and Update

---

### IN THIS CHAPTER

- Upgrade Paragon Automation | 39
  - Repair or Replace Cluster Nodes | 42
  - Update the OS | 50
-

# Upgrade Paragon Automation

## IN THIS SECTION

- [Prerequisites to the Upgrade Process | 39](#)
- [Upgrade using the local Option | 40](#)
- [Upgrade using the url Option | 41](#)

You can upgrade your current release version of Paragon Automation to a subsequent release version using Paragon Shell. The upgrade functionality enables you to upgrade your Paragon Automation installation and all the applications running on it. The upgrade process is automated and carries out the required pre-upgrade system checks, retrieves the upgrade package, and executes the upgrade process on the cluster nodes.

The upgrade process is automated by a set of Paragon Shell commands. You can upgrade using an upgrade file that is either downloaded locally on your primary node or accessed directly from a Web page.

During an upgrade its important that no change activities including onboarding of devices, provisioning of services or changing other configuration are done in the system. The upgrade will automatically reboot all components and there will be a short unavailability during that time. The upgrade process does not affect the traffic through the network and once the upgrade is complete, the devices and services are not reconfigured.

We recommend that you back up your configuration before upgrading. For information on backing up your current configuration, see ["Back Up and Restore Paragon Automation" on page 54](#).

## Prerequisites to the Upgrade Process

Before you upgrade the Paragon Automation cluster, ensure the following.

- Paragon Shell is accessible and operational.
- The cluster nodes have the following free disk space available:
  - The primary node from which the cluster was deployed must have 15% of the total disk space + three times the upgrade file size free.

- The other two primary and worker nodes must have 15% of the total disk space + the same amount as the upgrade file size free.
- The worker node must have 15% of the total disk space free.

Upgrade Paragon Automation using one of the following options.

## Upgrade using the local Option

Use this option for air-gapped environments where your paragon Automation installation does not have access to the Internet. However, you need to be able to copy the **upgrade\_paragon-release-build-id.tgz** and **upgrade\_paragon-release-build-id.tgz.psig** files to your primary node.

1. Log in as root user to the primary node from which the current cluster was installed. You are logged in to Paragon Shell.
2. Type `exit` to exit from Paragon Shell to the Linux root shell.
3. Copy the **upgrade\_paragon-release-build-id.tgz** and **upgrade\_paragon-release-build-id.tgz.psig** files, of the version to which you want to upgrade, to the **/root/epic/temp** folder.

You might need to download the **upgrade\_paragon-release-build-id.tgz** and **upgrade\_paragon-release-build-id.tgz.psig** files from the *Juniper Software Download* site to your local computer before copying it to the primary node.

4. (Optional) Use the `gpg --verify` command to validate the digital signature of the upgrade file. For example:

```
root@primary:~# gpg --verify upgrade_paragon-release-2.0.0.6824.g83b20ea7fd.tgz.psig
upgrade_paragon-release-2.0.0.6824.g83b20ea7fd.tgz
gpg: Signature made Tue Apr 23 01:00:09 2024 UTC
gpg:                using RSA key 4B7B22C9C4FE32CF
gpg: Good signature from "Northstar Paragon Automation 2024 ca@juniper.net" [ultimate]
```

Validation takes a couple of minutes to complete.

5. Type `cli` to enter Paragon Shell.
6. Use the following command to upgrade Paragon Automation.

```
request paragon cluster upgrade local filename upgrade_paragon-release-build-id.tgz
```

For example:

```
root@primary> request paragon cluster upgrade local filename upgrade_paragon-
release-2.0.0.6824.g83b20ea7fd.tgz
Using local file /root/epic/temp/upgrade_paragon-release-2.0.0.6824.g83b20ea7fd.tgz for
upgrade
Upgrade is in progress ...
Updated to build: paragon-release-2.0.0.6824.g83b20ea7fd
Upgrade is successful
```

## Upgrade using the url Option

Use this option if your Paragon Automation installation has access to the Internet.

1. Log in as root user to the primary node from which the current cluster was installed. You are logged in to Paragon Shell.
2. Use the following command to upgrade Paragon Automation.

```
request paragon cluster upgrade url "https://juniper.software.download.site/upgrade_paragon-release-build-
id.tgz?query_string"
```

For example:

```
root@primary> request paragon cluster upgrade url "https://cdn.juniper.net/software/paragon-
images/upgrade_paragon-release-2.0.0.6688.g63026f4af7.tgz?query_string"
Upgrading paragon cluster from https://cdn.juniper.net/software/paragon-images
Downloading tarball file      upgrade_paragon-release-2.0.0.6688.g63026f4af7.tgz
Download file size: 19,526,900,113 bytes
Current disk Usage:
    Total: 263,622,004,736 bytes
    Used: 83,496,677,376 bytes
    Available: 168,297,881,600 bytes
Please wait for current download to finish... (File is large. It may take a while.)
File upgrade_paragon-release-2.0.0.6688.g63026f4af7.tgz is downloaded.
Upgrade is in progress ...
Updated to build: paragon-release-2.0.0.6688.g63026f4af7
Upgrade is successful
```

## SEE ALSO

[Install Paragon Automation | 16](#)

[Back Up and Restore Paragon Automation | 54](#)

# Repair or Replace Cluster Nodes

## IN THIS SECTION

- [Repair Nodes | 42](#)
- [Replace Faulty Nodes | 43](#)

You can repair and replace faulty nodes in your Paragon Automation cluster using Paragon Shell. This topic describes how to repair and replace nodes in your cluster.

## Repair Nodes

To repair a faulty node in your existing Paragon Automation cluster.

1. Log in to the Linux root shell of the faulty node.

If you are unable to log in to the faulty node, go to step "4" on page 43.

2. Stop and kill all RKE2 services on the faulty node.

```
root@node-f:~# rke2-killall.sh
root@node-f:~# rke2-uninstall.sh
```

3. Clear the data on the disk partition used for Ceph.

```
root@node-f:~# wipefs -a -f /dev/partition
root@node-f:~# dd if=/dev/zero of=/dev/partition bs=1M count=100
```

Use `/dev/sdb` if you used the OVA bundle to deploy your cluster.

4. Log in to the Linux root shell of the node you deployed the cluster from. Note that you can repair the faulty node from any functional node in the cluster.
5. Delete the faulty node from the cluster.

```
root@primary1:~# kubectl delete node faulty-node-hostname
```

Where *faulty-node-hostname* is the hostname of the node you want to repair.

6. Type `cli` to enter Paragon Shell.

If you are not logged in to the node from where you deployed the cluster, then log out of the current node, and log in to the installer node.

7. Repair the node from Paragon Shell.

```
user@primary1> request paragon repair-node address ip-address-of-faulty-node
```

Where *ip-address* is the IP address of the node that you want to repair.

## Replace Faulty Nodes

### IN THIS SECTION

- [Replace-node failure scenario | 48](#)

You can replace a faulty node with a new node. To replace a node, you must prepare the new node, delete the faulty node and then add the new node to the cluster.

1. Log in to the Linux root shell one of the functional nodes of the cluster and delete the faulty node.

```
root@primary1:~# kubectl delete node faulty-node-hostname
```

Where *faulty-node-hostname* is the hostname of the node you want to replace.

2. Prepare the new node.

Perform the following steps to prepare the new node before replacing a faulty node.

The node that you want to replace the faulty node with can have a new IP address or the same IP address as the faulty node, but you will still need to create and prepare the node VM.

a. Log in to the VMware ESXi 8.0 server where have installed Paragon Automation.

**b. Create the new node VM.**

Perform the following steps to create the VM.

i. Right-click the **Host** icon and select **Create/Register VM**.

The New virtual machine wizard appears.

ii. On the Select creation type page, select **Deploy a virtual machine from an OVF or OVA file**.

Click **Next**.

iii. On the Select OVF and VMDK files page, enter a name for the node VM.

Click to upload or drag and drop the OVA file or the OVF file along with the **.vmdk** file.

Review the list of files to be uploaded and click **Next**.

iv. On the Select storage page, select the appropriate datastore that can accommodate 300-GB SSD for the node VM.

Click **Next**. The extraction of files takes a few minutes.

v. On the Deployment options page:

- Select the virtual network to which the node VM will be connected.
- Select the **Thick** disk provisioning option.
- Enable the VM to power on automatically.

Click **Next**.

vi. On the Ready to complete page, review the VM settings.

Click **Finish** to create the node VM.

vii. (Optional) Verify the progress of the VM creation in the Recent tasks section at the bottom of the page.

viii. When all the VM has been created, verify that it has the correct specifications and is powered on.

### c. Configure the new node VM

Perform the following steps to configure the node VM.

- i. Connect to the node VM console. You are logged in as root automatically.
- ii. You are prompted to change your password immediately. Enter and re-enter the new password. You are automatically logged out of the VM.



**NOTE:** We recommend that you enter the same password for as the VMs in your existing cluster.

- iii. When prompted, log in again as root user with the newly configured password.
- iv. Configure the following information when prompted.

**Table 5: VM Configuration Wizard**

| Prompt                                             | Action                                                                                                                                                                                 |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Do you want to set up a Hostname? (y/n)            | Enter <b>y</b> to configure a hostname.                                                                                                                                                |
| Please specify the Hostname                        | Enter an identifying hostname for the VM.<br><br>If you do not enter a hostname, a default hostname in the format controller- <i>&lt;VM-IP address 4th octet&gt;</i> is assigned.      |
| Do you want to set up Static IP (preferred)? (y/n) | Enter <b>y</b> to configure the IP address for the VM. This IP address can be different or the same as the faulty node.                                                                |
| Please specify the IP address in CIDR notation     | Enter the IP address in the CIDR notation. For example, 10.1.2.3/24.<br><br>The IP address must be in the same subnet as the IP addresses of your existing Paragon Automation cluster. |
| Please specify the Gateway IP                      | Enter the gateway IP address.                                                                                                                                                          |

**Table 5: VM Configuration Wizard (Continued)**

| Prompt                              | Action                              |
|-------------------------------------|-------------------------------------|
| Please specify the Primary DNS IP   | Enter the primary DNS IP address.   |
| Please specify the Secondary DNS IP | Enter the secondary DNS IP address. |

- v. When prompted if you are sure to proceed, review the information displayed, type **y** and press Enter.
- vi. When prompted to create a cluster, type **n** and press Enter.

You have prepared the node and can now replace the faulty node with the newly prepared node.

### 3. Replace the Faulty Node:

Log in to the node from which you deployed your existing Paragon Automation cluster. You are placed in Paragon Shell.

- 4. If the IP address of the new node is same as the IP address of the faulty node, go to step ["5" on page 47](#). If the IP address of the new node is different from the IP address of the faulty node, perform the following steps.
  - a. To edit the cluster, type `configure` to enter the configuration mode.

```
user@primary1> configure
Entering configuration mode

[edit]
user@primary1#
```

- b. Delete the faulty node.

```
user@primary1# delete paragon cluster nodes kubernetes 3
```

Where **3** is the index number of the node that you want to delete.

- c. Add the new node to the cluster configuration in place of the node you deleted and commit the configuration.

```
user@primary1# set paragon cluster nodes kubernetes 3 address 10.1.2.11

user@primary1# commit
commit complete
```

Where *10.1.2.11* is the IP address of the new node.

- d. (Optional) Verify the cluster configuration.

```
user@primary1# show paragon cluster nodes
kubernetes 1 {
    address 10.1.2.3;
}
kubernetes 2 {
    address 10.1.2.4;
}
kubernetes 3 {
    address 10.1.2.11;
}
kubernetes 4 {
    address 10.1.2.6;
}
```

- e. Exit configuration mode and regenerate the configuration files.

```
user@primary1# exit
Exiting configuration mode

user@primary1> request paragon config
Paragon inventory file saved at /epic/config/inventory
Paragon config file saved at /epic/config/config
```

5. Regenerate SSH keys on the cluster nodes.

When prompted, enter the SSH password for all the existing VMs and the new VM. Enter the same password that you configured to log in to the VMs.

```
user@primary1> request paragon ssh-key
Please enter comma-separated list of IP addresses: 10.1.2.3,10.1.2.4,10.1.2.6,10.1.2.11
Please enter SSH username for the node(s): root
Please enter SSH password for the node(s): password
checking server reachability and ssh connectivity ...
Connectivity ok for 10.1.2.3
Connectivity ok for 10.1.2.4
Connectivity ok for 10.1.2.6
Connectivity ok for 10.1.2.11

<output snipped>
```

## 6. Replace the node.

```
user@primary1# request paragon replace-node address 10.1.2.11
Process running with PID: 23xx032
To track progress, run 'monitor start /epic/config/log'
```

Where *10.1.2.11* is the IP address of the new node.

## Replace-node failure scenario

You might encounter issues with node-replacement when the IP address (or hostname) of the replacement node is different from the IP address (or hostname) of the faulty node; perform the following additional steps to fix the issue.

1. Log in to the Linux root shell of the node from where you deployed the cluster.
2. Delete the local volume pvc associated with the faulty node, if any.
  - a. Use the `# kubectl describe pv -A` command to determine if there is any lingering pvc associated with the faulty node and note the pvc name.
  - b. Use the `# kubectl get pvc -A` command to find the namespace associated with the pvc name.
  - c. Use the `# kubectl delete pvc -n namespace pvc_name` command to delete the pvc.

3. Run the following command to check if the status of Rook and Ceph pods installed in the rook-ceph namespace is not Running or Completed.

```
$ kubectl get po -n rook-ceph
```

4. Remove the failing OSD processes.

```
$ kubectl delete deploy -n rook-ceph rook-ceph-osd-number
```

5. Connect to the toolbox.

```
$ kubectl exec -ti -n rook-ceph $(kubectl get po -n rook-ceph -l app=rook-ceph-tools -o jsonpath={..metadata.name}) -- bash
```

6. Identify the failing OSD.

```
$ ceph osd status
```

7. Mark out the failed OSD.

```
$ ceph osd out osd-ID-number
```

8. Remove the failed OSD.

```
$ ceph osd purge osd-ID-number --yes-i-really-mean-it
```

## SEE ALSO

[Install Paragon Automation | 16](#)

# Update the OS

You create the node virtual machines (VMs) in a Paragon Automation cluster using the OVA or OVF and **.vmdk** software download files. The files are pre-packaged with all the utilities, OS, and software required to create the VMs. When the VMs are created, the Linux base OS on them is Ubuntu 22.04.4 LTS (Jammy Jellyfish). You may need to update the base OS to maintain the security, stability, performance, and compatibility of the Kubernetes cluster. Juniper provides you with the required OS update file to enable you to update the OS on your node VMs. The OS update functionality in Paragon Automation includes the following updates:

- Linux kernel update
- OpenSSL or OS security update
- Any third-party packages required by Paragon Automation
- All packages that are part of the base OS

To update the OS, perform the following steps:

1. Download the **paragon-ubuntu-22-04-update-*{dt}*.tar.gz** and **paragon-ubuntu-22-04-update-*{dt}*.tar.gz.psig** files from the Juniper Software Download site on to your computer or local installer VM.
2. Log in to any one of the Paragon Automation cluster nodes as the root user.
3. Type **exit** to exit Paragon Shell to the Linux root shell.
4. Copy the **paragon-ubuntu-22-04-update-*{dt}*.tar.gz** and **paragon-ubuntu-22-04-update-*{dt}*.tar.gz.psig** files to the cluster node.
5. Update the OS on the current node using the copied files.

```
root@node# update-os paragon-ubuntu-22-04-update-{dt}.tar.gz paragon-ubuntu-22-04-update-{dt}.tar.gz.psig
```

The process takes around 15-30 minutes to complete depending on the size of the updated packages. Once complete, the OS on the other three nodes of the cluster are also automatically updated.

## Verify the OS update

You can perform any of the following steps to verify that the OS update process is successful and the cluster operation is unaffected.

- The Paragon Automation cluster remains operational while updating the OS. To verify if the update process has succeeded, check the `/var/log/apt/history.log` log file to see the timestamp of the last update and updated packages. For example:

```
Start-Date: 2024-04-18 15:50:57
```

```
Commandline: apt upgrade
```

```
Install: ubuntu-pro-client-l10n:amd64 (31.2.2~22.04, automatic), ubuntu-pro-client:amd64 (31.2.2~22.04, automatic)
```

```
Upgrade: dpkg:amd64 (1.21.1ubuntu2.1, 1.21.1ubuntu2.3), libxtables12:amd64 (1.8.7-1ubuntu5, 1.8.7-1ubuntu5.2), initramfs-tools-core:amd64 (0.140ubuntu13.1, 0.140ubuntu13.4), udev:amd64 (249.11-0ubuntu3.7, 249.11-0ubuntu3.12), coreutils:amd64 (8.32-4.1ubuntu1, 8.32-4.1ubuntu1.2), libmm-glib0:amd64 (1.20.0-1~ubuntu22.04.1, 1.20.0-1~ubuntu22.04.3), python3-tz:amd64 (2022.1-1ubuntu0.22.04.0, 2022.1-1ubuntu0.22.04.1), openssh-client:amd64 (1:8.9p1-3ubuntu0.6, 1:8.9p1-3ubuntu0.7), iptables:amd64 (1.8.7-1ubuntu5, 1.8.7-1ubuntu5.2), python3-distupgrade:amd64 (1:22.04.16, 1:22.04.19), apt:amd64 (2.4.8, 2.4.12), sosreport:amd64 (4.4-1ubuntu1.22.04.1, 4.5.6-0ubuntu1~22.04.2), cryptsetup-bin:amd64 (2:2.4.3-1ubuntu1.1, 2:2.4.3-1ubuntu1.2), git:amd64 (1:2.34.1-1ubuntu1.9, 1:2.34.1-1ubuntu1.10), libunwind8:amd64 (1.3.2-2build2, 1.3.2-2build2.1), libldap-common:amd64 (2.5.16+dfsg-0ubuntu0.22.04.2, 2.5.17+dfsg-0ubuntu0.22.04.1), ufw:amd64 (0.36.1-4build1, 0.36.1-4ubuntu0.1), sg3-utils:amd64 (1.46-1build1, 1.46-1ubuntu0.22.04.1), grub-pc-bin:amd64 (2.06-2ubuntu7.1, 2.06-2ubuntu7.2), libfwupd2:amd64 (1.7.9-1~22.04.1, 1.7.9-1~22.04.3), libapt-pkg6.0:amd64 (2.4.8, 2.4.12), initramfs-tools-bin:amd64 (0.140ubuntu13.1, 0.140ubuntu13.4), apparmor:amd64 (3.0.4-2ubuntu2.2, 3.0.4-2ubuntu2.3), libip4tc2:amd64 (1.8.7-1ubuntu5, 1.8.7-1ubuntu5.2), libapparmor1:amd64 (3.0.4-2ubuntu2.2, 3.0.4-2ubuntu2.3), openssh-server:amd64 (1:8.9p1-3ubuntu0.6, 1:8.9p1-3ubuntu0.7), irqbalance:amd64 (1.8.0-1build1, 1.8.0-1ubuntu0.2), python-apt-common:amd64 (2.4.0ubuntu1, 2.4.0ubuntu3), libgpgme11:amd64 (1.16.0-1.2ubuntu4, 1.16.0-1.2ubuntu4.2), libldap-2.5-0:amd64 (2.5.16+dfsg-0ubuntu0.22.04.2, 2.5.17+dfsg-0ubuntu0.22.04.1), libudev1:amd64 (249.11-0ubuntu3.7, 249.11-0ubuntu3.12), motd-news-config:amd64 (12ubuntu4.3, 12ubuntu4.6), libsgutils2-2:amd64 (1.46-1build1, 1.46-1ubuntu0.22.04.1), libc6:amd64 (2.35-0ubuntu3.6, 2.35-0ubuntu3.7), locales:amd64 (2.35-0ubuntu3.6, 2.35-0ubuntu3.7), fwupd-signed:amd64 (1.51~22.04.1+1.2-3ubuntu0.2, 1.51.1~22.04.1+1.4-0ubuntu0.1), cloud-init:amd64 (23.1.2-0ubuntu0~22.04.1, 23.4.4-0ubuntu0~22.04.1), sg3-utils-udev:amd64 (1.46-1build1, 1.46-1ubuntu0.22.04.1), open-vm-tools:amd64 (2:12.1.5-3~ubuntu0.22.04.4, 2:12.3.5-3~ubuntu0.22.04.1), base-files:amd64 (12ubuntu4.3, 12ubuntu4.6), mdadm:amd64 (4.2-0ubuntu1, 4.2-0ubuntu2), cryptsetup-initramfs:amd64 (2:2.4.3-1ubuntu1.1, 2:2.4.3-1ubuntu1.2), python3-apt:amd64 (2.4.0ubuntu1, 2.4.0ubuntu3), snapd:amd64 (2.58+22.04.1, 2.61.3+22.04), systemd-hwe-hwdb:amd64 (249.11.3, 249.11.5), python3-distro-info:amd64 (1.1build1, 1.1ubuntu0.2), libcryptsetup12:amd64 (2:2.4.3-1ubuntu1.1,
```

```
2:2.4.3-1ubuntu1.2), multipath-tools:amd64 (0.8.8-1ubuntu1.22.04.1, 0.8.8-1ubuntu1.22.04.4),
distro-info-data:amd64 (0.52ubuntu0.2, 0.52ubuntu0.6), libip6tc2:amd64 (1.8.7-1ubuntu5,
1.8.7-1ubuntu5.2), grub2-common:amd64 (2.06-2ubuntu7.1, 2.06-2ubuntu7.2), cryptsetup:amd64
(2:2.4.3-1ubuntu1.1, 2:2.4.3-1ubuntu1.2), distro-info:amd64 (1.1build1, 1.1ubuntu0.2),
openssh-sftp-server:amd64 (1:8.9p1-3ubuntu0.6, 1:8.9p1-3ubuntu0.7), grub-common:amd64
(2.06-2ubuntu7.1, 2.06-2ubuntu7.2), ubuntu-standard:amd64 (1.481, 1.481.1), libc-bin:amd64
(2.35-0ubuntu3.6, 2.35-0ubuntu3.7), http://netplan.io :amd64 (0.105-0ubuntu2~22.04.3,
0.106.1-7ubuntu0.22.04.2), python3-apport:amd64 (2.20.11-0ubuntu82.4, 2.20.11-0ubuntu82.5),
initramfs-tools:amd64 (0.140ubuntu13.1, 0.140ubuntu13.4), ubuntu-server:amd64 (1.481,
1.481.1), apt-utils:amd64 (2.4.8, 2.4.12), ubuntu-release-upgrader-core:amd64 (1:22.04.16,
1:22.04.19), libfwupdplugin5:amd64 (1.7.9-1~22.04.1, 1.7.9-1~22.04.3), ubuntu-advantage-
tools:amd64 (27.13.6~22.04.1, 31.2.2~22.04), ethtool:amd64 (1:5.16-1, 1:5.16-1ubuntu0.1), git-
man:amd64 (1:2.34.1-1ubuntu1.9, 1:2.34.1-1ubuntu1.10), grub-pc:amd64 (2.06-2ubuntu7.1,
2.06-2ubuntu7.2), kpartx:amd64 (0.8.8-1ubuntu1.22.04.1, 0.8.8-1ubuntu1.22.04.4), python3-
problem-report:amd64 (2.20.11-0ubuntu82.4, 2.20.11-0ubuntu82.5), libnetplan0:amd64
(0.105-0ubuntu2~22.04.3, 0.106.1-7ubuntu0.22.04.2), apport:amd64 (2.20.11-0ubuntu82.4,
2.20.11-0ubuntu82.5), ubuntu-minimal:amd64 (1.481, 1.481.1), update-notifier-common:amd64
(3.192.54.5, 3.192.54.8), python3-debian:amd64 (0.1.43ubuntu1, 0.1.43ubuntu1.1)
```

```
End-Date: 2024-04-18 15:52:27
```

- Verify that cluster-operation is unaffected by checking that all pods are in Running status using the following command in the Linux root shell.

```
# kubectl get pods -A
```

- Also, verify cluster operation using the # health-check command in the Linux root shell.

# 5

CHAPTER

## Backup and Restore

---

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-

# Back Up and Restore Paragon Automation

## IN THIS SECTION

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- [Restore Paragon Automation | 55](#)
- [View Backup Files | 56](#)
- [Delete Backup Files | 56](#)

This topic describes the back up and restore functionality available in Paragon Automation.

## Back Up Paragon Automation

You can back up your current Paragon Automation network configuration using Paragon Shell CLI. When you run the back up command, all the application configuration information stored in PostgreSQL and ArangoDB configuration database systems are backed up. The back up procedure can be performed while the microservices and applications are running and does not affect the operation of the network.

To back up your Paragon Automation configuration state.

1. Log in as root user to any of the Paragon Automation nodes.
2. Execute the following command to back up the configuration.

```
root@Primary1> request paragon backup start
```

The back up takes a few minutes to complete and a back up file with a filename in the **yyyymmdd-hhmmss** format is created. The back up file is stored in the local persistent **/export/paragon-shell/backup** folder on the node. You'll have to exit out of Paragon Shell to the Linux root shell navigate to the **backup** folder.

### Caveat of the backup process

- Metrics data such as that stored in InfluxDB is not backed up.

## Restore Paragon Automation

You can restore your Paragon Automation network configuration from a backup configuration file. To restore from a backup configuration file, all microservices and applications must be stopped and the cluster is not functional until the databases are restored. Once the databases are flushed and restored to the backed-up configuration, the applications must be restarted and configuration restored from the databases must be reparsed.

To restore your Paragon Automation configuration from a specific backup configuration file.

- 1. Log in as root user to the node where the backup file is located.
- 2. Execute the following command to uninstall all the running applications.

```
root@Primary1> request paragon destroy cluster input "-v -t apps"
```

This command takes sometime to complete, and you must wait until all the applications are shut down before proceeding to the next step. To check the status of applications, perform the following steps.

- a. Type `exit` to exit Paragon Shell to the Linux root shell.
- b. Check each application namespace for running deployments using the `kubectl get deployments -n namespace` command, where *namespace* is the name of the application namespace. Use this command for each namespace and the output of every command should be empty, which indicates that no deployments are running. [Table 6 on page 55](#) lists all the namespaces that you must check.

**Table 6: Namespace List**

|           |        |           |           |
|-----------|--------|-----------|-----------|
| airflow   | epic   | foghorn   | gnmi-term |
| mems      | netbox | northstar | oc-term   |
| paa       | papi   | streams   | trust     |
| healthbot |        |           |           |

The command output should display only the following deployments:

```
vm-operator-victoria-metrics-operator, vmauth-victoria-metrics-auth, vminsert-victoria-metrics-cluster
```

When all applications are shut down, you are ready to proceed with the restore process.

- c. Type `cli` to log in again to Paragon Shell.
3. Restore the applications configuration from the backup file.

```
root@Primary1> request paragon restore start backup-id backup-id
```

#### 4. Reinstall all the applications.

```
root@Primary1> request paragon deploy cluster input "-v -t apps"
```

#### 5. Reparse and synchronize the restored configuration.

```
root@Primary1> request paragon restore sync
```

You must perform the restore operation only on the node where the required backup file is located.

### Caveats of the restore process

- When you perform the restore operation, the network configuration is returned to the configuration present in the backup file. From the time the backup was taken, if the network configuration has changed due to new devices being onboarded or new service orders being executed, the network configuration in Paragon Automation might be different from the actual network state. To ensure that the network configuration in Paragon Automation and the actual network state have minimal mismatch post a restore operation, we recommend that you take regular periodic backups or specific backups after every network intent change.
- You cannot restore data from a version different from the installed version of Paragon Automation.

## View Backup Files

To view a list of all backup files across all nodes, use the following command:

```
root@Primary1> show paragon backup
```

The node connects to all the other nodes in the Paragon Automation cluster using SSH and displays a list of all backup filenames along with the IP address of the node on which the file is located.

To view a list of backup files along with a list of failed back up attempts, use the following command:

```
root@Primary1> show paragon backup include-failure true
```

## Delete Backup Files

To delete a backup file, use the following command.

```
root@Primary1> request paragon backup delete backup-id backup-id
```

You can delete a backup file located only on the node that you execute the command.

**SEE ALSO**

[Upgrade Paragon Automation | 39](#)

---

*request paragon backup*

---

*request paragon restore*

---

*show paragon backup*